

Forestry Best Management Practices:

Achieving Water Quality through Land Management

THE IMPORTANCE OF FORESTS TO WATER QUALITY

Forests perform many important environmental, recreational, and economic functions. Forests protect stream banks and soils, and therefore directly influence water quality. Large areas of healthy forest are essential to keeping our water clean. Like a sponge, forests capture rainfall, reduce runoff, maintain streamflow, filter nutrients and sediment, and stabilize soils. When streams are buffered by surrounding forests, the amount of excess nutrients (nitrogen and phosphorus) washing into streams is significantly reduced. This filtration function is critical in the Chesapeake Bay watershed, where nutrient pollution is a concern. Forests retain and process 85 percent of airborne nitrogen, the number one pollutant in the Chesapeake Bay. An acre of mature trees can also absorb as much carbon dioxide as that generated by a car driving 26,000 miles.

The amount of forest cover in a watershed is directly tied to stream health. Studies show that when only 15 – 25 percent of the forest in a watershed is converted to development, stream health and water quality begins to decline. The entire food chain in and near streams can be affected and damaged by land management activity. Best Management Practices (BMPs) are a proven method to lessen the potential damage from land-disturbing activities.

APPLICATIONS OF BEST MANAGEMENT PRACTICES

Best Management Practices (BMPs) are land use and land management practices that are designed to protect surface and ground water from sedimentation and other forms of non-point source pollution. BMPs work to reduce the negative effects that land development, forestry and agriculture have on water quality. BMPs may be structural, such as a bioretention basin, or nonstructural, such as a riparian buffer, forest stewardship plans or a public education campaign.

Urban BMPs address non-point source pollution caused by stormwater runoff from the impervious surfaces associated with land development. Agricultural BMPs address the nutrient and sediment pollution associated with raising crops and livestock. Forestry BMPs are directed primarily to control erosion and prevent soil from entering waterways. This issue brief focuses on forestry BMPs and urban and agricultural BMPs will be addressed separately.

POLLUTANTS AND IMPACTS FROM IMPROPER FOREST MANAGEMENT

Non-point source pollution occurs when rain and snowmelt runoff picks up and carries pollutants into streams and groundwater. Soil, including the organic debris and nutrients contained within it, becomes nonpoint source pollutant when it is exposed and unprotected. Nationwide, 3-9% of nonpoint source pollution comes from forestry activities. While 3% seems like a relatively small amount, localized non-point source pollution can be significant, particularly in Virginia where many of the highest quality streams flow through forested watersheds.

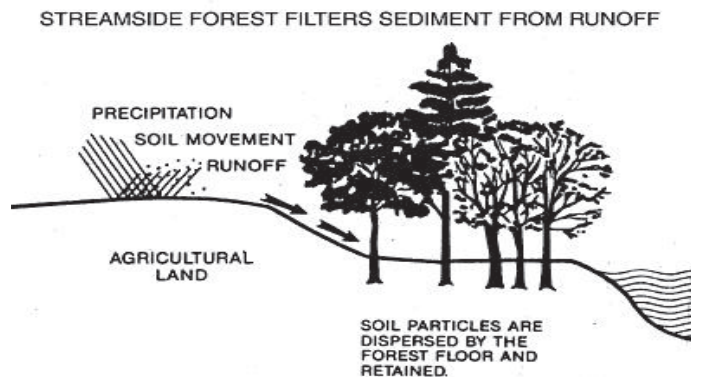


Forest management activities can generate the following forms of nonpoint source pollution:

Sediment Forest floor vegetation and organic matter protect the soil from erosion, while forest activities, such as road building, can remove this protection. Without using appropriate BMPs on exposed and sloping land, the soil may erode and wash into a body of water. Sediment is the primary pollutant associated with forest activities, especially at stream crossings for forest roads and skid trails.

Although sedimentation is a naturally occurring process, it can be intensified by forestry and other land activities that leave soil exposed. The result can be large amounts of sediment accumulating in lakes, streams, and wetlands that speed up the aging of lakes, bury fish spawning grounds and alter habitat for fish, mussels, and other aquatic organisms. Increase sedimentation raises filtering costs for drinking water and chokes irrigation systems.

Accumulating sediment also constricts naturally flowing channels, leading to increased stream bank erosion and possible flooding. Suspended sediment clouds the water, making it difficult or impossible for sight-feeding fish to locate their prey. It can also



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A skid trail is used to move logs and wood products from the stump to the log landing. Source: Virginia Department of Forestry

clog the gills of fish and have detrimental effects on aquatic life. High sediment loads make it difficult for beneficial aquatic plants to grow, and silt deposited on a lake or streambed can smother fish eggs and invertebrates important in the aquatic food chain.

Organic Debris Leaves and large woody debris that naturally fall into streams can benefit aquatic ecosystems. Fallen trees 12" and larger with the root ball attached serve as prime fish habitat. However, too much organic debris deposited in a short time can harm water quality. This can occur during logging when treetops and branches fall or wash into streams. Too much decomposing matter in streams decreases dissolved oxygen in the water, which fish need to thrive and reproduce. In extreme cases, logging waste can trap sediments and eventually interrupt streamflow and the movement of fish.

Nutrients Nutrients such as nitrogen and phosphorus exist naturally in forest soil and enter water bodies if the soil erodes into water. Also, if fertilizers are used in forest management, they can wash into runoff. Excessive amounts of nutrients may cause algal blooms in lakes and streams, which can reduce levels of dissolved oxygen below what fish and other aquatic species need to survive.

Temperature Sunlight filtering through trees is healthy for many streams. It can promote plant growth in the water and foster healthy ground vegetation along shorelines. However, when trees and the shade they provide are removed along most small streams, peak mid-summer water temperatures climb as a result of increased sunlight. This can accelerate harmful algae growth, reduce dissolved oxygen, and eliminate sensitive species of fish and other aquatic organisms.

Chemicals Fuel, oil, and coolants used in harvesting and road-building equipment must be handled carefully to avoid water pollution. Pesticides (e.g., herbicides, insecticides, and fungicides) help control forest pests and undesirable plant species. But when applied improperly, pesticides can be toxic to aquatic organisms.

Streamflow When timber-harvesting equipment compacts forest soil, water infiltration into the soil is reduced and surface runoff into streams increases. This also reduces water percolation through the soil to recharge groundwater. Groundwater feeds water supplies, lakes and streams, maintaining steady streamflows and lake levels throughout the summer.

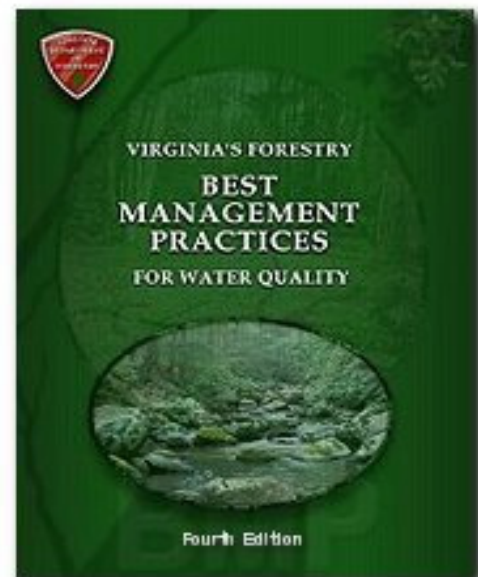
FORESTRY BMPs

Forestry BMPs are practices that protect our forest, soil, and water resources while allowing appropriate use of the resources. The Virginia Department of Forestry provides a BMP manual intended to minimize pollution from forested sites and ensure that forest resources are used wisely.

The actual cutting of trees has little impact on site degradation or stream water quality. However, those activities associated with moving the product from the stump to the mill have the potential for causing substantial site and water quality degradation. In general, the most serious problems involve erosion, the transport of the eroded material, and the deposition of this material. Since site management and water quality degradation may be directly related to erosion and sedimentation problems, the majority of BMPs focus on measures to minimize site disturbance. BMPs can benefit loggers with lower costs through more efficient operations; forest owners by reducing the need for site reconditioning; and forest ecology by minimizing degradation of soil and water on the harvested area.

The Virginia Department of Forestry recommends the following BMPs designed to prevent stream erosion and sedimentation:

- Using proper locations for roads and skid trails (on well-drained, stable soils with less than 10% grade and good load bearing capacity such as clay or sandy-clay loams with solid base), and by placing



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them as far from streams and wetland areas as possible;

- Locating logging decks (landings) on stable soils with a slightly sloping drainage;
- Using culverts and timber bridges at stream crossings;
- Using water control structures on roads or skid trails, such as water bars and rolling dips;
- Carefully selecting the schedule of operations and the harvest pattern;
- Revegetation and planting on exposed mineral soils, including landings and roads; and
- Identifying streamside management zones (SMZs).

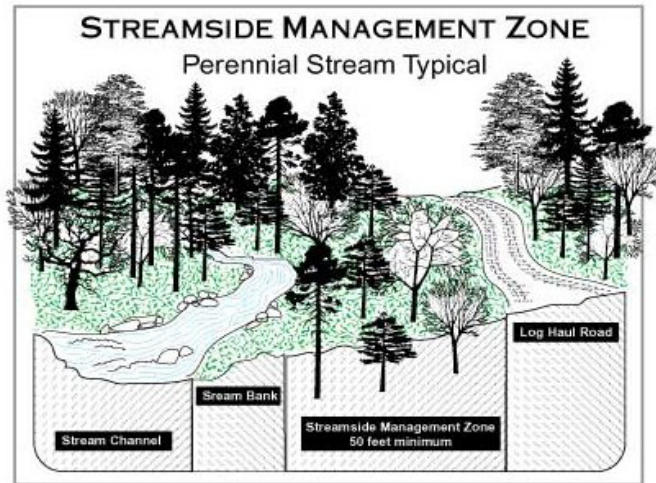
STREAMSIDE MANAGEMENT ZONES (SMZs)

A Streamside Management Zone is a BMP that designates areas adjacent to streams, as well as lakes, ponds, natural springs, municipal water supplies, and caves (in areas of karst geology) to protect water quality. An effective SMZ will filter sediment and nutrients, maintain desirable water temperature, and provide many of the essential requirements of forest stream ecosystems. It is recommended that all SMZs be a minimum of 50 feet in width, measured from the top of the streambank. In areas adjacent to tidal marshes, the SMZ begins at the marsh grass/forest edge and 50 feet inland. This 50-foot SMZ is a managed forest; within this managed area up to 50% of the basal area or forest canopy can be harvested. Steep slopes, cold-water fisheries and municipal water supplies all need wider SMZs to protect water quality. Within the SMZ:

- Harvesting should minimize disturbance. The forest floor should remain virtually undisturbed;
- Manual felling, directional felling, and mechanized felling can be effectively used providing minimal disturbance of the forest floor results; and
- All roads, trails, decks, and sawmill sites should be avoided. If



Regeneration and re-growth: A seedling pushing up from the forest floor. Source: Virginia Department of Forestry



necessary, water bars, broad-based dips, culverts and additional practices should be used to protect water quality.

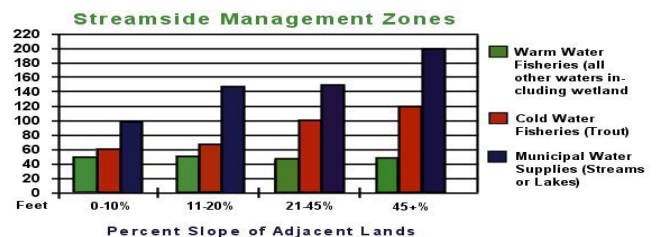
VIRGINIA REGULATIONS

If a logging operation is negatively affecting water quality, the logger, landowner and timber buyer are all liable and each may be required to correct the problem. In July of 1993, the Virginia Department of Forestry (DOF) was given the responsibility to inspect harvesting operations for water quality degradation. The Department, through this legislation, has the authority to do the following:

1. Recommend corrective action;
2. Stop harvesting; and
3. Impose civil penalties of up to \$5,000 per violation, with each day of continuing violation being considered a separate violation.

Today, state law requires all logging operations to notify DOF before commencing. In 2002, Virginia's General Assembly gave DOF the authority to impose a \$500 fine on loggers who fail to notify the department of the location on logging operations, and a \$1,000 fine for subsequent violations within a two-year period.

Virginia Forest Watch, a grass-roots coalition of individuals and groups, claims that over 50% of all logging jobs in Southwest Virginia are not reported to DOF. They also claim more than half of the logging operations that were inspected by DOF had active water quality problems as a result of poor harvesting practices. The



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Department of Forestry strongly disagrees with the Forest Watch claims and report having documentation of inspections on 95% of harvesting operations in Southwest Virginia. Further, DOF officials report that water quality issues and violations are fewer than those claimed by Forest Watch. The foregoing highlights the attention being paid to harvesting operations in Southwest Virginia and the strong opposition of some parties to traditional forestry operations.

Citizens may report logger and water quality complaints here:
http://www.dof.state.va.us/resources/f025_po.pdf

Additional Suggested Reading:

Best Management Practices for Water Quality. Virginia Department of Forestry. 2002.

<http://www.dof.virginia.gov/wq/index-bmp-guide.shtml>.

A pocket Field Guide can be obtained by emailing:
matt.poirot@dof.virginia.gov

“State of Our Rivers Report: For the Commonwealth of Virginia.” Friends of the Rivers of Virginia, January 2002.

Firehock, Karen. “A Stream Corridor Protection Strategy for Local Governments.” Institute for Environmental Negotiation. University of Virginia. July 2002.

Guidelines for the use of Innovative BMPs in Fairfax County, Virginia:
http://www.co.fairfax.va.us/dpwes/publications/bmp_guide.pdf

Virginia Forest Watch website:
<http://www.virginiaforestwatch.org/bmp.html>

Still, Kathy. “Virginia Forest Watch Seeking to Strengthen Laws Governing Logging on Private Land.” Bristol Herald Courier.

Riparian Buffer Implementation Plan. Virginia Riparian Forest Buffer Panel. July 1998.

National Fish and Wildlife Program website: http://www.nfwf.org/programs/targetedwatershed/resources_nutrient.cfm

Chesapeake Bay Program publication:
<http://www.chesapeakebay.net/tribtools.htm>