Other Factors that Influence Stream Health

Other factors besides impervious cover can damage streams and make them less likely to attain water quality goals. If you want to protect streams from urbanization or restore impaired streams, then pay attention to all of these other factors.

Altered Riparian Zone —The riparian zone is the area of forest and wetland next to a stream. Riparian zones are extremely valuable for shading streams, keeping water cool, filtering pollutants, and providing habitat. Also, leaves from trees and shrubs are the base of food webs of small streams. In the picture to the left, the left bank has a good riparian zone and the bank to the right does not.

Loss of Floodplains— Floodplains are flat parts of the riparian zone that allow water to spread out during floods. Floodplains help minimize flood damage to streams and adjacent property. Streams need floodplains to remain healthy.

Temperature Increase — Keeping stream water cold helps trout and other aquatic life that need cold water. Trees and shrubs in the riparian zone help keep streams cool.

Altered Channels—Many urban streams have altered stream channels. Some streams were channelized or straightened in the past. Other streams were widened or armored with rock. Despite past good intentions, channel alterations do long-term damage to streams by reducing habitat quality and preventing them from functioning properly.

Altered Headwaters — A stream is only as healthy as its headwaters. The little streams that dry up in the summer may not seem valuable, but they are the life blood of larger streams. Protecting and restoring headwaters helps maintain the health of larger streams.

Loss of Wetlands — Marshes, bogs, wet meadows, and forested swamps are ecologically important parts of the landscape. Wetlands help protect streams from floods, pollutants, and nutrient enrichment. Wetlands also provide habitat for many species. Urban streams in Maine usually have few wetlands remaining in their watersheds.

Salt — Salt is a great threat to urban streams and kills many organisms. Road salt contaminates streams when snow melts. Salt also contaminates groundwater, making stream water too salty in the summer.

Culverts — Improperly sized culverts often cause stream bank erosion. Hanging culverts, like the one to the left, are barriers to the movement of fish and other aquatic life

Nutrients — Phosphorus and nitrogen are nutrients found in fertilizer, pet waste, sewage, manure, and decomposing plants. Too many nutrients in streams causes blooms of filamentous algae and dissolved oxygen problems.

Bare soil — Bare soil promotes erosion. Sediment from cleared land or farm fields can smother stream habitat and carry nutrients into streams. Developers should prevent erosion from cleared land. Also, buffer strips, no-till agriculture, and contour plowing can keep valuable soil where it belongs - in the fields.

Livestock — Cows and other livestock can directly harm streams by walking in streams and damaging riparian zones. Manure from livestock is rich in nutrients, which promote algal blooms.

Legacy Pollutants — Some streams are polluted by groundwater that is contaminated with salt, fertilizer, or toxic chemicals. Fixing these streams can be challenging. Preventing new problems is critical.

For More Information

Technical Report: Danielson, T. J., L. Tsomides, D. Suitor, J. L. DiFranco, and B. Connors. 2016. *Effects of Urbanization on Aquatic Life of Maine Streams*. Maine Department of Environmental Protection, Augusta, ME.

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Effects of Urbanization on Maine's Streams

Tom Danielson, PhD, Leon Tsomides, Doug Suitor, Jeanne DiFranco, and Beth Connors

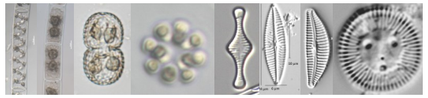
Bureau of Water Quality, Division of Environmental Assessment

Monitoring Stream Health

We are fortunate in Maine that most of our streams and rivers are healthy and have good water quality, ideal for fishing and recreation. Our streams are also homes to many different kinds of fish, algae, insects, and other aquatic animals. The Department of Environmental Protection (DEP) monitors streams to see if they are healthy. DEP biologists collect water samples and identify algae and macroinvertebrates that live in the streams. Macroinvertebrates are animals without backbones that you can see without magnification. Common macroinvertebrates in our streams include mayflies, dragonflies, crayfish, and snails. Some species need cold, clean water and good habitat to survive. Some species are a little more tolerant of pollution, but still need relatively clean water. Other species are tolerant to pollution and poor habitat. When streams get too polluted or damaged, the sensitive species die and only tolerant species remain.

Maine streams are home to...

more than 1,500 species of algae

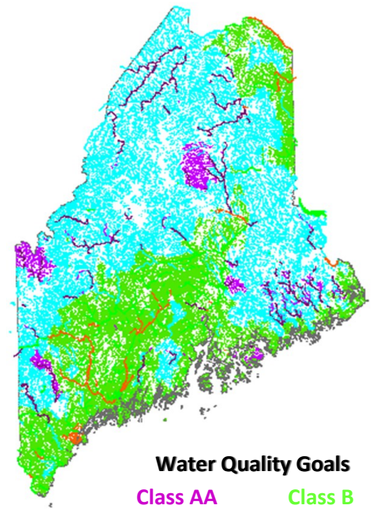


more than 800 species of macroinvertebrates

more than 40 species of fish

To keep our streams healthy, Maine has water quality standards with four water quality goals, including Class AA, Class A, Class B, and Class C. The four classes set targets for water quality and condition of aquatic life. Biologists sample the streams to find out if they attain their water quality goals. If a stream does not attain its goal, then DEP tries to figure out why so people can fix it. If a stream consistently exceeds its goal, then DEP could nominate it to the Legislature to upgrade its class.

- The goal for Class AA (magenta lines on map) and Class A (blue lines) streams is to have natural habitat and very clean water. Biologists expect to find many different species. Also, they expect to find many sensitive species that need cold, clean water and good habitat to survive. No dams and discharges of pollution are allowed in AA streams.
- The goal for Class B streams (green lines) is to still have a variety of sensitive species, however species that are little more tolerant to pollution may be more common. Often there is more algae and macroinvertebrates in Class B streams than AA and A streams.
- The goal for Class C streams (orange lines) is to be healthy enough to still have trout and balanced communities with a variety of algae and macroinvertebrates. Class C streams should have some sensitive species, but species that are tolerant of pollution or poor habitat may be more common.



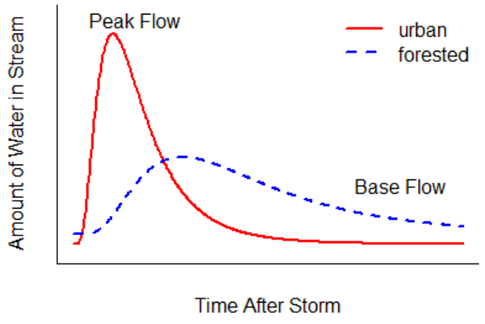
Impervious Cover

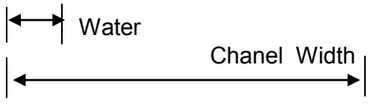
One aspect of urban and rural development that greatly influences stream health is impervious cover. Impervious cover includes hard surfaces, such as roofs, pavement, cement, and compacted soil, that prevent water from soaking into the ground. In areas without impervious cover, such as forests, water soaks into the ground, slowly moves downhill through the soil, and gradually enters nearby streams later in the year. By letting water soak into the ground, forests and wetlands not only make floods smaller, they also help keep more water in the streams later in the summer. In contrast, pavement and other impervious surfaces prevent water from soaking into the ground. Instead, stormwater often rushes off impervious cover into ditches and storm drains that often discharge untreated into nearby streams. Also, large amounts of pavement can make streams warmer in the summer, which is bad for trout and many other animals.

Both the quantity and quality of stormwater can damage streams. Stormwater rushing off of impervious surfaces makes floods larger, which causes stream bank erosion. Impervious cover also can make streams drier in the summer because less rain soaked into the ground earlier in the year. Water rushing off of pavement also carries salt, dirt, oil, and chemicals that are harmful to aquatic life. To help manage stormwater quantity and quality, developers and engineers can use smarter, modern alternatives when designing roads and development. Developers can install structures that detain water and either gradually release it to streams or let it soak into the ground. This helps to prevent floods and ensure stream flow in the summer. Some stormwater is relatively clean and can be diverted away from storm drains and safely put into the ground. Dirty stormwater should be filtered before entering our streams and groundwater. Reducing the amount of road salt is also critical to keeping stream s healthy because salt kills many species of aquatic life that live in Maine's streams.

Eroding Bank

Dirty Stormwater





Change to Peak Flow

Water runs off the impervious surfaces quickly and often gets to a nearby stream through storm drains. → Peak surges of water in an urban stream are bigger compared to a stream in a forested watershed. → The stream channel is too wide and flat because of erosion from the surges of stormwater.

Change to Base Flow

Water does not soak into the ground like it would if rain fell in a forest. → There is less water in an urban stream later during base flow compared to a stream with a forested watershed. → There is not enough water in the stream during the summer. The stream has poor habitat quality.

Relationship of Impervious Cover and Aquatic Life

DEP biologists delineated 140 watersheds (drainage areas) upstream of sample sites. They then calculated the percent of impervious cover within watersheds, which ranged from 0% to over 50%. For example, the forested watershed on the left had 0% impervious cover and the urban watershed on the right had 35% impervious cover.

The risk of not attaining water quality goals because of increasing impervious cover was evaluated with data from algal and macroinvertebrate samples. The results are shown in the graph to the right.

- For Classes AA and A, there was a rapid loss of sensitive species between 1 and 3% impervious cover. The risk of not attaining Class AA and A was high after 3%.
- For Class B, there was greater loss of sensitive species between 3 and 6%. There was a high risk of not attaining Class B goals after 6%.
- For Class C, there was a large transition to tolerant species between 10 and 15%. The risk of not attaining Class C was high after 15%.

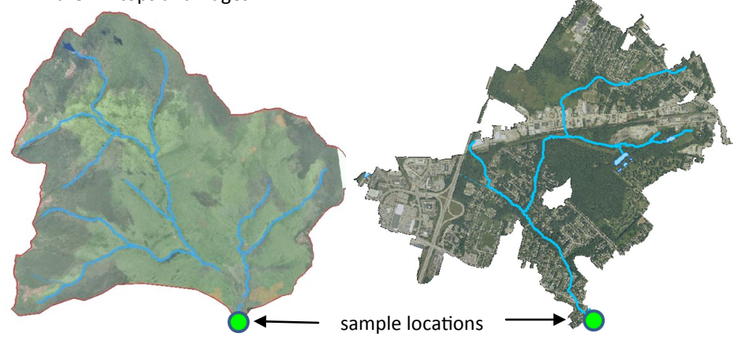
In general, historic development was done with little planning and antiquated methods. Better land use planning and development practices could help keep streams healthier.

Forested Watershed

The watershed is the area where surface water drains downhill to the stream. The edges of the watershed are hill tops and ridges.

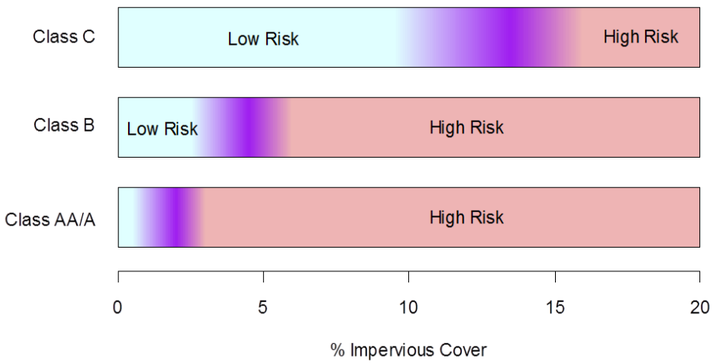
Urban Watershed

This watershed has been changed by storm drains. Some areas of the original watershed are now piped elsewhere.



Risk of Not Attaining Water Quality Goals

The central, purple regions of the bars represent ranges of rapid transition from low risk to high risk.



Location of Impervious Cover Matters

DEP biologists found that the streams with the development nearby were in worse condition than streams with development located further away. For example, the stream to the right had 8% impervious cover in the watershed, but all the development was right next to the stream. It had poor water quality and did not attain its goal of Class B. In contrast, another stream with 10% impervious cover still attained Class A because the development was far from the stream. Leaving native trees and shrubs next to streams is essential to keep streams healthy. Also, protecting wetlands and the little streams that drain into larger streams help to keep streams healthy.