Physical Habitat

WHY DO WE CONDUCT STREAM HABITAT ASSESSMENTS? [1, 2]

The physical characteristics of stream habitat—such as the presence or absence of instream cover, substrate characteristics, and riparian integrity—have important effects on benthic macroinvertebrates and fish. Evaluating habitat quality is critical to assessing a stream's ecological integrity and aquatic-life potential, while characterizing habitat allows us to interpret results and determine the cause of decreasing biotic integrity.

A degraded habitat is a major stressor to aquatic environments and can sometimes complicate investigations on the effects of poor water quality.

PHYSICAL HABITAT STRESSORS

Many human activities stress the physical condition of rivers and streams and, by extension, fish and other aquatic organisms. These include construction, certain agriculture practices, removal of vegetation along rivers and streams, land development, and the spread of impervious surfaces (e.g., roads and parking lots).

For the San Juan Watershed Monitoring Program, the team will apply habitat assessment methods used for the U.S. EPA's National Rivers and Stream Assessment (NRSA).[3] At each site where we collect biological information, such as macroinvertebrates, we will also evaluate physical habitat stressors.

INDICATORS OF PHYSICAL HABITAT CONDITIONS

The NRSA focuses on four indicators of physical habitat conditions in rivers and streams, described below. These indicators help document the impact of our human footprint across the landscape as well as the progress made through widespread protection and mitigation efforts.

Excess Streambed Sediments. The size and shape of natural stream and river channels, as well as the size of the particles that make up their beds, reflect the interplay between sediment inputs and water flow. Landscape uses such as agriculture, forestry, construction, and urbanization can increase the amount of fine sediments entering streams and rivers. As these excess fine sediment inputs are transported downstream, channel particles become finer and less stable, often filling in the habitat spaces between stream cobbles and rocks where many aquatic organisms live and breed. Land uses can also change the amount and timing of water runoff into channels, especially when they increase the amount of impervious land surfaces. Such hydrologic alterations typically increase the frequency of high-magnitude floods, resulting in river incision, bank erosion, and aquatic habitat loss.

In-Stream Fish Habitat. The healthiest and most diverse communities of fish and macroinvertebrates are found in rivers and streams that have complex, varied forms of habitat, such as boulders, undercut banks, tree roots, and logs within stream banks. Human use of these water bodies and their adjacent riparian areas often results in the removal or loss of much of this habitat, which in turn affects biological condition. The NRSA uses a habitat complexity measure that sums the amount of in-stream fish habitat and concealment features (e.g., undercut banks, boulders, large pieces of wood, brush, and cover from overhanging vegetation) within the water body and its banks. Because this measure differs naturally within and among ecoregions, the NRSA compares low in-stream fish habitat with expected values across reference conditions adjusted for factors such as geography and climate.

Riparian Vegetative Cover. Healthy, multi-layered vegetation in the land corridor surrounding a river or stream can act as a buffer from human disturbances. These buffers can reduce nutrient and sediment runoff from the surrounding landscape; prevent streambank erosion; provide shade to reduce water temperature; and provide leaf litter and large wood (e.g., branches and logs) to serve as food, shelter, and habitat for aquatic organisms. The NRSA sums the amount of cover provided by three layers of riparian vegetation: the ground layer, woody shrubs, and canopy trees. Because the amount and complexity of riparian vegetation differs naturally within and among ecoregions, the NRSA assesses lower-than-expected riparian vegetative cover by comparing it with expected values across reference conditions.

Riparian Disturbance. Human disturbances—such as roads, pavement and cleared lots, buildings, pastures and rangeland, row crops, dams, and logging or mining operations—that are closer to a river or stream will have more impacts. To measure those impacts, the NRSA tallies 11 specific forms of human activity and their proximity to 22 riparian plots along the water body. The NRSA applies the same criteria to define high, medium, and low riparian disturbances in streams and rivers nationwide and ranks them as being in poor, fair, and good condition, respectively. For example, a river or stream scored medium (i.e., fair) if one type of human influence was noted in at least one-third of the riparian plots, and scored high (i.e., poor) if one or more types of disturbance were observed at all the plots.

To learn more about U.S. EPA's NRSA, including methods and findings, visit:
https://www.epa.gov/national-aquatic-resource-surveys/what-national-rivers-and-streams-assessment.

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[1] Texas Commission on Environmental Quality. 2014. Chapter 9: Physical Habitat of Aquatic Systems. In: *Surface Water Quality Monitoring Procedures, Volume 2: Methods for Collecting and Analyzing Biological Assemblage and Habitat Data*. Available at https://www.tceq.texas.gov/assets/public/comm_exec/pubs/rg/rg416/chapter-9.pdf.

[2] U.S. EPA. 1999. Chapter 5 (part A): Habitat Assessment and Physiochemical Parameters. In: *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition*. Available at https://archive.epa.gov/water/archive/web/html/ch05main.html.

[3] U.S. EPA. 2016. National Rivers and Streams Assessment 2008–2009: A Collaborative Survey. Available at https://www.epa.gov/sites/production/files/2016-03/documents/nrsa_0809_march_2_final.pdf.

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