Purdue University - **Forestry and Natural Resources**

FNR-184

A Landowner's Guide to Sustainable Forestry *in Indiana*

Part 5. Forests and Water

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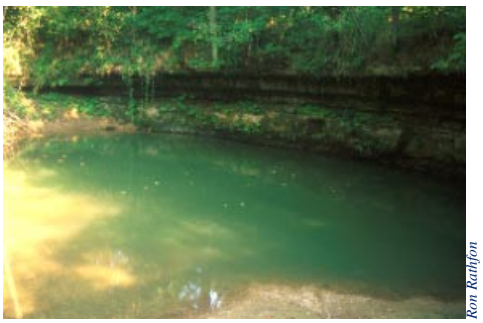
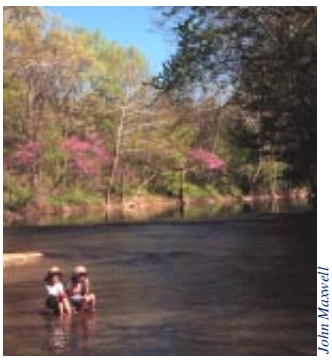


Ron Rathfon

Many miles of streams and rivers flow underground in the limestone region of south-central Indiana. This artesian spring, called Orangeville Rise, is a major tributary of the Lost River.



John Maxwell

Forests are living water filters, contributing to cleaner water in Indiana streams, rivers and lakes. This is the Flat Rock River in southeast Indiana.

Ron Rathfon

Numerous natural lakes grace northern Indiana's landscape. Development pressure and loss of surrounding forest threaten water quality in many of these lakes.

Forests protect and purify water. Forest soils act like a huge sponge, capturing and filtering amazing quantities of rainfall. They slow runoff, preventing soil erosion and the resulting stream and lake sedimentation. They also filter pesticide and nutrient runoff from agricultural fields and developed areas. "Forest filters" improve municipal drinking water supplies. They also shade waterways, cooling water temperatures, thereby creating a favorable environment for fish and other aquatic life. Forests provide organic materials, such as dead leaves and branches, that feed aquatic food chains.

Indiana has a wide variety of important water resources whose health depends on forest cover. Humans, through dredging, channelizing, and other drainage projects, have drastically altered many streams and rivers. Others remain pristine. South-central Indiana has a large underground river system associated with caves and sinkholes. Natural lakes formed by retreating glaciers grace parts of the northern Indiana landscape. Large man-made reservoirs provide flood control, drinking water, and recreation for tens of thousands of Hoosiers.

Most people think of an open water marsh when they think of wetlands. Over half of Indiana's wetlands are in fact forested. These forested wetlands include wooded

Checklist

Protecting and Improving Water Resources

- ☑ Fence livestock out of forests and streams.
- ☑ Reforest open fields that have highly erodible soils.
- ☑ Reforest stream banks and 50- to 100-foot, or wider, buffer strips next to streams and rivers.
- ☑ Reforest sinkholes.
- ☑ Avoid clearing forest for other land uses, particularly around sensitive water resources.
- ☑ Properly construct and maintain forest roads and trails to keep them in a stable, non-eroding condition.
- ☑ Use forestry best management practices (BMPs) when harvesting timber.
- ☑ Avoid applying pesticides over streams, rivers, lakes, wetlands, and sinkholes. Follow all other pesticide label instructions.
- ☑ Minimize disturbance in and around sensitive water resources.

swamps, river bottoms, wet areas around springs, and areas of high or perched water tables and poorly drained soils.

Sustainable forest management is compatible with the protection of these important water resources. If you are interested in protecting or improving water resources you will be happy to know that "trees are the answer."

Livestock

Where livestock have access to the forest, there is a high risk of accelerated soil erosion and reduced water quality. Part 3, *Keeping Your Forest Healthy and Productive* (FNR-182) of the *Sustainable Forestry Series* discusses other harmful effects of livestock on the forest. Livestock trample stream banks and streambeds causing direct stream sedimentation and deterioration of aquatic habitat. Livestock manure and urine adds abnormally large amounts of nitrogen and phosphorus to the water, which causes an explosion in algae growth. Decaying algae depletes oxygen supplies in the water creating lethal conditions for many aquatic organisms.

Jim Ray

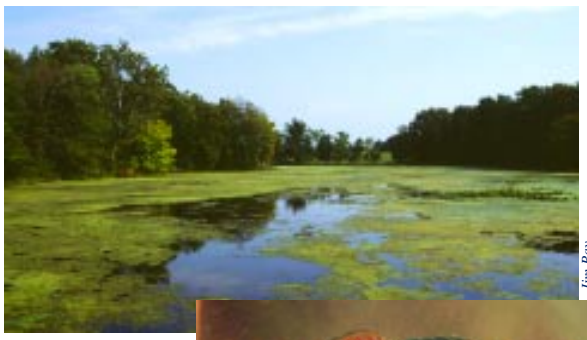
Livestock should be fenced out of streams, rivers, springs, and active sinkholes.

Livestock should be fenced out of the forest. However, small, stable areas along the edge of a forest may be included in the pasture where deemed beneficial for shade, wind protection, or access to water supplies. You should also consider doing the following:

- Develop alternate livestock watering facilities away from streams, rivers, lakes, and springs.
- Fence livestock from springs, streams, sinkhole openings and highly erodible slopes.
- Maintain a strip of undisturbed vegetation next to waterways to filter sediments and excess nutrients before they enter the water.

It takes 10 to 20 acres of forest to produce the same amount of forage that one acre of productive, open pasture would provide.

Contact your local Natural Resources Conservation Service (NRCS) office, your county Soil and Water Conservation District, or your county Cooperative Extension Office for more information on managing livestock for soil and water conservation.



Jim Ray

John Maxwell

Manure from livestock operations and fertilizers from crop fields and lawns can add a lot of nitrogen and phosphorus to streams, rivers, lakes, and other water resources. Excess amounts of these elements cause algae blooms which, when they decay, consume oxygen from the water and suffocate fish and many of the organisms they feed on.

National Archives

Early tree planting programs, like those of the Civilian Conservation Corp and the Soil Bank program helped stabilize many acres of worn-out, eroding farm land in Indiana.

Reforestation Benefits Water Resources

Planting trees produces multiple benefits, not the least of which is the protection and improvement of water resources. Large tree planting efforts in the 1930's through the 1960's stabilized many eroding farm fields, stopping soil erosion and improving the water draining from those areas. Marginal or eroding crop- and pastureland may be more profitably managed as forest and wildlife habitat.

Protective native forest has been cleared from many of Indiana's stream- and riverbanks. Most of this clearing was to facilitate drainage for agriculture and to develop the rich soil in these stream and river bottoms for row crop production. Housing, commercial, and industrial development have also taken a toll on many streamside forests.

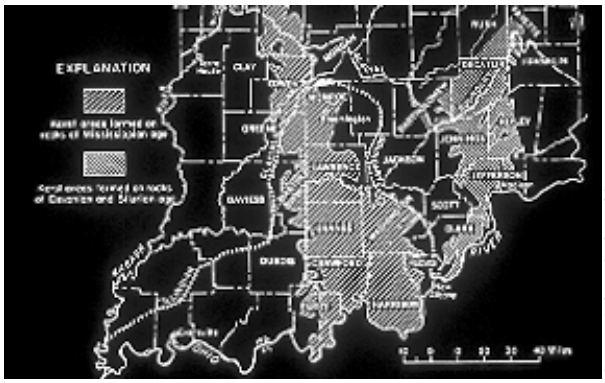
Although development is necessary, poor location decisions have unnecessarily degraded some of Indiana's water resources. Replanting trees on stream banks and in

Allen Pursell

Sinkholes collect surface water and direct it to underground streams flowing through caverns.

50- to 100-foot, or wider, buffer strips next to streams, rivers, and lakes will, in time, restore many of the benefits that native forests provide to water quality and fish habitat. River bottoms and wetlands can be very productive forestland. If you own such land and are thinking of taking it out of crop production, consider reforestation for timber production and wildlife habitat. Many incentives are available for doing so.

Sinkholes are depressions or holes in the land caused by water dripping or trickling through cracks in limestone bedrock. They are relatively common in some parts of southern Indiana and are not found at all elsewhere. Sinkholes naturally collect water and direct it to underground streams flowing through caverns. The water eventually re-emerges at a spring, rise, or well. While underground, however, it is the lifeblood of a number of cave animals adapted to a world without light. Planting trees or simply allowing native trees to seed in to sinkholes will help filter agricultural chemicals or other contaminants from the water before it reaches an underground stream.



Courtesy Indiana Geological Survey

*A large area in south-central Indiana is underlain with limestone bedrock. This is home to Indiana's **karst** region, where sinkholes, caverns, underground streams, and springs abound.*

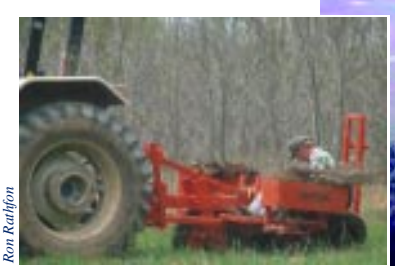
John MacGregor

Adapted to a world without light, many cave animals have no eyes and no skin pigment. Cave fish depend on clean water for their survival.

A number of government cost share and land rent programs are available to help you with reforestation that directly benefits water resources. Contact your local Natural Resources Conservation Service office or your District Forester for more information on these programs. Purdue Cooperative Extension Service publication FNR-36, *Planting Trees and Shrubs in Indiana* gives more information on how to plant trees. Many private consulting foresters provide tree planting services. Consult with a District Forester or a private consulting forester when making tree planting plans (Part 2, FNR-181, of the *Sustainable Forestry Series*, entitled, *Planning for the Future,* has forester contact information; Part 8, FNR-187, of the same series entitled, *Help!*, and Purdue University Cooperative Extension Service, FNR- 87, *Forestry and Wildlife Management Assistance Available to Indiana Landowners: Providers, Organizations and Programs,* has information on cost share and incentive programs).

Maintain at least a 50- to 100-foot forest buffer along streams, rivers, and lakes to protect water quality and fish habitat.

Courtesy NRCS, Mike McGovern



Ron Rathjon

Planting trees on eroding land and along streams and rivers improves water quality.

Avoid Clearing Forest

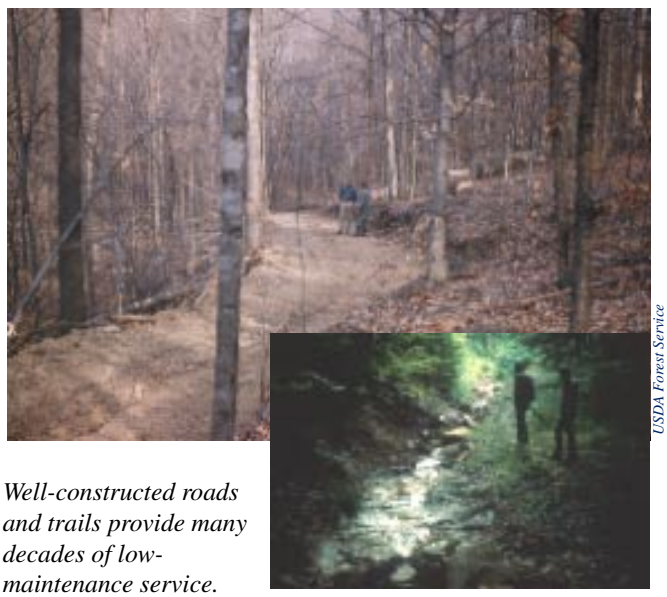
Since forest located anywhere on the landscape protects and improves water, it should not be cleared for other land uses if there are better alternatives. When building a new home, for instance, choose a site that is already open or on the edge of the forest instead of an interior site.

For reasons already mentioned, it is particularly important to maintain forest next to streams, rivers, lakes, and sinkholes. If you choose to clear forest for crop or livestock production, maintaining a 50- to 100-foot buffer of undisturbed forest next to these water resources will provide much of the protection desired.

Forest Roads and Trails

Access roads and trails enable you to manage your forests more easily, aid in fire protection, and increase recreational enjoyment. If not properly constructed and maintained, however, roads and trails erode and wash out, sending large amounts of soil or sediment into the nearest stream.

To minimize erosion, roads and trails should be constructed on slopes less than 10% in grade whenever possible. They should be constructed so that water drains off of the road or trail surface onto the forest floor to soak in. Seeding with a soil stabilizing ground cover (usually some type of grass) may be needed. Constructing good roads and trails takes a little extra work, time and expense, but not near the extra time and expense of fixing poorly designed trails gullied by erosion or rutted due to poor drainage. Technical advice on forest road construction and maintenance is available from your District Forester, the U.S. Forest Service, and the Natural Resources Conservation Service.



USDA Forest Service

Well-constructed roads and trails provide many decades of low-maintenance service. Poorly constructed and inadequately maintained roads lose their usefulness, pollute local streams and lakes, reduce forest productivity, and look ugly.

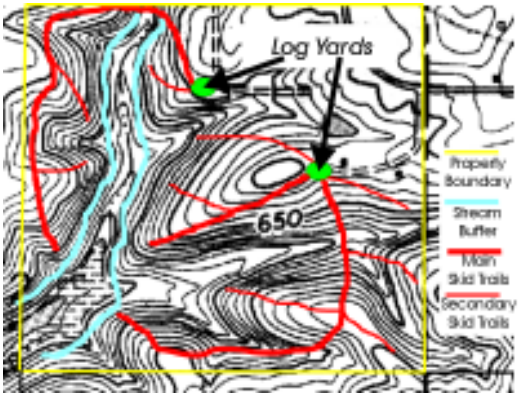
Best Management Practices (BMPs) for Timber Harvesting

A common misperception is that cutting down trees during timber harvesting necessarily results in erosion. In reality, a well-managed forest in Indiana will experience very little soil erosion due to tree cutting. Even under natural conditions, some soil erosion occurs. Soil erosion rates in the native forest are the lowest compared to any other land use. However, significant erosion can occur as a result of using heavy machinery, or even horses, to drag or **skid** logs out of the forest. Skidding logs and driving heavy machinery back and forth disturbs the protective leaf and duff layers on the forest floor. Once this layer is disturbed and bare soil is exposed to rainfall and running water, erosion occurs.

> Minimally disturbed forestlands in the Eastern United states lose 0.01 to 0.10 tons of soil per acre per year (James Patric; *Water, Woods, and People: A Primer*). Much of this is actually from stream bank and channel erosion and not soil washing off of hillsides. Similarly sloped, conventionally plowed cropland in Indiana loses 7-1/2 to 29 tons per acre per year (J.V. Mannering, D. P. Franzmeier and G.C. Steinhardt; *What Soil Erosion Means to Land Productivity*).

Through well planned harvesting and the use of forestry **best management practices (BMPs)** when harvesting timber, the threat of soil erosion and sediment delivery to waterways can be greatly reduced or virtually eliminated. Indiana Department of Natural Resources has published voluntary forestry BMPs. Indiana Forest Industry Council, in cooperation with Indiana Department of Natural Resources, Division of Forestry, provides BMP training for foresters, loggers, and landowners. Specific BMPs include:

- Maintain at least a 50-foot buffer strip or **streamside management zone (SMZ)** next to perennial streams, rivers, and lakes and a 25-foot SMZ next to large intermittent streams (flow only part of the year, usually in the spring). SMZs may need to be wider next to larger streams and on steep slopes. If any trees are harvested in an SMZ, at least 50% tree canopy cover should be left. Haul roads, skid trails, and log yarding areas should not be located within an SMZ. The Indiana Flood Control Act requires tree tops and other logging debris to be removed from a SMZ following logging.



Planning the logging job ahead of time is a key step to preventing damage to soil, water, and timber. Your forester and logger should work together to decide the best place to locate log yards, haul roads, and skid trails.

- Haul roads, skid trails, and log yarding areas should be located to minimize erosion and to disturb a minimum amount of soil. Stream channels should never be used as skid trails. Roads and trails should be located on well-drained soils to prevent rutting. Carefully planning the location and construction of roads, trails, and log yards also improves the efficiency of the logging job.
- Log skidding and hauling should stop when the soil becomes too wet or soft to hold the machinery. It can resume again when the soil dries out or freezes enough so that severe rutting does not occur.
- Where possible, avoid crossing streams. When stream crossing is necessary, carefully choose a crossing that minimizes stream bank excavation and that provides a solid rock or gravel bottom. Portable timber bridges may be available to provide a temporary stream crossing that eliminates damage to the stream's banks and channel.
- Wastes such as used motor oil, hydraulic fluids, and trash should be recycled or properly disposed of in accordance with state and local laws.

Portable timber bridges make stream crossing during timber harvesting easier while also helping to keep soil out of the stream.

- Take precautions to avoid spilling fuel.
- When logging is complete, water diversion structures, such as **water bars**, should be constructed on roads, trails, and log yards where erosion could occur. Ruts should be graded smooth. Temporary culverts, soil fill, and logging debris should be removed from stream channels.

Ron Rathfon

Water bars prevent erosion from trail surfaces. They are one example of best management practices (BMPs) that should be installed upon completion of logging.

You should expect BMPs to be used in your forest and even include a BMP provision in your timber sale contract. Your forester will help you insure that BMPs are properly applied. Part 6, *Maintaining the Beauty and Enhancing the Recreational and Cultural Values of Your Forest,* FNR-185, of the *Sustainable Forestry Series,* gives tips for a more aesthetically pleasing logging job. For more information on forestry BMPs, contact your District Forester.

Pesticides

Pesticides can be very useful in accomplishing some of your forest management objectives. Herbicides (chemicals that kill plants) are most commonly used to kill unwanted trees, brush, and vines in timber stand improvement work (TSI, see Part 3 *Keeping Your Forest Healthy and Productive Sustainable Forestry Series*, FNR-182) or for controlling weeds in new tree plantings. While it may be possible to accomplish your goals without the use of herbicides, there is a much greater risk of failure.

When using pesticides, always follow the manufacturer's label. Use prescribed personal protective equipment and chemical hygiene. Pesticides should not be applied over streams, rivers, lakes, wetlands with standing water, or active sinkholes. Take special precautions to avoid spilling pesticides. Leftover

pesticides should never be dumped out, especially not into or near any water resources. They should be disposed of in an approved manner according to the pesticide label. Application equipment should never be washed off in or near any water resource.

Many professional foresters are trained and licensed by the state to safely apply pesticides. If you have any pesticide application questions or needs, contact your District Forester, a private consulting forester, or your county Cooperative Extension Service.

Minimize Disturbance Around Sensitive Water Resources

Sustainable forestry practices also protect other vulnerable water resources during logging and other forest management activities. Open sinkholes are very sensitive to disturbance and can be difficult to remedy once they become unstable. They can sometimes be negatively affected by forest management activities, but the problems are easy to avoid. Logging slash should not be pushed into an open sinkhole or cave entrance. Waste products such as oil or pesticides should under no circumstances be dumped into sinkholes. Not only is sinkhole dumping illegal but it could contaminate wells used for drinking water, posing a threat to human health.

Springs and seeps are places where groundwater comes to the surface. They provide important habitat for both animals and plants. When possible they should be protected from logging equipment. **Springtime pools**, also known as **vernal pools**, occur all over Indiana. They are usually small, shallow depressions that hold water from springtime rains and winter snowmelt. Many of these vernal pools provide the ideal breeding habitat for amphibians such as frogs, toads, and salamanders. On warm spring nights in the peak of their breeding season the combined voices of these animals at a vernal pool can be impressively loud. Although logging equipment may have in the past created some small pools in the forest, vernal pools should be avoided while harvesting timber, particularly during spring breeding season.

Vernal pools provide important breeding habitat for amphibians such as frogs, toads, and salamanders. Avoid disturbing vernal pools during spring breeding season.

Wetlands collect and store water, filter out pollutants such as sediment, excess nutrients, and pesticides, and then slowly release the purified water into waterways. Forested wetlands are some of the most productive forests in Indiana, in terms of timber, wildlife and aquatic habitats, plant and animal species richness, and water purification. Forestry practices commonly used in Indiana wetlands are not normally regulated under wetland laws. However, section 404 of the federal Clean Water Act prohibits filling or draining wetlands without a permit issued by the U.S. Army Corp of Engineers. Certain forestry exemptions apply (see *Forested Wetlands* listed in *Additional Information* on page 7). Some wetlands may be unique habitats supporting rare plant communities or species and as such should be avoided when harvesting timber.

Don Leopold

Forested wetlands are some of the most productive forests in Indiana in terms of timber growth. They also filter pollutants from water, provide natural flood control, and are home to numerous species of wildlife.

Without special care, wetland drainage patterns are easily altered by road construction or rutting caused by log skidding. Altering these drainage patterns can raise the water table in some areas and lower it in others. Raising the soil water table by only a couple inches may be enough to kill or weaken the trees in that area. Logging in forested wetlands should only be done when the soils are dry or frozen enough to support the heavy equipment. Logging debris should not be pushed into

standing water in wetlands. Consult your District Forester or the Natural Resources Conservation Service before constructing roads in wetland areas.

Additional Information

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A Landowner's Guide to Sustainable Forestry in Indiana

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- Indiana's Forests Today
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- Maintain Important Scenic Views
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- Christmas Trees and Greenery
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- Forest Bank
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- Carbon Sequestration
- Forest Certification
- Education and Technical Assistance

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