

## *Chapter 3*



Photo courtesy of the Georgia Department of Natural Resources

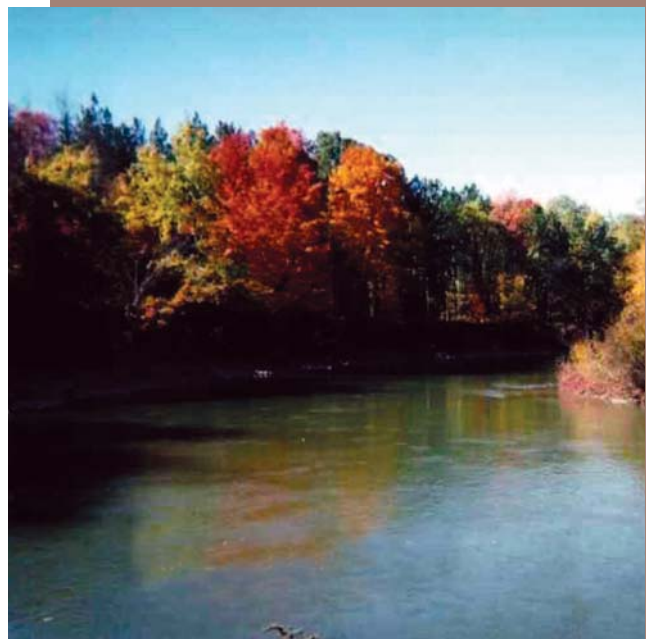
## *Wadeable Streams Assessment Ecoregion Results*

# Wadeable Streams Assessment Ecoregion Results

The WSA is designed to report on three geographic scales: national, regional, and ecoregional. Chapter 2 presented the national- and regional-scale results, and this chapter will focus on the results for the nine WSA ecoregions.

Ecoregions are areas that contain similar environmental characteristics, such as climate, vegetation, soil type, and geology. EPA has defined ecoregions at various scales, ranging from coarse (Level I) ecoregions at the continental scale to fine (Levels III and IV) ecoregions that divide states into smaller ecosystem units. Ecoregions are designed to be used in environmental assessments, for setting water quality and biological criteria, and to set management goals for non-point source pollution.

The nine WSA ecoregions are aggregations of the Level III ecoregions delineated by EPA for the conterminous United States. This chapter provides background information on physical setting, biological setting, and human influence for each of the WSA ecoregions and describes WSA results for the wadeable stream length throughout each ecoregion. The WSA results may not be extrapolated to an individual state or stream within the ecoregion because the study design was not intended to characterize stream conditions at these finer scales. Note that a number of states implement randomized designs at the state scale to characterize water quality throughout their state, but these characterizations are not described in this WSA report.

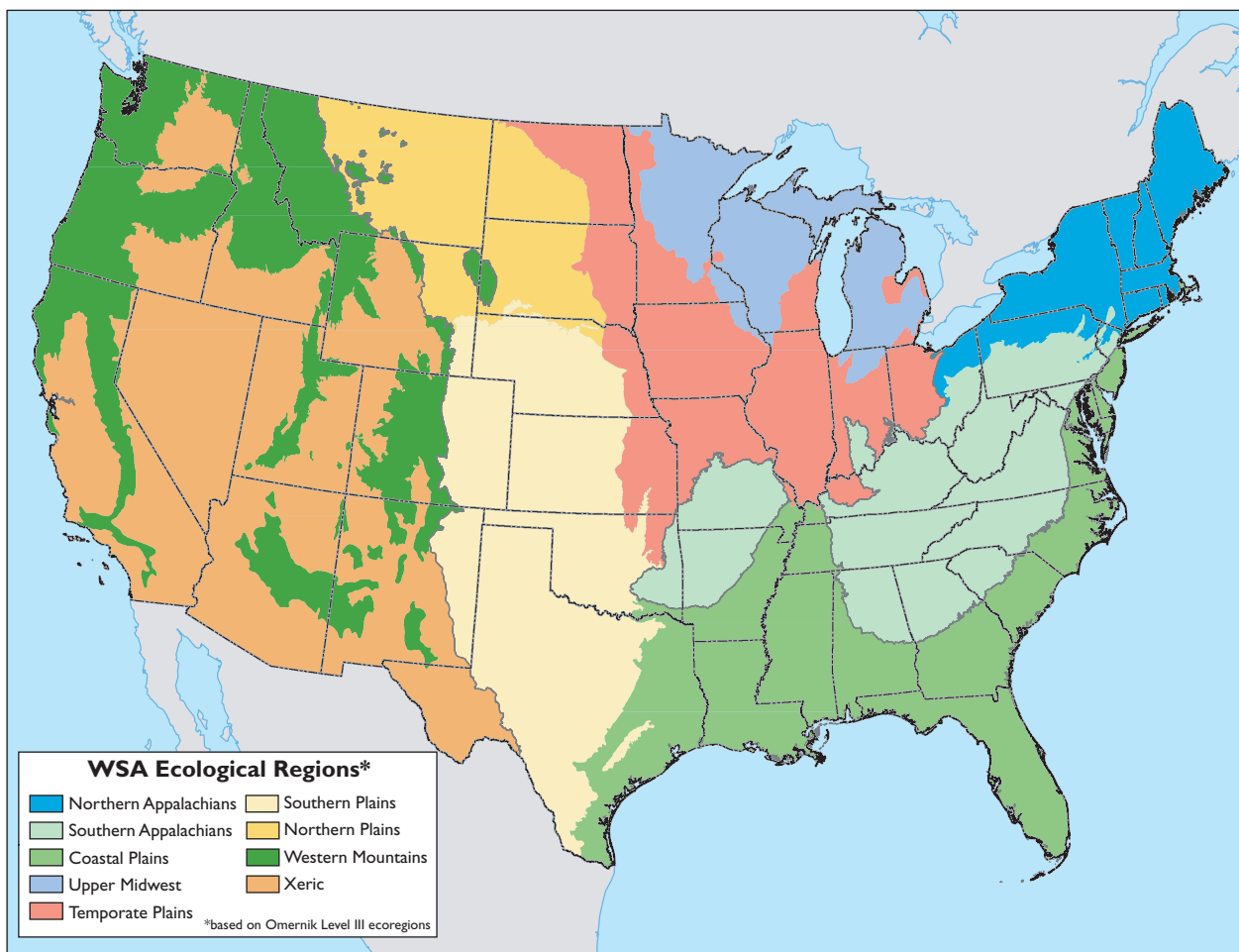


**Manistee River, MI, in the Upper Midwest ecoregion** (Photo courtesy of the Great Lakes Environmental Center).

The nine ecoregions encompass a variety of habitats and land uses, and the least-disturbed reference sites used to set benchmarks for good, fair, and poor condition reflect that variability. For some ecoregions, the variability among reference sites is very small, while it is larger in others. During a series of WSA workshops held around the country, professional biologists examined the variability of reference sites and implications to the benchmarks used to characterize an ecoregion and to compare stream condition across ecoregions. These benchmarks or thresholds were adjusted for those ecoregions where there was a disturbance signal associated with the variability among reference sites. Additional details on the development of benchmarks or thresholds for each of the indicators can be found in the data analysis method available in Chapter 1 and on the EPA Web site at <http://www.epa.gov/owow/streamsurvey>.

This report includes brief descriptions of the WSA ecoregions. It should be noted that there are many specific and unique features within each ecoregion that are not fully captured in these brief descriptions (see the References section at the end of this report for more information). The nine ecoregions displayed in Figure 25 and defined in this text are the following:

- Northern Appalachians
- Southern Appalachians
- Coastal Plains
- Upper Midwest
- Temperate Plains
- Southern Plains
- Northern Plains
- Western Mountains
- Xeric.



**Figure 25. Ecoregions surveyed for the WSA (U.S. EPA/WSA).**

## Northern Appalachians Ecoregion

### *Physical Setting*

The Northern Appalachians ecoregion covers all of the New England states, most of New York, the northern half of Pennsylvania, and northeastern Ohio. This ecoregion encompasses New York's Adirondack and Catskill mountains and Pennsylvania's mid-northern tier, including the Allegheny National Forest. Major river systems for the Northern Appalachians ecoregion are the St. Lawrence, Allegheny, Penobscot, Connecticut, and Hudson rivers, and major waterbodies include Lake Ontario, Lake Erie, New York's Finger Lakes, and Lake Champlain. The total stream length represented in the WSA for the Northern Appalachians ecoregion is 97,913 wadeable stream miles.

The topography of this ecoregion is generally hilly, with some intermixed plains and old mountain ranges. River channels in the glaciated uplands of the northern parts of this ecoregion have steep profiles and rocky beds, and flow over glacial sediments. The climate is cold to temperate, with mean annual temperatures ranging from 39 to 48 °F. Annual precipitation totals range from 35 to 60 inches. The land area of Northern Appalachians ecoregion comprises some 139,424 mi<sup>2</sup> (4.6% of the United States), with about 4,722 mi<sup>2</sup> (3.4%) of land under federal ownership. Based on satellite images from the 1992 National Land Cover Dataset (NLCD), the distribution of land cover in this ecoregion is 69% forested and 17% planted/cultivated, with the remaining 14% of the ecoregion comprised of other types of land cover.



**Cedar Stream, NH, in the Northern Appalachians ecoregion** (Photo courtesy of Colin Hill, Tetra Tech, Inc.).

### *Biological Setting*

Contemporary fish stocks are lower than at the time of European contact, but the coastal rivers of the Northern Appalachians ecoregion still have a wide variety of anadromous fish, including shad, alewife, salmon, and sturgeon.

### *Human Influence*

Early European settlers in 17th-century New England removed beaver dams, allowing floods to pass more quickly, thereby flushing sediment and decreasing the diversity and availability of riparian habitat. Forests were cleared to introduce crops and pasture for grazing animals, and these efforts caused the erosion of sediments, increased nutrients, and reduced riparian habitat. Roughly 96% of the original virgin forests of the eastern and central states were gone by the 1920s.

Smaller tributaries in this ecoregion were often disrupted through splash damming — a 19th century practice of creating dam ponds for collecting timber and then exploding the dams to move timber downstream with the resulting torrent of flood waters. These waters carried flushed sediment and wood downstream, and these materials scoured many channels to bedrock. Streams that were not splash dammed currently have tens to hundreds of times more naturally occurring woody debris and deeper pools. During the 18th and early 19th centuries, streams with once-abundant runs of anadromous fish declined due to stream sedimentation, clogging from sawmill discharges, and the effects of dams. Increased human and animal waste from agricultural communities changed stream nutrient chemistry. When agriculture moved west and much of the ecoregion's eastern farmland converted back into woodlands, sediment yields declined in some areas.

Today, major manufacturing, chemical, steel, and power production (e.g., coal, nuclear, oil) occur in the large metropolitan areas found around New York City and the states of Connecticut and Massachusetts. Many toxic substances, including petroleum products, organochlorines, polychlorinated biphenyls (PCBs), and heavy metals, along with increased nutrients such as nitrates and phosphates, are the legacy of industrial development. There are currently 215 active, 6 proposed, and 45 former EPA Superfund National Priority List sites in the Northern Appalachian ecoregion.

It is also common for treated wastewater effluent to account for much of the stream flow downstream from major urban areas in this

ecoregion. Treated wastewater can be a major source of nitrate, ammonia, phosphorus, heavy metals, volatile organic chemicals (VOCs), PCBs, and other toxic compounds.

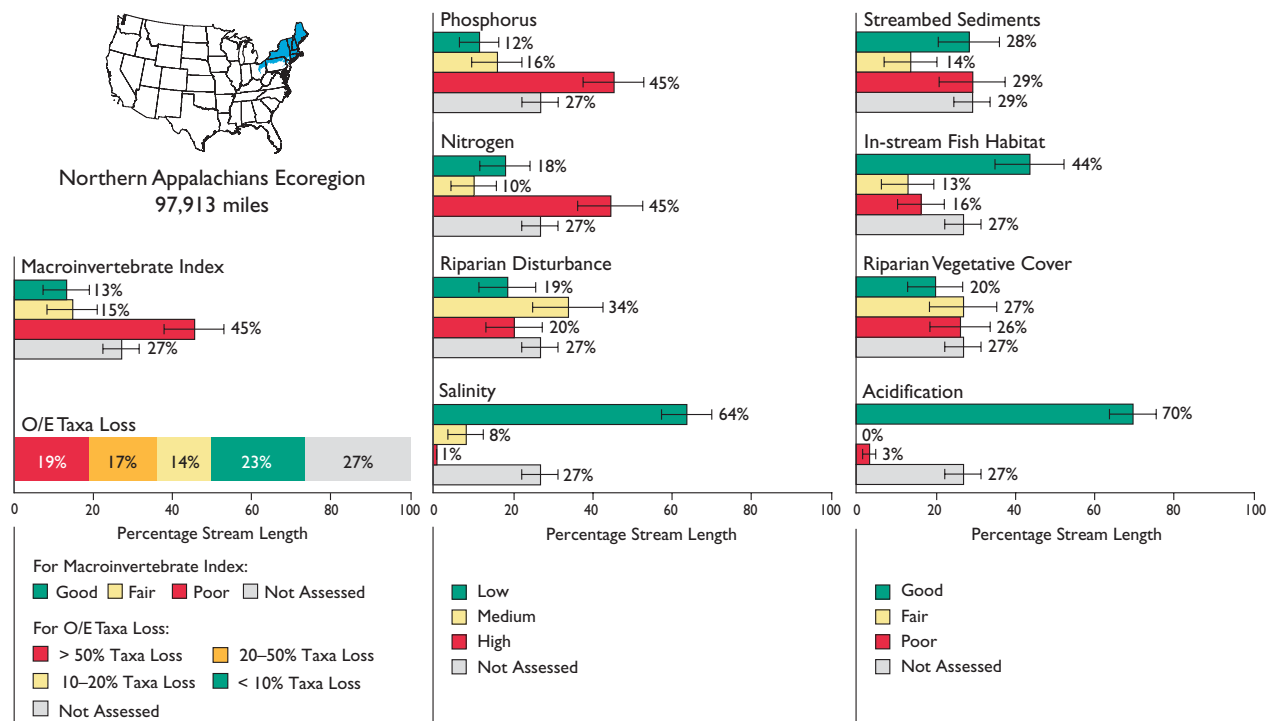
This ecoregion supports forestry; mining; fishing; wood processing of pulp, paper, and board; tourism; and agricultural activities, such as dairy cattle farming, potato production, poultry farming, and timber harvesting.

The approximate population within the Northern Appalachians ecoregion is 40,550,000, representing approximately 14% of the total population of the United States.

### *Summary of WSA Findings*

A total of 85 WSA sites were sampled during the summer of 2004 to characterize the condition of wadeable streams in the Northern Appalachians ecoregion. An overview of the WSA survey results for this ecoregion is shown in Figure 26. These results may not be extrapolated to accurately assess the ecological condition of an individual state or stream within the ecoregion because the study design was not intended to characterize stream conditions at these finer scales.

It should be noted that about 27% of wadeable stream length in the Northern Appalachians ecoregion was not assessed because small, 1st-order streams in New England were not included in the sample frame. These streams were excluded from the WSA due to a decision to match an earlier New England random design. The numbers cited below apply to the 73% of wadeable stream length that was assessed in the Northern Appalachians ecoregion.



**Figure 26. WSA survey results for the Northern Appalachians ecoregion (U.S. EPA/WSA).** Bars show the percentage of stream length within a condition class for a given indicator. Lines with brackets represent the width of the 95% confidence interval around the percent of stream length. Percents may not add up to 100 because of rounding.

During a series of WSA workshops conducted to evaluate assessment results, professional biologists working in the Northern Appalachians ecoregion said that many least-disturbed reference sites in this ecoregion are nearly undisturbed streams, with sparse human population in the immediate watershed; therefore, the reference condition for the ecoregion is of very high quality.

### Biological Condition

- The findings of the Macroinvertebrate Index show that 45% of stream length in the Northern Appalachians ecoregion is in poor condition, 15% is in intermediate or fair condition, and 13% is in good condition when compared to least-disturbed reference condition. As noted above, 1st-order streams, which are generally considered to be of high

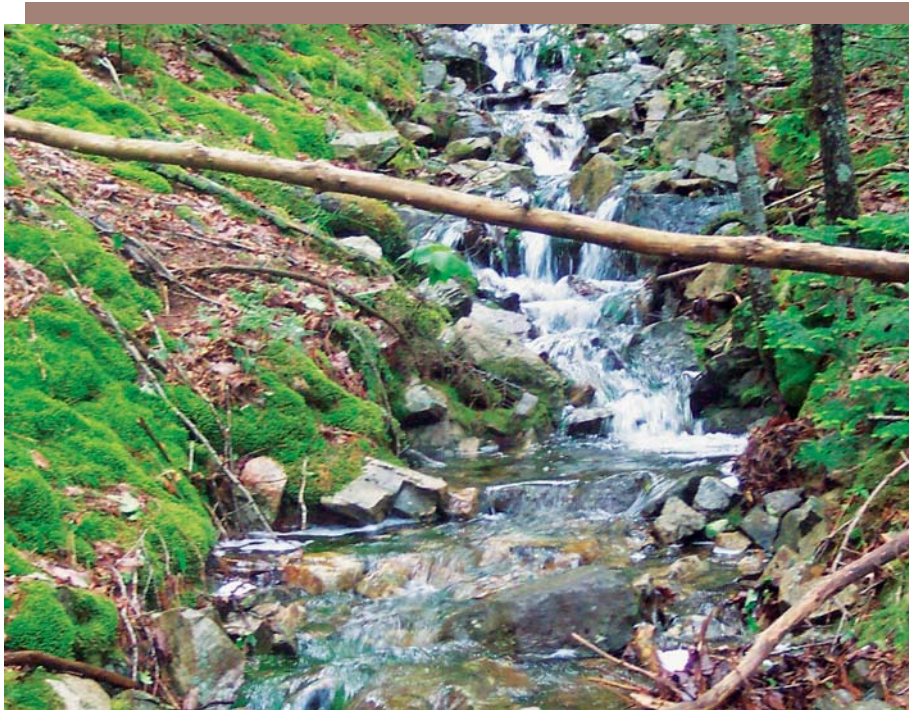
quality in this ecoregion, were not included in the WSA.

- The O/E Taxa Loss results show that 50% of stream length in the Northern Appalachians ecoregion has lost 10% or more of the macroinvertebrate taxa expected to occur, and 19% has lost more than 50% of taxa. These results indicate that 23% of stream length has retained 90% of the groups or classes of organisms expected to occur based on least-disturbed reference condition.

### Indicators of Stress

Leading indicators of stress in the Northern Appalachians ecoregion include total phosphorus, total nitrogen, streambed sediments, and riparian vegetative cover.

- Approximately 45% of stream length in the Northern Appalachians ecoregion has high phosphorus concentrations, 16% has medium phosphorus concentrations, and 12% has low phosphorus concentrations based on least-disturbed reference condition.
- Similarly, approximately 45% of the ecoregion's stream length has high nitrogen concentrations, 10% has medium nitrogen concentrations, and 18% has low nitrogen concentrations based on least-disturbed reference condition.
- Riparian disturbance, or evidence of human influence in the riparian zone, is at high levels in 20% of stream length, at medium levels in 34% of stream length, and at low levels in 19% of stream length.
- Salinity is found at high levels in 1% of stream length, at medium levels in 8% of stream length, and at low levels in 64% of stream length.
- Streambed sediments are rated poor in 29% of stream length in the Northern Appalachians ecoregion, fair in 14%, and good in 28%.
- In-stream fish habitat is in poor condition in 16% of stream length, fair in 13% of stream length, and good in 44%.
- Vegetative cover in the riparian zone along stream banks is in poor condition for 26% of stream length, fair condition for 27% of stream length, and good condition for 20% of stream length.
- Acidification, which is primarily associated with acid rain in this ecoregion, is rated poor in 3% of stream length.



**Stream channels in the glaciated uplands of the Northern Appalachians are characterized by steep profiles and rocky beds** (Photo courtesy of Lauren Holbrook, IAN Image Library).