



Stream Physical Habitat

Resource Brief

Importance

The physical habitat and water quality of a stream are the template upon which aquatic communities of fish and macroinvertebrates must live.

An aquatic macroinvertebrate is any water-dwelling animal without a backbone that is large enough to be seen by the naked eye. They need spots to cling and burrow, and organic material to consume. Fish require places to hide, feed, and lay eggs.

Together, water quality, aquatic communities, and stream physical habitat indicate a great deal about the condition of a stream and its watershed.



NPS/Watts

North Fork of Quantico Creek

Monitoring

Stream physical habitat monitoring is part of a broader effort by the National Capital Region Network (NCRN) Inventory & Monitoring (I&M) program to assess the condition of streams and watersheds.

Long-term stream physical habitat monitoring at thirty-seven park sites throughout the NCRN began in 2008 and follows a set, six-year rotation. Each spring 5-8 sites are visited. At Prince William, monitoring is done in Carters Run, Mary Bird Branch, Mawavi Run, Middle Branch of Chopawamsic Creek, North Branch of Chopawamsic Creek, North Fork Quantico Creek, Orenda Run, and Taylor Run. The objectives of this combined monitoring are to:

- determine current conditions and track long-term trends in stream condition,
- determine trends in species composition and functional groups of fish and benthic invertebrates

Observations of stream physical habitat are gathered at the same location and time as fish monitoring in late summer and macroinvertebrate monitoring in spring. Monitoring is conducted on non-tidal, wadeable streams and rivers.

Glossary

Benthic- Referring to the bottom of a body of water.

Embeddedness- The amount of space around large stream bottom particles (gravel, cobble, etc). When smaller particles (sand, silt, mud) surround larger particles, embeddedness rises and habitat for small fish, macroinvertebrates, and other creatures is reduced.

Epifaunal Substrate- hard, stable materials that stream biota can live on (such as large woody debris, rootwads, cobble, gravel, etc).

PHI Scores

To calculate Physical Habitat Index (PHI) scores, streams are sorted by physiographic province. Prince William's monitored streams are all in the Eastern Piedmont stream class except for Carters Run and Mary Bird Branch which are Coastal Plain streams. Both Eastern Piedmont and Coastal Plain streams are evaluated on the following characteristics:

- stream bank stability (the extent, height, and severity of bank erosion)
- quantity of woody debris and root wads in the stream
- instream habitat available for aquatic creatures
- epifaunal substrate (the quality of materials on the stream bed surface)
- shading
- distance from nearest road (remoteness)

Eastern Piedmont streams are also evaluated on:

- riffle quality
- embeddedness of substrates (higher embeddedness)

Riffle- Section of stream with faster flow and more turbulence. Provides shelter, is a food source, and adds oxygen to water.

Root wads- A mass of plant roots (a type of woody debris).

Shading- Amount and duration of shade cast over a stream. Helps lower water temperatures.

Woody Debris- large branches, logs, and tree material. Provides shelter.



reduces living space between particles and limits area for small fish, macroinvertebrates, and periphyton.)

PHI scores range from 0-100 with four possible ratings:

(81-100) minimally degraded

(66-80) partially degraded

(51-65) degraded

(0-50) severely degraded

Results & Discussion

All streams were monitored in 2011. Middle Branch Chopawamsic Creek was also monitored in 2004 and North Branch Chopawamsic Creek was monitored in 2004 and 2006 (at site very close to the 2011 location).

Most streams scored poorly for PHI (except Mary Bird Branch) but earned moderate scores for instream habitat, a metric representing the quality of available fish habitat. This may help explain why Taylor Run and the North and Middle Branches of Chopawamsic Creek earned the park's best ratings for fish communities.

Carters Run (QUAN-104-N)

2011 PHI = 65 (partially degraded)

Carters Run, a Coastal Plain stream, earned a partially degraded score during 2011 monitoring. Characteristics influencing this score were moderate stream shading, good instream wood levels, good streambank stability, close proximity to a roadway, and moderate levels of epifaunal substrate good for macroinvertebrates.

Mary Bird Branch (QUAN-206-N)

2011 PHI = 83 (minimally degraded)

Mary Bird Branch is a Coastal Plain stream that earned one of the region's highest PHI scores. Characteristics that influenced the high score included a long distance to any nearby roadways, high levels of stream shading, lots of epifaunal substrate for macroinvertebrates, high levels of instream habitat for fish, and good streambank stability.

Mawavi Run (QUAN-101-N)

2011 PHI = 41 (severely degraded)

Mawavi Run earned a PHI score of severely degraded in

2011. While the stream had good levels of streambank stability, it is also in close proximity to a roadway, had low levels of epifaunal substrate beneficial for macroinvertebrates, poor instream habitat for fish, and high embeddedness.

Middle Branch of Chopawamsic Creek (CHOP-103-N)

2011 PHI = 43 (severely degraded)

The 2011 PHI score for Middle Branch of Chopawamsic Creek fell into the severely degraded category. While it did exhibit good instream habitat for fish, it also had high levels of embeddedness (i.e. poor overall habitat value), low streambank stability, low levels of instream wood, low levels of epifaunal substrate suitable for macroinvertebrates, and close proximity to a roadway.

2004 PHI = n/a

Middle Branch of Chopawamsic Creek was first monitored in 2004 but was not scored for PHI. At the time of monitoring, the presence of two beaver dams in the stream resulted in very high levels of instream woody debris.

North Branch of Chopawamsic Creek (CHOP-102-N)

2011 PHI = 57 (degraded)

The North Branch of Chopawamsic Creek was rated as being in degraded condition. Characteristics contributing to this score include good stream bank stability, good stream shading, and high embeddedness (poor overall habitat).

2006 PHI = 70 (partially degraded)

In 2006, North Branch of Chopawamsic Creek earned a partially degraded score, in part for good shading, moderate levels of embeddedness (poor overall habitat), and moderate levels of stream bank erosion.

2004 PHI = 64 (degraded)

In 2004, North Branch of Chopawamsic Creek earned a degraded score, in part for good shading, and moderate stream bank erosion levels.



North Fork Quantico Creek (QUAN-201-N)

2011 PHI = 69 (partially degraded)

The partially degraded score for the North Fork of Quantico Creek in 2011 came from several factors. The stream had poor levels of instream wood, yet is far from any roadways, has good levels of stream shading, and good streambank stability.

Orenda Run (QUAN-102-N)

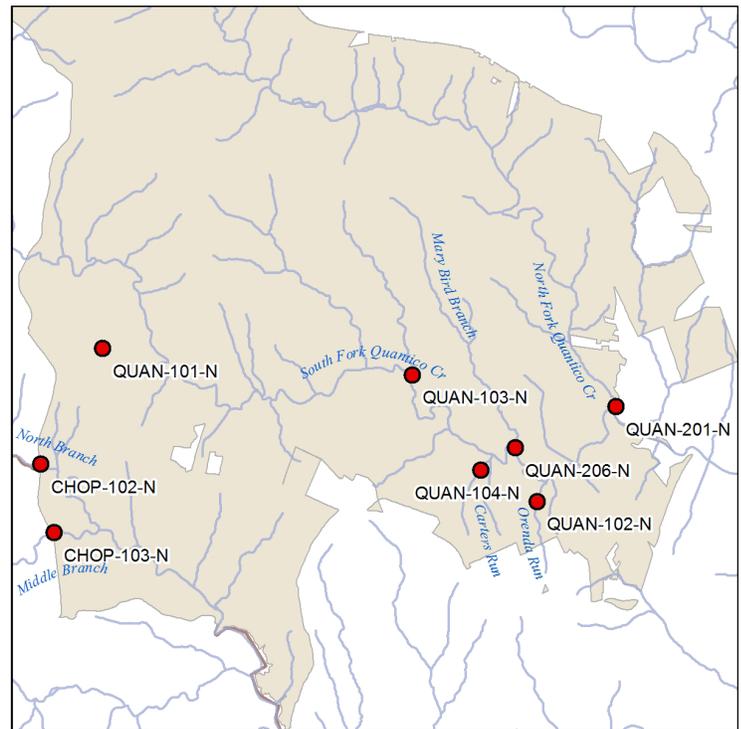
2011 PHI = 49 (severely degraded)

Orenda Run earned a severely degraded PHI score in 2011. Characteristics that influenced this score include good streambank stability, close proximity to a roadway, low levels of epifaunal substrate for macroinvertebrates, high embeddedness, and low levels of instream habitat for fish.

Taylor Run (QUAN-103-N)

2011 PHI = 59 (partially degraded)

Taylor Run earned a partially degraded PHI score in 2011. While the stream had high levels of instream habitat for fish, it is also in close proximity to a roadway, had a high level of embeddedness, and little epifaunal substrate for macroinvertebrates.



Sites in Prince William monitored for fish, macroinvertebrates, and stream physical habitat condition.

References:

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