FORESTRY BEST MANAGEMENT PRACTICES ARE ESSENTIAL IN MINIMIZING SOIL EROSION WHEN HARVESTING FORESTS

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Cutting trees does not cause erosion. Soil is unaffected as tree roots, other vegetation, and the organic duff layer continue to hold the soil in place. However, the transport of cut trees from the stump to the paved road can impact soils and cause erosion. The disruption of the soil when trees are dragged or carried by equipment to the log landing can alter soil properties. Implementation of Best Management Practices (BMPs) are actions taken to curtail the potential for erosion and stream sedimentation to protect water quality.

Erosion is the detachment and removal of soil particles (sand, silt, and clay) by water and sometimes wind. Soil structure is the arrangement of soil particles into various aggregates which will differ in shape, size, stability, and adhesion. The soil structure influences movement of air, water, and ions affecting soil retention, water-holding capacity, drainage, aeration, and erosion. Soil is composed of air space (pores), water, minerals, and organic matter, all required for plant growth and development.

Rainfall on exposed soil and overland flow from compacted soil are the major components of erosion in forest harvest operations. Erosion from the energy of raindrop impact on exposed soil detaches soil particles. Normally, the organic duff surface layer protects forest soils by absorbing the force of raindrops. Removal of the duff layer on roads,

Soil erosion on a forest operation without BMPs

Revegetated stream approaches

skid trails, and log landings during harvest operations can initiate erosion.

Soil compaction is when pore space is reduced by the weight of logs, harvesting equipment and trucks. Water cannot infiltrate the compacted soil, especially on roads. When compaction occurs, rainfall remains on the soil surface and flows downhill through overland flow or surface runoff. Detached soil particles from raindrop erosion become suspended in the water. Additionally, the energy associated with the downhill flow is an erosive force that also detaches soil particles. The suspended soil particles (known as sediment) will eventually enter and be deposited in a stream, river, pond, or lake, negatively affecting water quality.

An objective of erosion control on roads is to keep water from accumulating and concentrating on the road surfaces. Fast-moving water can readily erode soil. Excessive road steepness may cause water to build velocity that facilitates erosion. When water is dispersed at intervals, road erosion can be controlled. Runoff is forced into adjacent, uncompacted areas where water will infiltrate the soil and deposit its sediment load before reaching the stream.

BMPS are designed to counteract soil erosion. Two examples are: (1) re-establishing and maintaining ground cover on exposed soil to promote infiltration and absorb rainfall energy impact to prevent raindrop erosion, and (2) minimize slope gradient and slope length (draining the water from short stretches of the disturbed ground surface quickly) to reduce the volume of water and prevent buildup of water energy flowing down slope that causes erosion.

BMPs to address potential erosion in harvesting operations are:

1. **Revegetate exposed bare soil as soon as possible to alleviate raindrop erosion. Refer to recommended ground covers in the University of Tennessee Extension publication PB1916 (https://utia.tennessee.edu/publications/wp-content/uploads/sites/269/2023/10/PB1916.pdf).**

Turnout or wing ditch diverting runoff from the road

Poorly constructed water bars that are breached causing substantial erosion on a skid trail.

2. **Control water in small amounts and short distances. Divert potential surface flow of water from the road surface to the adjacent forest. Once water flow enters the forest, the velocity declines, water infiltrates the soil, and suspended sediment in solution is deposited before reaching a water body. Possible water control structures to turn water from roads include varying the grade of the road, outsloping or insloping, berms, humps, wing ditches (water turnouts), cross-drain culverts, crowning roads and ditches, rolling and broad-based dips, water bars on skid trails, hardened drains, and silt fence. For guidance on these water control structures, refer to Guide to Forestry Best Management Practices in Tennessee (https://www.tn.gov/content/dam/tn/agriculture/documents/forestry/2023/Forestry-BMP-Guide.pdf).**

Another potential source of sediment from roads into streams is crossing the stream. Crossings are the lowest point of drainages where runoff enters the stream. Crossings are considered **RED flag areas**, where sediment can easily enter the stream unless preventive measures are taken. Generally, stream crossings are discouraged if the property can be accessed without crossing the stream. However, if a stream crossing is unavoidable, fords, culverts, and bridges may be used. Crossings should be made at right angles (90 degrees) to stream banks and located where stream channels are straight and will not interfere with streamflow. Logs should not be dragged across streams because sediments at the bottom of the stream will be disturbed, particles become suspended and dispersed further downstream, altering water quality.

A crowned forest road with ditches for drainage

Gravel or revegetated approaches can provide stability to prevent washing during high water and rutting. Runoff should be directed off the road into the adjacent forest with dips and turnouts before the stream approach. The use of water control structures to redirect runoff and revegetation or graveling stream approaches is instrumental in minimizing erosion when crossing streams.

Streamside management zones (SMZs), often referred to as buffer zones or filter strips, are implemented adjacent to streams to protect water quality. SMZs protect stream channels and banks from disturbance by harvesting equipment, provide a filtering area to prevent eroded materials from entering water courses, and to maintain stream water temperature for aquatic life. Specifications for stream crossing options and SMZs are outlined in the Guide to Forestry Best Management Practices in Tennessee mentioned previously.

Tennessee has adopted BMPs for forestry operations to minimize potential soil erosion and to protect water quality. These essential practices are used on forest road design, skid trails, log landings, and stream crossings to reduce the environmental impact of forest management activities. BMPs offer a flexible and preventive approach to protecting water quality and are designed to be low cost, practical, and easily applicable to forestry operations.

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