

Indicator 4.21:

U.S. Forest Sustainability Indicators <https://www.fs.fed.us/research/sustain/>

Area and percent of water bodies or stream length in forest areas with significant change in physical, chemical, or biological properties from reference conditions

Michael C. Amacher, Claire O'Dea, and Debbie Page-Dumroese

May 1, 2020

What is the indicator and why is it important?

Water quality in forest ecosystems is controlled by climate, hydrology, catchment geology, natural disturbances, land management, and actual land use activities, whether managed or not. Water quality in undisturbed forested catchments can serve as important baseline references for water quality in catchments with varying land use and management activities. This indicator aims to measure the amount of water in forested areas of the United States that is undergoing changes in physical, chemical, or biological properties. In its current version, however, most of the data presented here relates to all water bodies, not just those occurring in forested lands. Trends in these properties can indicate effects of changing land use and suggest where management can be altered to preserve water quality.

What does the indicator show?

Every 2 years, States submit water quality reports to the U.S. Environmental Protection Agency (EPA) under Section 305(b) of the Clean Water Act. The National Assessment Database summarizes the data submitted by the States (http://ofmpub.epa.gov/waters10/attains_nation_cy.control). States designate water uses and assess water quality attainment in the National Assessment Database. States also determine the principal sources of impairment for both linear water bodies (rivers and streams) and area-based water bodies (lakes, ponds, and reservoirs).

Rivers and Streams

There are 3,533,205 miles of rivers and streams reported by the States in the most recent National Assessment Database. Of these, 1,105,205 miles have been assessed for water quality attainment (31.3 percent of total). About 53 percent

of all assessed U.S. rivers/streams are in poor overall condition (fig. 21-1). In contrast, only about 25.1 percent of assessed rivers/streams designated as public water supplies are in poor overall condition, representing a decline from past assessments. Since waterbodies designated as public water supplies receive some degree of protection, including forest buffers, forest-protected rivers/streams have about 1.6 times the percentage in good condition as all U.S. rivers/streams (75 percent vs. 47 percent).

Besides the State-level surveys, the EPA also conducted a statistically based survey in which representative rivers/streams of various sizes and geographic areas were assessed for a number of water quality parameters, including overall biological condition (EPA 2016a). The State-level surveys

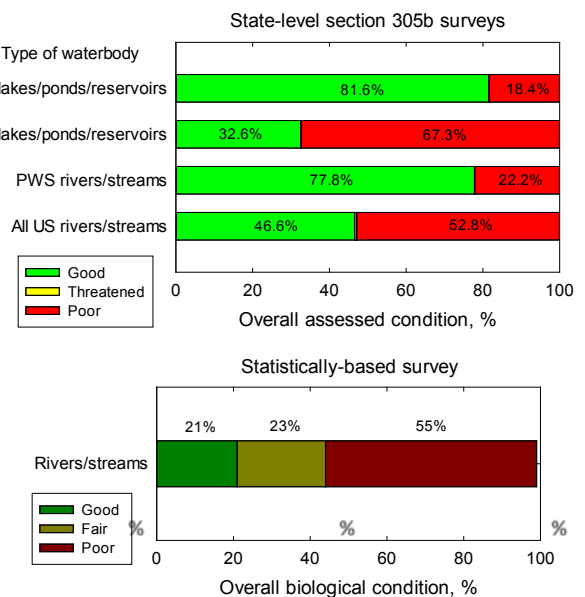


Figure 21-1—All U.S. and public water supply (PWS) designated waterbody overall assessed conditions from State-level section Clean Water Act 305b surveys (top) and statistically based overall biological condition survey of rivers/streams (bottom).

and the statistically based survey show similar percentages of U.S. rivers/streams in poor overall condition (53 percent for State-level survey vs. 46 percent for statistically based survey) (fig. 21-1), even though different metrics were used, thus reinforcing the State-level survey results.

Silvicultural activities were identified as a source of impairment for 40,822 miles of rivers/streams (about 3.6 percent of all assessed miles) (fig. 21-2). In contrast, the top three sources of impairment (unknown sources, agriculture, and hydromodification) account for about a third of all miles impaired. Silviculture ranked 10th in miles impaired out of 22 sources of impairment. Note that this assessment does not include areas where forest management has been used to enhance water quality through, for example, targeted afforestation in riparian zones or watershed catchment areas.

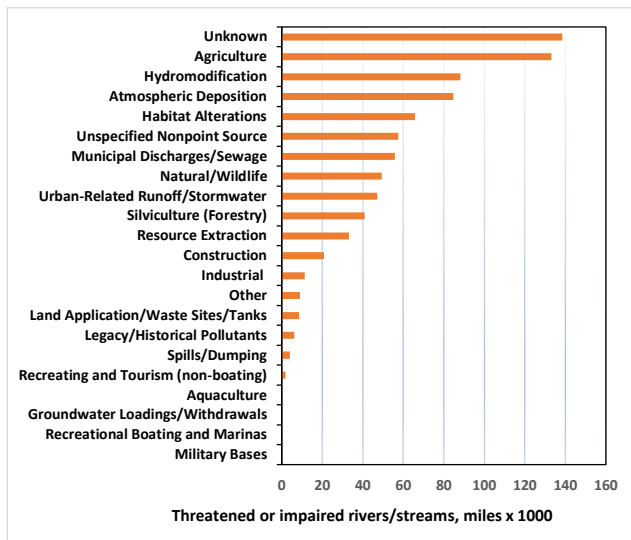


Figure 21-2—Probable sources of impairment in U.S. rivers/streams from State-level Clean Water Act Section 305b surveys (U.S. Environmental Protection Agency National Assessment Database. http://ofmpub.epa.gov/waters10/attains_nation_cy.control).

Lakes, Ponds, and Reservoirs

A total of 41,666,049 acres of lakes/ponds/reservoirs were reported by the States in the most recent National Assessment Database. Of these, 18,542,346 acres have been assessed for water quality attainment (44.5 percent of total). About 71 percent of all assessed U.S. lakes/ponds/reservoirs are in poor overall condition (fig. 21-1). In contrast, only about 22 percent of assessed lakes/ponds/reservoirs designated as public water supplies are in poor condition. Thus, forest-protected lakes/ponds/reservoirs have 2.7 times the percentage in good condition compared to all U.S. lakes/ponds/reservoirs.

The EPA also conducted a statistically based survey examining the chemical, physical, biological, and human use condition of representative lakes of various sizes and geographic areas (EPA 2016b). Results showed poor chemical condition in 35 to 40 percent of lakes (with another 15 to 25 percent in impaired condition), poor physical condition in 18 to 29 percent of lakes (with another 23 to 53 percent in impaired condition), poor biological condition in 21 to 31 percent of lakes (with another 26 to 27 percent in impaired condition), and poor human use condition in 0 to 40 percent of lakes (with another 0 to 51 percent in impaired condition). Given that these indicators were analyzed separately, and that overlap of lakes categorized as poor conditions for multiple indicators is not provided, the results cannot be compared to the State-level survey.

Silvicultural activities were identified as a source of impairment for 170,181 acres (0.9 percent of total assessed acres) (fig. 21-3). In contrast, atmospheric deposition, unknown sources, and unspecified nonpoint source accounted for more than half of all acres impaired. Silviculture ranked 17th in acres impaired out of 22 sources of impairment.

Critical loads have been calculated for 10,684 surface water bodies to identify the vulnerability of these surface waters to atmospheric deposition. A critical load is a quantitative estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge. Comparing these thresholds to current deposition rates of nitrogen and sulfur indicates that 36.5 percent of these surface water bodies are exceeding their critical loads, and are likely experiencing aquatic acidification impacts (fig. 21-4).

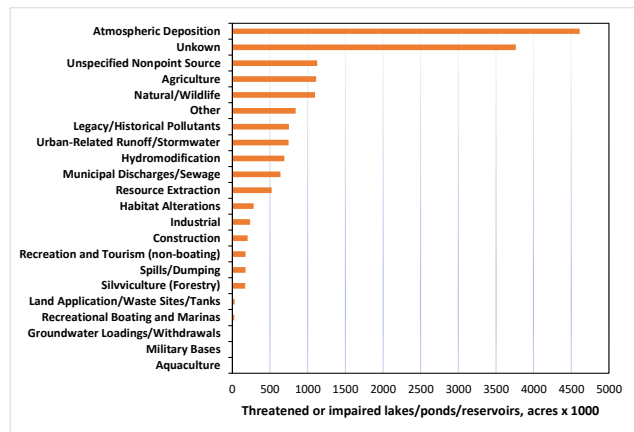


Figure 21-3—Probable sources of impairment in U.S. lakes/ponds/reservoirs from State-level Clean Water Act Section 305b surveys (U.S. Environmental Protection Agency National Assessment Database. http://ofmpub.epa.gov/waters10/attains_nation_cy.control).

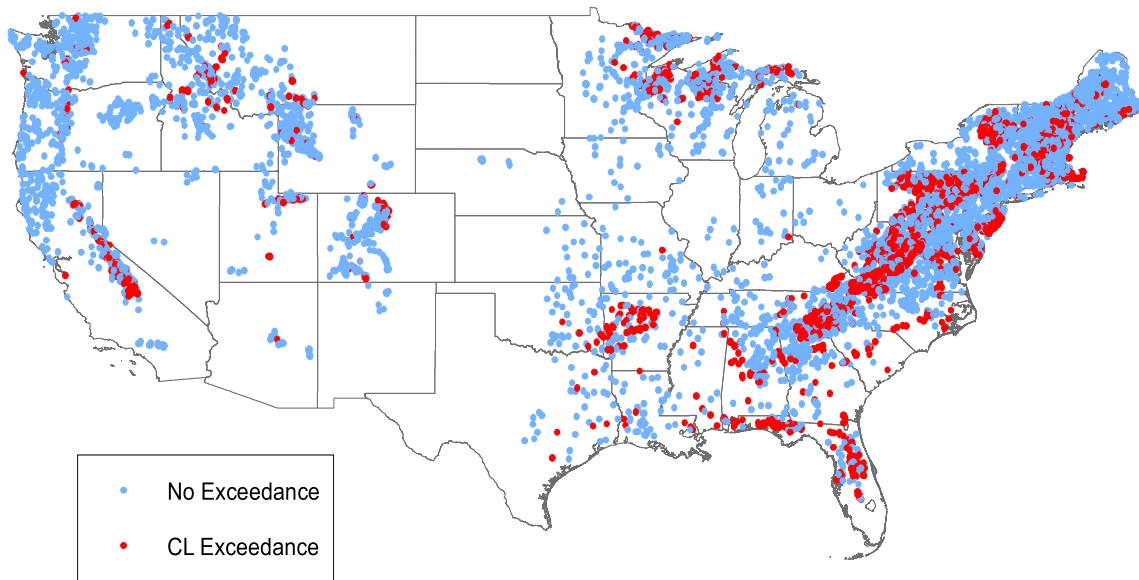


Figure 21-4—Locations of surface water critical loads for aquatic acidification, with 2012 exceedances shown in red. Source: National Atmospheric Deposition Program, Critical Loads of Atmospheric Deposition Science Committee.

What has changed since 2010?

How this indicator is evaluated has changed somewhat since the 2010 report. Figure 21-1 has been added to compare public water supply waterbody conditions with all U.S. waterbodies. In the case of lakes/ponds/reservoirs, silviculture has decreased as a source of waterbody impairment, with 46 percent fewer acres reported to have been impaired by forestry-based activities since the last report. For rivers/streams, however, silviculture has increased as a source of waterbody impairment, with 72 percent more assessed miles identified as impaired by forestry-based activities since the last report. Some of this increased impairment is likely due to the increased number of assessed miles since the last report, in addition to the fact that only 16 States identified silviculture as a source of impairment in 2010.

The number of surface water bodies exceeding their surface water critical load for aquatic acidification has declined by 1 percent since 2010 and 6 percent since 2005.

Are there important regional differences?

Because many States do not specifically identify silviculture as a source of water quality impairment, and because many waters have yet to be assessed, it is not yet possible to determine regional differences with a reasonable degree of accuracy. Critical load exceedances, however, are concentrated in the eastern half of the United States.

Why can't the entire indicator be reported at this time?

There are many other sources of water quality impairment identified in the National Assessment Database. Some of these, such as flow and habitat modification, sedimentation, riparian vegetation removal, grazing impacts, resource extraction, and others, occur in forested areas. Unfortunately, other than silviculture, the National Assessment Database does not separate sources of impairment by vegetation cover related to land use. Thus, it is not possible to separate resource extraction impairments, for example, in forested areas from other land use/vegetation cover classification areas.

Another problem is that sources of impairment may originate inside or outside of forested areas. Also, the National Assessment Database does not indicate the quantitative degree of impairment. Some impairments may be transitory, others more permanent. Although individual stressors and pollutants are identified, quantitative water quality data summarized by forested area across the entire United States are lacking. To fully report this indicator, quantitative water quality data summarized by land and water use, vegetative cover, sources and origins of impairments, and stressors and pollutants are needed. If it was available, a full integration of EPA assessment and U.S. Geological Survey water quality data by forested hydrologic unit code (HUC) would better meet the intent of this indicator

References

- U.S. Environmental Protection Agency (EPA). 2012. National Assessment Database. http://ofmpub.epa.gov/waters10/attains_nation_cy.control. (February 2018).
- U.S. Environmental Protection Agency. 2016a. National Rivers and Streams Assessment 2008–2009: A Collaborative Survey. EPA 841-R-16-007. Washington, DC. <http://www.epa.gov/nationalaquaticresourcesurveys/nrsa>. (Date accessed unknown).
- U.S. Environmental Protection Agency. 2016b. National Lakes Assessment 2012: A Collaborative Survey of Lakes in the United States. EPA 841-R-16-113. Washington, DC. <https://nationallakesassessment.epa.gov/>. (Date accessed unknown).
- We acknowledge the Critical Loads of Atmospheric Deposition (CLAD) Science Committee of the National Atmospheric Deposition Program (NADP) for their role in making available CLAD_CL_ACID_v2.5 and CLAD_CL_N_v2.5acddb datasets. <http://nadp.slh.wisc.edu/committees/clad/db/>. (August 2017).