Habitat Assessment:
The Parts Equal the Whole

Volunteer Monitoring Factsheet Series 2023

Why are we concerned?

- The habitat functions holistically, so any changes to a part may affect the entire habitat.
- Certain land uses affect habitat quality and stream health.
- The Habitat Assessment uses visual measurements of land and water conditions to help pinpoint land uses affecting water quality.

Time Needed:
90-120+ minutes

Equipment Needed:
- Hipboots or waders
- Tape measure
- Yardstick or marked D-frame net pole
- Calculator
- Datasheets
- Pen or pencil
- Clipboard
- Marking flags

When to Measure: Usually once a year in the summer once leaves have emerged.

Overview of Stream Habitat

A healthy stream is a busy place. Wildlife find shelter and food near and in its waters. Vegetation grows along its banks, shading the stream and filtering pollutants before they enter the stream. Within the stream itself are fish, insects and other tiny creatures with specific needs: dissolved oxygen to breathe; rocks, overhanging tree limbs, logs and roots for shelter; vegetation and other tiny animals to eat; and special places to breed and hatch their young. For any of these activities, they might also need water of specific velocity, depth and temperature. Many land-use activities can alter these characteristics, causing problems within the entire habitat.

A stream with healthy riparian zone.

Definition of Terms

Riparian Zone: The land between the water's edge and the upper edge of the flood plain; transition zone between water and land.

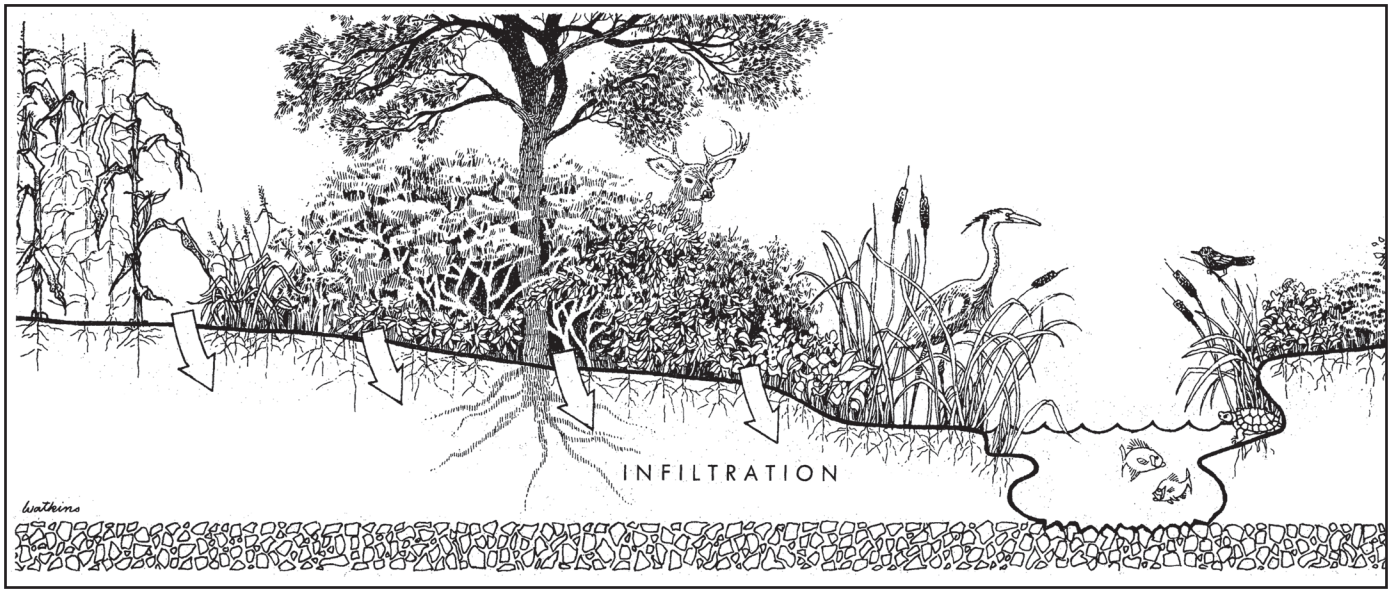
Embeddedness: The extent to which rocks are buried by silt, sand or mud on the stream bottom.

Riffles: The shallow fast-water areas of the stream in which water movement is turbulent.

Thalweg: The path of deepest and fastest water.

Substrate: The stream bottom surface on which plants and animals attach or live.

Concepts in the Habitat Assessment



This diagram shows a healthy vegetated buffer in the riparian zone. The buffer allows runoff water to infiltrate into the ground instead of rushing into the stream unfiltered. Note the vegetated undercut bank on the right, which provides animal habitat and is resistant to erosion.

The Habitat Assessment is an easy-to-use approach for identifying and assessing the elements of a stream's habitat. It is the same protocol used by Department of Natural Resources biologists who make observations of stream habitat characteristics and major physical attributes. Conducting a habitat assessment is an annual event, best performed in summer once leaves have emerged. This assessment is useful as: 1) a screening tool to identify habitat stressors and 2) a method for learning about stream ecosystems and environmental stewardship.

Taking stock of the habitat's characteristics may begin at the riparian zone where land is making a transition into water. Within healthy stream corridors, this area generally has vegetation that acts as a buffer between land and water, soaking up many runoff pollutants. Moving on, the stream assessment will then focus on the condition of the bank and finally the stream channel and stream itself. In order to help prepare you to fill out the DNR Wadable Stream Qualitative Fish Habitat Rating Form, certain stream and river characteristics and concepts are defined on the following pages.

Riparian Zone

The healthy riparian zone is characterized by trees, bushes, shrubs and tall grasses that help to buffer the stream from polluted runoff and create habitat for fish and wildlife. These plants also provide stream shading (or overhead canopy) and serve several important functions in the stream habitat. The canopy helps keep water temperatures cool by shading it from the sun, while offering protection and refuge for animals.

Certain conditions in the riparian zone can negatively affect the stream's habitat. Lawns maintained to the water's edge are abrupt transitions from land to water, offering very little or no buffering protection for the stream. In these cases, lawn care products and grass clippings could be entering the stream. Short-grassed stream banks also provide poor habitat for animals. Bare soil and pavement provide no buffering action from runoff.

Features to note in riparian zones:

- Evergreen trees (conifers) - cone-bearing trees that do not lose their leaves in winter.
- Hardwood trees (deciduous) - in general, trees that shed their leaves at the end of the growing season.
- Bushes - short conifers or deciduous shrubs less than 15 feet high.
- Tall grass, ferns, etc. - includes tall, natural grasses, ferns, vines, and mosses.

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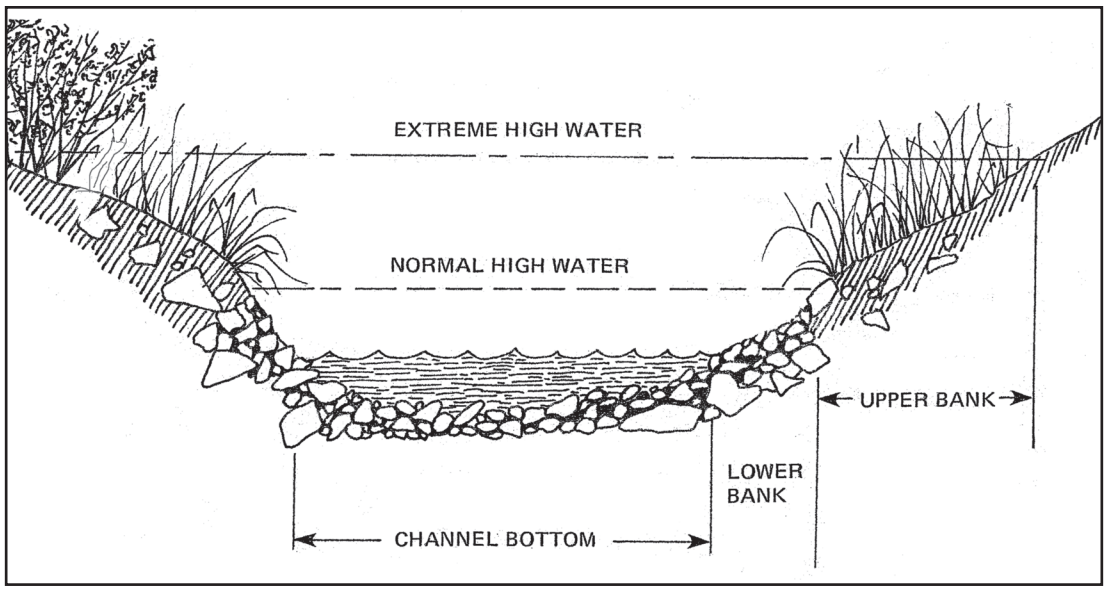


This diagram shows a cross section of a typical streambank, demarcating the upper and lower banks.

- Lawn - cultivated and maintained short grass.
- Boulders - rocks larger than 10 inches in diameter.
- Gravel/cobbles/sand - rocks smaller than 10 inches in diameter; sand.
- Bare soil
- Pavement or structures - any structures or paved areas, including paths, roads, bridges, houses, etc
- Garbage or junk adjacent to the stream - Note the presence of litter, tires, appliances, car bodies, or other large objects.

Stream Bank Characteristics

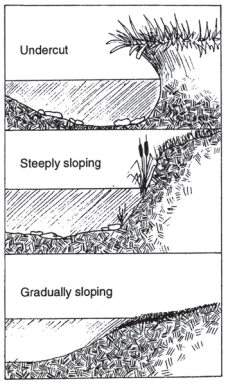
The stream bank consists of the upper and lower bank. The shape and condition of the stream bank can give many clues to the types of land uses in the adjacent watershed. For example, sometimes the channel may be altered by too much water flooding the stream in a short time. This may indicate a nearby urban area with many impervious surfaces, so the rain or melting snow cannot naturally soak into the ground. Large volumes of runoff then flood the nearest stream with too much water, which erodes and distorts the stream channel. Sometimes it is obvious that the banks have been eroded by excessive water because the normal flow does not reach the new shoreline which has been pushed back.

This stream has a gradually sloping bank.

A **vertical or undercut bank** rises vertically (at an approximate 90-degree angle) or overhangs the stream. This type of bank generally provides good cover for aquatic invertebrates (small animals without backbones) and fish and is resistant to erosion. This bank usually has a good vegetative cover that helps to stabilize the bank. If seriously undercut, however, the bank could collapse.

This steeply sloping bank has obvious and severe erosion.

A **steeply sloping bank s**lopes at more than a 45-degree angle. This type of bank is very vulnerable to erosion.



A **gradually sloping bank** has a slope of about 30 degrees or less. Although this type of stream bank is highly resistant to erosion, it does not provide much streamside cover.

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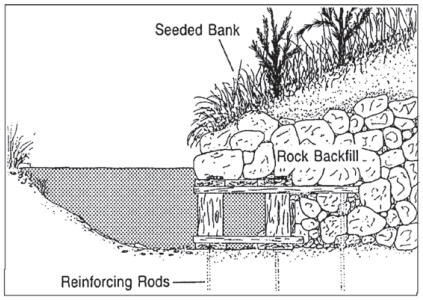
Artificial bank modifications include ditching and other changes such as concrete embankments and gabions to stem further erosion from the action of the water. Also included are LUNKER structures which are wooden underwater habitats set into the bank and designed for trout and other game fish. Rock rip rap placed at bends and other areas subject to erosion serve to improve fish habitat and stabilize stream meanders.



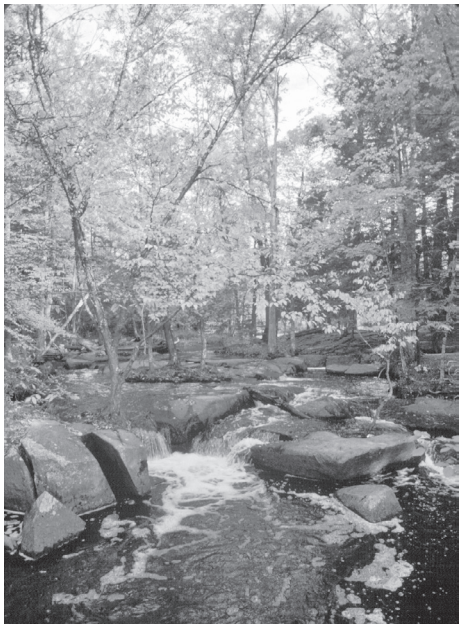
LUNKER structure

Note the presence of any artificial embankments. This stream has a fortified concrete embankment.

Poor stream bank conditions can include the loss of natural plant cover. Erosion can occur when streamside vegetation is trampled or missing or has been replaced by poorly designed landscaping or pavement. More severe cases of stream bank erosion include washed away banks or banks that have collapsed. Excessive mud or silt entering the stream from erosion can distort the stream channel, interfere with beneficial plant growth, dissolved oxygen levels and the ability of fish to sight prey. It can irritate fish gills and smother fish eggs in spawning areas. Often it is the result of eroding stream banks, poor construction site practices, urban area runoff, silviculture (forestry practices) or ditches that drain the surrounding landscape.

In-stream Characteristics

Stream bottoms (substrate) are classified according to the comprising material. Rocky bottom streams are defined as those made up of gravel, cobbles and boulders in any combination. They usually have definite riffle areas. Soft bottom streams have naturally muddy, silty or sandy bottoms that lack riffles. Usually, these are slow-moving, low-gradient streams (i.e., streams that flow along flat terrain).



This rocky bottom stream has lots of riffles — fast, turbulent, shallow water. Note the size of the boulders.

Substrate types include:

Silt/clay/mud—This substrate has a sticky feeling. The particles are fine. The spaces between the particles hold a lot of water, making the sediments feel like ooze.

Sand (up to 0.1 inch)—A sandy bottom is made up of tiny, gritty particles of rock that are smaller than gravel but coarser than silt (gritty, less than a grain of rice).

Gravel (0.1-2 inches)—A gravel bottom is made up of stones ranging from tiny quarter-inch pebbles to rocks of about 2 inches (fine gravel - rice size to marble size; coarse gravel - marble to ping pong ball size).

Cobbles (2-10 inches)—Most rocks on this type of stream bottom are between two and 10 inches (between a ping pong ball and a basketball).

Boulders (greater than 10 inches)—Most of the rocks on the bottom are greater than 10 inches (between a basketball and a car in size).

Bedrock—This kind of stream bottom is solid rock (or rocks bigger than a car).

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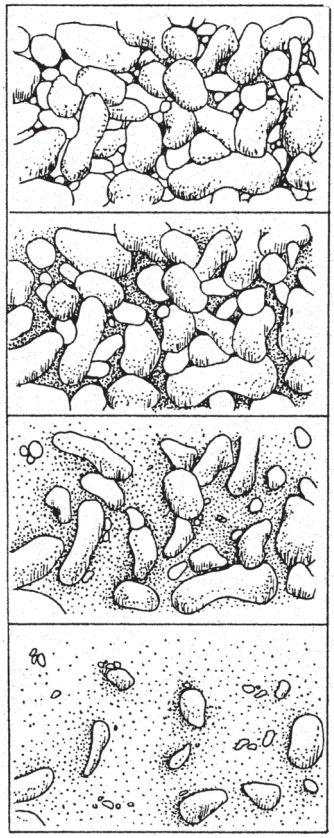
Embeddedness is the extent to which rocks (gravel, cobbles, and boulders) are buried by silt, sand, or mud on the stream bottom. Generally, the more embedded rocks, the less rock surface or space between rocks available for aquatic macroinvertebrate habitat and for fish spawning. Excessive silty runoff from erosion can increase a stream's embeddedness. To calculate embeddedness, estimate the amount of silt or finer sediments overlying, in between, and surrounding the rocks (see diagram).

Presence of logs or woody debris in streams can provide important fish habitat. Be sure to differentiate between logs or woody debris and naturally occurring or moderate amounts of organic material in streams, which includes leaves and twigs. Also be sure to only consider such materials to be fish habitat if water is at least 8 inches deep.

This diagram represents a rocky bottom stream becoming embedded with sand. As sand settles on the streambed, spaces between the rocks fill up.



Water Characteristics

Pools, riffles, and runs. A mixture of flows and depths creates a variety of habitats to support fish and invertebrate life (see illustration below).

- Pools are deep with slow water.
- Riffles are shallow with fast, turbulent water running over rocks.
- Runs are deep with fast-moving water with little or no turbulence.

Stream velocity influences the health,variety, and abundance of aquatic animals. If water flows too quickly, some organisms might be unable to maintain their hold on rocks and vegetation and be flushed downstream; if water flows too slowly, oxygen diffusion is insufficient for species needing high levels of dissolved oxygen. Dams, channelization or straightening out the stream's natural bends (sinuosity), certain kinds of terrain, runoff, and other factors can affect stream velocity.

The *thalweg* is the path of the deepest and fastest water.

Rooted aquatic plants provide food and cover for aquatic organisms. They can also indicate water quality problems. Sometimes, excess nutrients may flush into the stream and stimulate unnatural aquatic plant growth. Compare the amount of plants in your stream to other streams in the area when deciding if there are too many plants.

Algae are simple plants that do not grow true roots, stems, or leaves and that mainly live in water, providing food for animals low on the food chain. Algae may be green or brown, grow on rocks, twigs, or other submerged materials, or float in the water. Excessive algal growth may indicate excessive nutrients (organic matter or a pollutant such as fertilizer) in the stream.

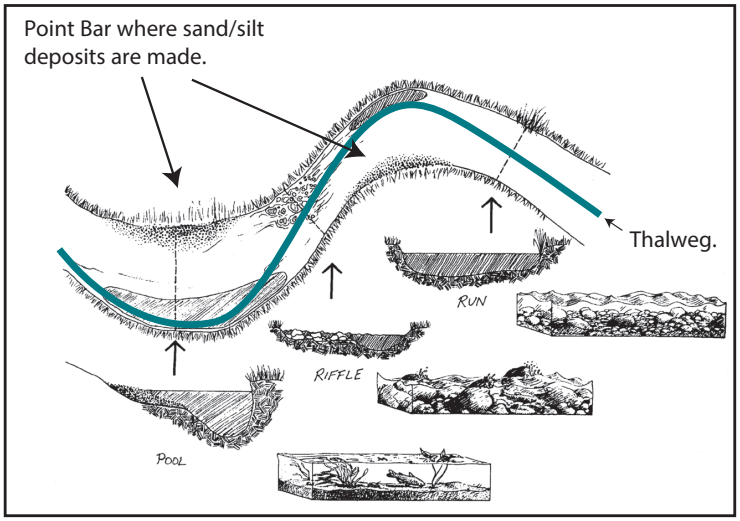


Diagram of a stream with a mixture of pools, riffles, and runs. Varying flows and depths create a variety of habitats for macroinvertebrates.

When to be Wary of Water:

Water appearance can indicate water pollution. However, it can also indicate a possible safety hazard. If you notice any unusual water characteristics, **DO NOT ENTER THE WATER** and contact your local DNR office to report it. Your safety is important to us. Here is a list of normal and possibly hazardous characteristics of water:

Clear - colorless, transparent
Milky - cloudy-white or gray, not transparent; might be natural or due to pollution
Foamy - might be natural or due to pollution such as detergents or nutrients (foam that is several inches high and does not brush apart easily is generally due to some sort of pollution)
Turbid - cloudy brown due to suspended silt or organic material
Dark brown - tea-colored water might indicate that a naturally occurring, harmless acid is being released into the stream (normal for some streams)
Oily sheen - multicolored reflection might indicate oil floating in the stream, although some sheens are natural
Orange - might indicate unnatural acid drainage
Green - might indicate excess nutrients being released into the stream.

Water odor can also be an indicator of possibly hazardous water pollution. If you detect any unusual odors, **DO NOT ENTER THE WATER** and contact your local DNR office. Your safety is important to us.

No smell or a natural odor
Sewage - might indicate the release of human waste
Chlorine - might indicate over-chlorinated sewage treatment from water treatment plant or swimming pool discharges
Fishy - might indicate the presence of excessive algae growth or dead fish
Rotten eggs - might indicate sewage pollution (the presence of methane from anaerobic conditions)

When assessing fish cover, be sure that cover, such as cobbles and boulders like in this stream are in at least eight inches of water.

Determining Stream Width and Station Length

Your station length along which to assess habitat characteristics should be 35 times the mean stream width, up to a maximum of 400m (1300 ft). To simplify the method for volunteers, we recommend measuring the starting width at your baseline sampling site.

If you are unable to assess your stream for the full station length, please do not assess habitat.

The reason for this is that in order to provide the highest quality data for DNR biologists, volunteers carry out the habitat assessment method in the same manner as biologists. Monitoring a shorter station length may result in missed observations about the stream reach. Further, as everyone must follow the same method for the data to be comparable, monitoring a shorter reach will invalidate the data set.

What do Habitat Assessments Mean?

Each stream will have a unique habitat assessment value. This value is an important baseline measure or future comparisons. By comparing specific habitat parameter scores, between years at one site or between sites in small watersheds, the connection between land use and aquatic habitat may be better understood.

Interpreting the Results

Water Quality Rating	Score Range
Excellent	>80
Good	60-80
Fair	20-60
Poor	<20

Extension
UNIVERSITY OF WISCONSIN–MADISON

WISCONSIN DEPT. OF NATURAL RESOURCES

Water Action Volunteers is a cooperative program between the University of Wisconsin-Madison Division of Extension and the Wisconsin Department of Natural Resources. For more information, go to https://wateractionvolunteers.org/