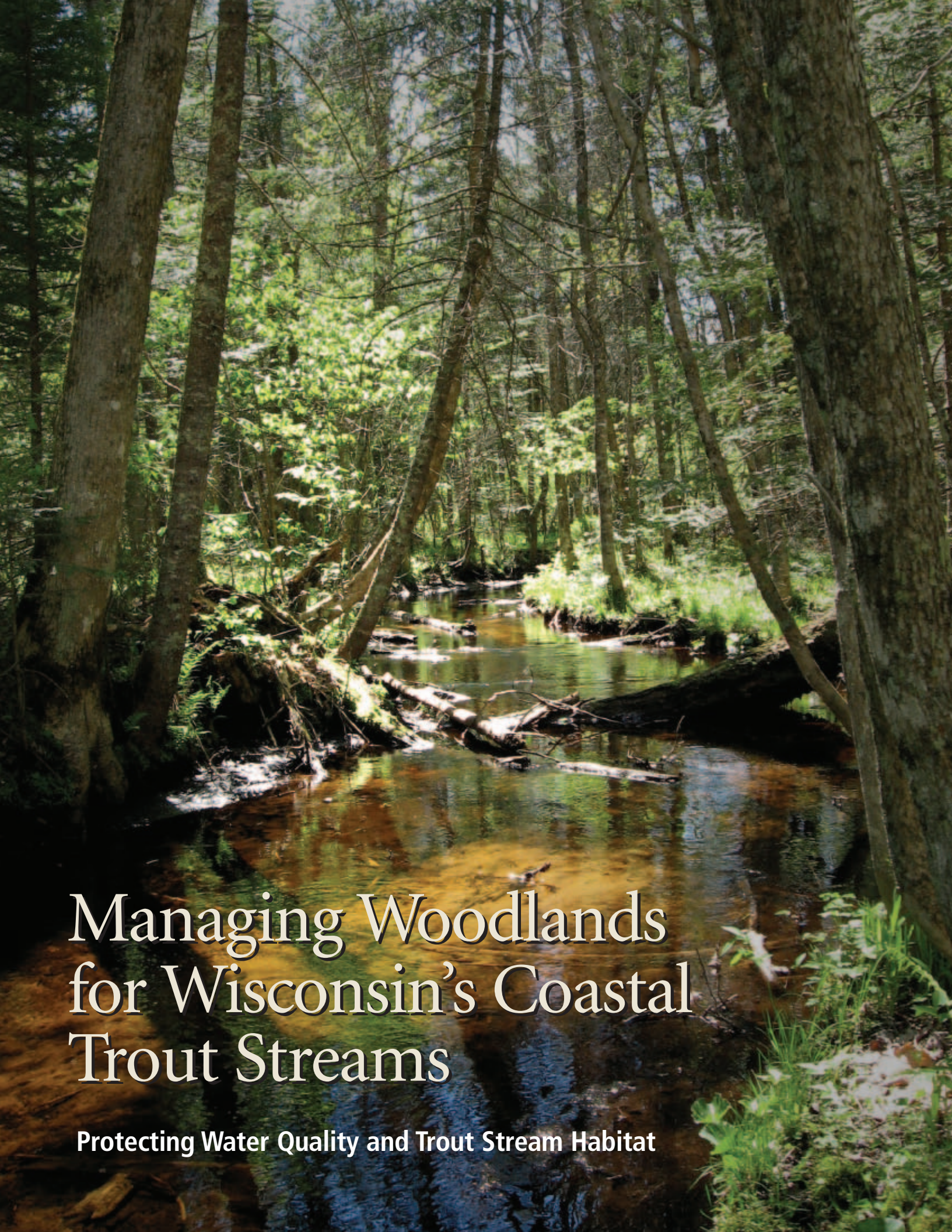
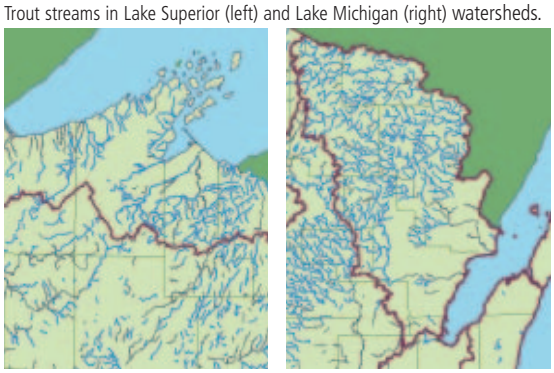


Managing Woodlands for Wisconsin's Coastal Trout Streams

Protecting Water Quality and Trout Stream Habitat

Coastal Trout Streams in Wisconsin

Trout streams in Lake Superior (left) and Lake Michigan (right) watersheds.



One-third of Wisconsin's trout streams flow into Lake Superior and Lake Michigan. More than 3,300 miles of trout streams meander through nearly 3 million acres of forestland on their way to the Great Lakes coasts. Historically, logging harmed trout streams, but today's landowners can manage their woodlands to protect and improve trout streams. This publication describes steps woodland owners can take to protect water quality and trout stream health while managing their forest land. It is highly recommended that Forestry Best Management Practices (BMPs) are used in addition to the following recommendations.

Trout Ecology

Changes in the riparian area – the land adjacent to a stream – can affect trout and the many other fish, insects, and organisms found in streams. Trout need cold water, gravel streambeds and shelter from predators. Healthy riparian areas minimize fluctuations in water temperature, reduce sediment washing into the stream, and help control water flows in streams. During the different stages of their life cycle, trout may be vulnerable to any changes in the stream.

There are four stages in the life cycle of trout:

- Spawning is the migration period of the male and female trout. During this period, the female constructs a gravel nest, lays its eggs in the nest, and covers the eggs with gravel.
- Incubation starts with the laying of the eggs and continues until the hatched fry emerge from the gravel spawning bed into the open water.
- Juvenile rearing includes the time period from when the fry emerge from the spawning bed until they reach adulthood.
- Adult trout are at sexual maturity when they grow to eight inches or longer, and depending on environmental factors and the species, when they are one to three years old.

Trout build gravel nests for spawning and egg incubation in stream segments with cold, well-oxygenated water and gravel-bottoms. When the coarse rock and gravel in streambeds is surrounded or covered by fine sediment, like sand and clay, the quality of spawning habitat declines. Researchers believe that when sand covers more than 30% to 40% of a streambed, most spawning habitat is lost.

Water speed is one factor limiting trout survival. If the speed of stream flow is too great, fry, or juvenile trout, need to use too much energy to swim which causes them to lose weight and potentially die from malnutrition.

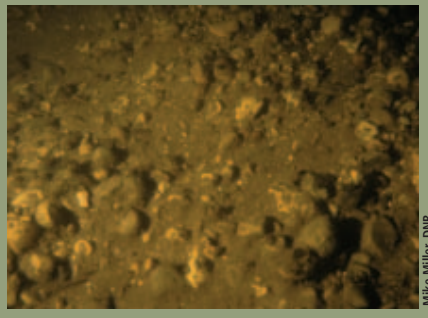
Lack of cover can also affect trout survival. Boulders and logs in the stream, banks undercut by the current, tree root wads, and overhead vegetation all provide cover which help protect trout from hungry blue herons and other predators. These materials can also provide a resting place for trout because stream flows are usually slower behind them.

Dennis Pratt, DNR

Brook trout are one species of trout found in Wisconsin streams.

Mike Miller, DNR

Trout lay their eggs in gravel nests such as this one.



Mike Miller, DNR

When gravel streambeds become covered with sand, trout can no longer use them for spawning

Historic Impacts to Trout Streams

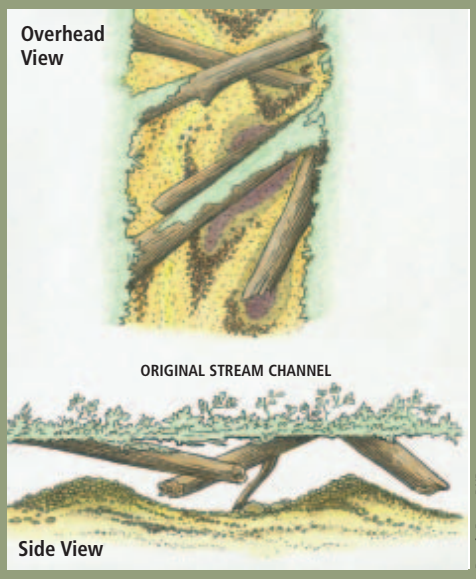
Clearing of forestland, including stream-side forests, during the late 1800s and early 1900s, eliminated many of the benefits that these forests were providing to the streams. The loss of trees and other vegetation caused the amount and speed of water running over the land to increase because there were fewer branches, twigs, and leaves to slow the flow of water over the forest floor. As a result, streams had to carry much larger volumes of water traveling at much faster speeds. The excess volume and velocity of water washed away large logs and eroded the streambanks. The sediment from those eroding streambanks buried or washed away gravel spawning sites and filled in deep refuge areas.

The health of trout streams has improved since the intensive logging during the late 1800s and early 1900s. There is an opportunity for landowners to build on those improvements and protect this valuable resource. Understanding the impacts that past activities had provides insight on how current land management practices might affect trout streams.

Understanding the impacts of past activities provides insight on how current land management practices affect trout streams.

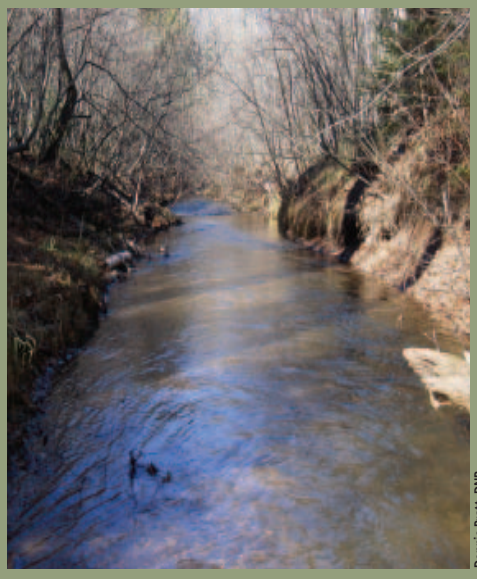
Dennis Pratt, DNR

This is what trout streams looked like before the intense logging of the late 1800s and early 1900s.



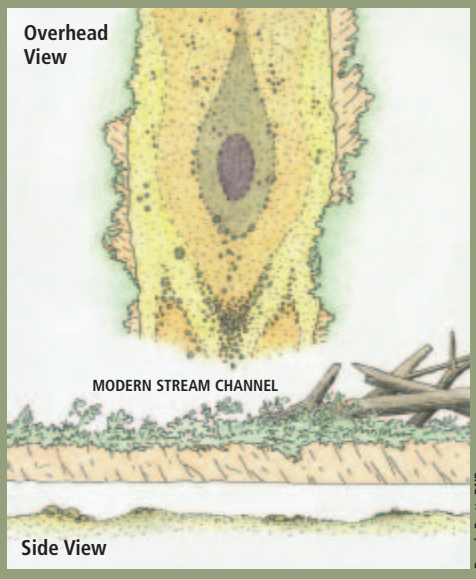
Dennis Pratt, DNR

This drawing shows how much habitat the in-stream wood created for trout.



Dennis Pratt, DNR

After poor logging practices, vegetation composition along streams had changed, streambanks had eroded, and streams had much less in-stream habitat due to lack of woody cover.



Dennis Pratt, DNR

This drawing shows how poor logging practices removed much of the in-stream habitat and created a more uniform environment.

Managing Forests to Reduce Runoff

Forested areas along streams provide numerous benefits to trout streams. Trees help to prevent erosion and sedimentation (soil washing into streams) by stabilizing the soil with their extensive root systems. When forests are harvested improperly, the soil is vulnerable to erosion and sedimentation in streams can be greatly increased.

Forest canopies intercept precipitation, reducing the amount of water reaching the forest floor and the amount of snow that accumulates. When trees shade the ground, the snow that accumulates melts more slowly. The reduced snow pack and the prolonged melting period reduce the peak flows of spring meltwater.

The fallen leaves, branches, and other material on the forest floor also help to reduce runoff. Leaves and branches absorb the force of falling raindrops, preventing the soil underneath from moving. This layer of fallen material also increases how far water needs to travel to reach a stream. The extra distance slows down the water, giving it time to soak into the ground, which reduces the amount of water that finally reaches a stream. In addition, leaves and twigs that fall into streams are a key food source for aquatic insects which are the base of the food chain in streams.

Fallen leaves provide food for aquatic insects which are part of a trout's food.

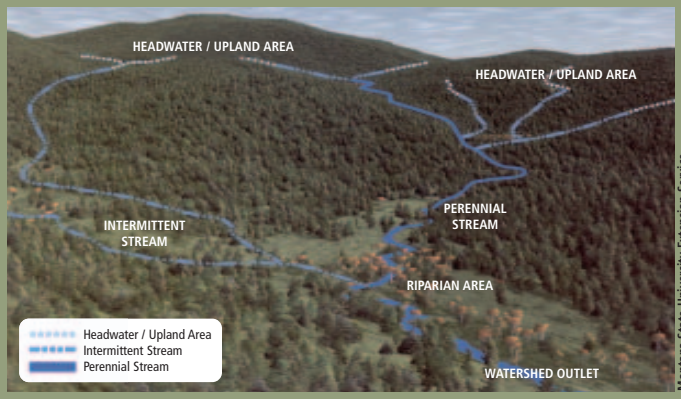
Mike Miller, DNR

Kristin Shy, DNR

Forested areas along streams stabilize the soil and help to reduce the runoff and sediment that may enter a stream.

How You Can Help

You can help protect water quality and trout stream habitat even if you do not own land with a trout stream. How you manage land that drains to a trout stream can have as much of an effect on a trout stream as how the land next to a trout stream is managed.



Montana State University Extension Service

A watershed and its parts.

The watershed of a stream includes all the land that drains to that stream. It may include upland areas far from the stream, which are connected to it through a network of drainages or streams that may only have flowing water for a short time during the year (headwater streams). Watersheds can be a few acres in size or hundreds of square miles.

Upland landowners may feel disconnected from a trout stream farther down in the watershed, but their activities may influence water flows, water quality, and trout populations much farther down in the watershed. Water quality problems from the uplands can worsen as they move down through the watershed. Sand and clay can erode into a small headwater stream and travel downstream to a perennial stream with one heavy rainstorm or during spring snowmelt. Furthermore, if high volumes of water runoff are draining to many small streams throughout the watershed, they will eventually combine to form much higher flows in downstream areas.

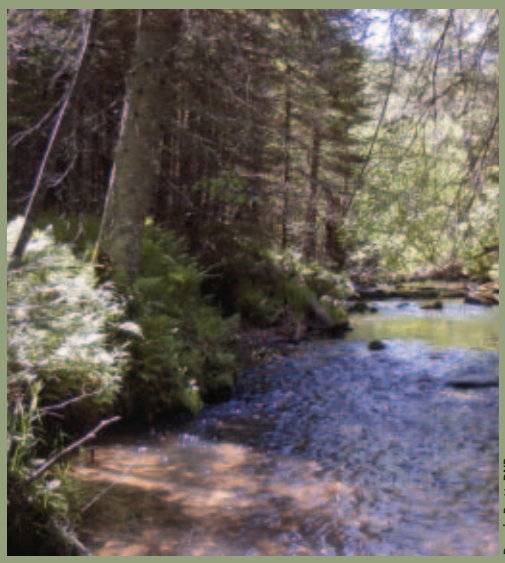
The riparian area, or the land next to a stream, can be thought of as the last line of defense in protecting water quality and trout habitat. A forested riparian area may reduce the amount of runoff and sediment that reaches the stream. The effectiveness of a riparian area at reducing runoff and sedimentation will be partially determined by the management of that riparian area.

Managing Vegetation Composition in Riparian Areas

The tree species that can successfully grow on a site will depend on site conditions such as soils, topography, and other factors. Managing for long-lived trees species in the riparian area will help to stabilize the soil, increase the amount of rain and snowmelt that soaks into the ground, and provide organic material to streams. In New Hampshire, researchers found that 99% of the stream's biological energy came from the bits, pieces and chunks of plants and trees that fell in the stream.

Manage for long-lived, shade-tolerant tree species.

- Forest composition should attempt to reflect vegetation that existed prior to European settlement, which includes a major component of evergreen species. Long-lived, shade tolerant species are preferred.
- In the Lake Superior watershed, this includes species such as white pine, eastern hemlock, northern white cedar, white spruce, balsam fir, sugar maple, red maple, yellow birch, ironwood, American elm, and ash.
- In the Lake Michigan watershed, this includes species such as white spruce, balsam fir, maple-basswood-beech, and hemlock-hardwood.
- Contact your local forester to discuss which tree species would be most appropriate on your property.
- Consider planting trees in areas that used to be forested but are now open.



Dennis Pratt, DNR

Vegetation composition along trout streams should include a significant component of evergreen species, if appropriate for the site. Forest composition should reflect tree species that existed prior to Wisconsin statehood.

Harvesting Forest Products

Proper forest management can be accomplished on lands adjacent to trout streams, but extra precautions should be taken. When planning a timber harvest, consider how much timber harvesting is occurring over time and space, both on your individual property and within the watershed. Extensive harvesting can have major impacts on streams by increasing the amount and speed of runoff reaching streams.

- Maintain a Riparian Management Zone (RMZ) to act as a protective buffer along waterways. Consider implementing the recommendations in this publication within the RMZ.
- Spread out harvesting over time, especially clearcuts.
- Consider the amount of land that is in young forests, such as young aspen stands. Extensive amounts of land in young forests can cause increased snowmelt and sedimentation.

Kristin Shy, DNR

A successful timber harvest was conducted along this trout stream. A Riparian Management Zone (RMZ) was marked and timber harvesting was conducted in a way that protected the trout stream.

Protecting Headwaters

Timber harvesting that occurs near headwater streams must protect the integrity of those streams. Most of the sediment that enters a stream system is brought from smaller streams to larger streams during heavy rains.

- The best time to identify headwater streams is in spring after snowmelt or after heavy rains.
- Black ash, black spruce and other wetland plants may be found in or near these types of water features.
- Mark headwater streams by flagging or painting nearby trees. Be sure that your forester or logger is aware of these areas before any harvesting takes place, so that steps can be taken to protect these resources.

Dennis Pratt, DNR

All trees were harvested along this headwater stream. This increased the potential for runoff. Aspen is now growing along the stream and this young forest may also increase snowmelt and runoff.

Providing Large Woody Cover

Dennis Pratt, DNR

This headwater stream has plentiful large woody cover both in and around it which helps to slow runoff. When downed logs like this fall in a stream, they provide protective cover and habitat for trout.

Large pieces of wood in a stream are essential components of trout habitat. They provide resting places where trout can find slower water and create spawning sites. Large woody cover also provides protection against predators and increases food availability.

- Manage the riparian area to promote the growth of native, large, older-aged trees. This will create the opportunity for woody cover to naturally fall into the stream.
- Some tree species are more valuable in a stream because they last longer under water and so will provide habitat for a longer period of time. This includes oak, maple, cedar, tamarack, white pine, and red pine.
- Leave dead and downed trees in the riparian area.

Protecting Stream Shade

Trout rely on cold water and consistent temperatures. When stream-side trees are harvested, the water is exposed to direct sunlight, increasing the water temperature. Higher water temperatures reduce the amount of oxygen in the water, affecting the metabolism and development of fish. Stream-side vegetation also insulates streams during the winter, preventing water from becoming too cold.

- Manage for evergreen species which are especially beneficial in protecting water temperatures. Hardwood species may be better adapted to certain sites however.

Managing Aspen and Beaver

When beavers build dams and impound water, water temperatures can rise. Beaver flowages can also destroy critical trout habitat features, flood riparian areas killing trees and block the free movement of trout and other fish.

- Manage riparian areas for species other than aspen, the preferred food and dam-building material of beavers. Native, long-lived conifers or hardwoods are preferred.
- Do not perform large aspen clearcuts in riparian areas as this will result in aspen regrowth and local over-populations of beaver.
- Removal of beavers and their dams may be required to protect cold water trout streams. Consult with a local fish or wildlife biologist if it appears beaver or beaver dam removal will be necessary.

Removal of beavers and their dams may be required to protect trout streams.

Dennis Pratt, DNR

Beaver dams can have a variety of negative impacts on streams, including increased water temperatures, flooding of riparian areas, and blockage of free movement of fish.

Dennis Pratt, DNR

High populations of beaver will persist when aspen is regenerated in riparian areas because it is their preferred food and dam building material.

Designing and Installing Roads and Skid Trails

Roads are the largest source of sediment from forestry-related activities.

- Sedimentation may be reduced during timber sales by using old roads instead of building new ones.
- Do not locate roads or skid trails down natural drainage ways or they will simply act as a conduit for water.
- Surface roads with gravel, especially if they will be used during non-frozen conditions.
- Wait at least two days after heavy rains before using roads and trails to allow soils to drain so they can support equipment.

Kristin Shy, DNR

Surface roads with gravel, especially if they will be used when the ground is not frozen.

Crossing Trout Streams

Stream crossings, if not properly installed, can prevent fish from moving to different reaches of streams. Stream crossings are also likely places for erosion and sedimentation to occur.

- Select a type of stream crossing structure that ensures safe passage of trout.
- Temporary stream crossing structures are recommended if a permanent stream crossing is not needed.
- Bridges may be preferred crossing methods over culverts.
- Structural plate-arch culverts are the most desirable type of culvert to ensure fish passage and maintain natural stream flow, followed by pipe arch culverts, and the least desirable type of culvert to use is the standard corrugated-round culvert.
- Use one culvert whenever possible. If more than one is needed, use fewer, larger culverts.

Kristin Shy, DNR

This temporary bridge can support fully loaded logging trucks.

Bobbi Jo Reiser, DNR

Structural plate-arch culverts are set in concrete footings, leaving the natural streambed almost entirely unchanged.

Kristin Shy, DNR

This culvert is perched. When culverts are perched, fish cannot enter it and will not be able to reach important segments of the stream.

Improperly installed culverts can cause some of the following problems:

Barrier	Description	Impact
Perched culvert	Drop at culvert outlet exceeds jumping ability of fish.	Fish cannot enter structure or will expend too much energy entering the structure to traverse other obstacles.
Turbulence	Turbulence within culvert dissuades fish from entering and confuses their	Fish do not enter culvert or are unable to successfully navigate the waterway.
Velocity	High velocity of water in culvert exceeds fish swimming ability.	Fish tire before passing through the culvert.
Debris	Caught within a culvert, debris can block flow or portions of flow.	Fish may not be able to pass by debris or constructed flow may increase velocity with the culvert.
Length	Culvert is longer than 100–105 feet.	Fish may not enter culvert due to darkness. Fish may fatigue before traversing the culvert.
Depth	Low flow depth causes fish not to be fully submerged.	Fish will be unable to swim efficiently or pass through the culvert.

USDOT Federal Highway Administration

Contact Information

- For questions about trout management, contact your local fisheries biologist:
  http://dnr.wi.gov/fish/people/fisheriesbiologists.html
- For questions about vegetation composition and timber harvesting, contact your local forester:
  http://dnr.wi.gov/org/land/forestry/ftax/County.asp
- For questions about crossing trout streams, contact your local water management specialist:
  http://dnr.wi.gov/org/water/fhp/waterway/watermanagementspecialists.shtml

Additional Sources of Information

More information on the topics discussed in this publication is listed below. DNR publications are also available from your local DNR Service Center or by calling (608) 267-7494.

- Wisconsin's Forestry Best Management Practices for Water Quality Field Manual, DNR Publication PUB-FR-093: **http://dnr.wi.gov/org/land/forestry/usesof/bmp/bmpfieldmanual.htm**
- A Landowner's Guide to Building Forest Access Roads, USDA Forest Service Publication #NA-TP-06-98: **http://www.na.fs.fed.us/spfo/pubs/stewardship/accessroads/accessroads.htm**
- Forest Management Practices: Managing Water Series, University of Minnesota Extension Service Publications #1-13: **http://dnr.wi.gov/org/land/forestry/Usesof/bmp/bmpownerguides.htm#3**
- Fish Friendly Culverts, University of Wisconsin – Extension Publication: **http://clean-water.uwex.edu/pubs/pdf/shore.fishfriendlyculverts.pdf**
- Forest Management Practices: Crossing Options Series, University of Minnesota Extension Service Publications #1-16: **http://dnr.wi.gov/org/land/forestry/Usesof/bmp/bmpownerguides.htm#4**
- Forested Wetlands: Functions, Benefits and the Use of Best Management Practices, USDA Forest Service Publication #NA-PR-01-95: **http://www.na.fs.fed.us/spfo/pubs/n_resource/wetlands/index.htm**

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This publication is available from Wisconsin Department of Natural Resources, Division of Forestry, PO Box 7921, Madison, WI, 53707.

For additional information, call (608) 267-7494 or visit our web-site at: www.dnr.wi.gov/org/land/forestry

WISCONSIN DEPT. OF NATURAL RESOURCES

WISCONSIN COASTAL MANAGEMENT PROGRAM

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