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A Logger's Guide to Forest Planning

Robert M. Shaffer, Extension Specialist, Timber Harvesting, Virginia Tech

Timber harvesting is an extremely complex operation. It involves several interrelated processes carried out over a large and sometimes highly variable area, often taking several weeks or months to complete. Since pay is based on production, operational efficiency is critical. In addition, today's logging contractor must comply with numerous laws and regulations affecting every facet of his business. Best Management Practices, or BMP's, are recommended operation guidelines for logging that are designed to minimize environmental impact and maintain water quality. To incorporate BMP's into a logging operation while carrying out that operation in the most efficient manner requires ***planning***.

Harvest Planning

There are two stages of harvest planning - preliminary pre-harvest planning and comprehensive harvest planning. A pre-harvest plan is a fairly simple plan commonly prepared by a "service" forester or forestry consultant for a forest landowner prior to conducting a timber sale. It normally identifies recommended streamside management zones as well as potential problem areas like fragile soils or steep slopes that may require special treatment during the harvesting operation.

A comprehensive harvest plan is much more complex and detailed. It is usually prepared by the logger or logging manager just prior to beginning the harvesting operation. The logging plan may include recommendations on logging roads, log decks, streamside management zones, stream crossings, skid trails, and the schedule of activities. The logging planner must have the following information at his disposal:

- The type of cut (clearcut, row thinning, individual tree selection, etc.). Will trees be removed from the streamside management zones? This could affect deck size and location, equipment restrictions or job layout.
- The terms of the timber sale contract. For example, the length of time on the contract may dictate the time of year that the tract will be logged, which may impact the haul road construction standards.
- The tract topography. In the mountains, topography will often limit the logger's options for road and deck location. In addition to slope, aspect and exposure should also be considered.
- The tract soil conditions. Soils will affect road and deck location, especially in the coastal plain and piedmont regions. Soils also impact equipment decisions and scheduling of activities.
- The tract hydrology. Knowing how much water to expect in a stream after a big rain will affect decisions on stream crossing structures.
- The tract boundaries, easements, and rights-of-way. This information is necessary to locate access points and haul roads.
- The timber volumes to be removed by species and product, and the distribution of those volumes across the tract. This information is vital for determining haul road standards, deck size and location, and scheduling.
- The logging system and equipment spread. The planner must be intimately familiar with the characteristics of the logging operation, including any equipment limitations or operating constraints. For example, the type of log truck (tandem or tractor/trailer) will impact the haul road layout, acceptable curve radius, and landing size.
- The applicable laws and regulations affecting logging, including the current non-regulatory BMP's. These will affect all aspects of the harvest plan.

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There are several tools available to the harvest planner. Topographic maps, available from the U.S. Geological Survey, are a must in the piedmont or mountain regions. Soil survey maps are most important in the coastal plain regions, where soils impact logging operations much more than topography. Soils maps for each county can be obtained from the Soil Conservation Service. A detailed timberstand map can be of great assistance in planning log deck location and scheduling operations. Many landowners have these on file for their property, prepared by a service forester or forestry consultant. County ownership maps are available commercially in some states. They can save time in obtaining rights-of-way or easements, or in notifying adjoining landowners regarding boundary line problems or questions that may arise during harvesting.

In the piedmont or mountains, every logging planner needs an instrument to determine percent slope. By degree of accuracy, the available options are an Abney level (about $100), a clinometer (about $75), and a slope gauge ($0-10). An accurate estimate of slope is necessary to maintain acceptable road grade, determine spacing between required water-bars, and comply with various BMP recommendations. Plastic flagging of various colors is an important tool for the logging planner. Boundaries, log deck locations, "back-lines" for skidding zones, streamside management zones, and designated skid trails can all be effectively marked and distinguished by flagging of different colors. Plastic flagging, as well as slope-determining instruments, can be purchased from any forestry or engineering supply company.

Perhaps the most important tools available to the harvest planner are his legs and eyes, to be used in a thorough, on-the-ground reconnaissance of the tract to be harvested. This "walk-through" will often uncover important features that maps, no matter how accurate, will not show.

Finally, several publications are available that outline or explain the various laws, regulations, or "recommendations" that impact timber harvesting. Examples are the "Logger's Guide" that explains the BMP's (available from the Virginia Department of Forestry) and Publication 420-142, Laws and Regulations Affecting a Logging Business in Virginia (available from Virginia Cooperative Extension).

Steps To Prepare A Harvest Plan

The following twelve "steps" provide a possible framework for a comprehensive harvest plan.

STEP 1. Study applicable maps and conduct an on-the-ground reconnaissance of the area to be logged.

Note the slope, aspect, soils, timber, streams, access, boundaries, old logging roads, "indicator" plants, etc. Put it down on paper as you go - a good method is to carry a large-scale topo map covered with a sheet of acetate or mylar on a clipboard, then mark important details and locations on the acetate "map." Become totally familiar with all of the tract characteristics that will impact logging. It is possible that a close reconnaissance may cause the harvest planner or logger to postpone or reschedule harvest of a particular tract to minimize probable production delays, possible equipment damage, or site damage.

STEP 2. Identify and mark streamside management zones (SMZ's).

These are one of the most important and effective ways to reduce stream sedimentation in a logged area, and should be implemented whenever possible. SMZ's are low cost (to the logger), highly effective, and improve the looks of a clearcut operation. A suggestion: mark SMZ's where some timber will be selectively removed with a different colored flagging from SMZ's that will not be cut at all.

STEP 3. Locate and flag log decks.

These are critical decisions that will directly affect production. Log deck location is a tradeoff between skidding distance and haul road construction-should you locate a log deck in the far corner of the tract and build a quarter-mile of haul road to get the trucks to it (keeping maximum skidding distance to 500 feet), or should you simply skid the timber from that area 2000 feet back to the big deck in the middle of the tract? The "best" answer depends upon factors such as road cost, skidding cost, timber volumes in the area in question, skidder payload, system balance, and environmental impact. Individual landing size will vary depending upon type of loader, type of trucks, number of sorts, topographic constraints, landing layout, need to inventory material, timber volume skidded to the deck, and environmental impact. Log decks should generally be kept as small as feasible, and should be well "daylighted" to facilitate

drying out after a shower. An ideally located log deck will be on a slightly sloped area (to facilitate drainage) with stable soils that do not easily rut.

STEP 4. Locate and mark logging road stream crossings.

Generally, the best rule regarding stream crossings is not to have any, if possible. They can be expensive and a potential source of major environmental and water quality problems. However, if it is determined that a stream crossing is necessary, choosing the proper location is critical. Look at the stream width, water depth, stability of the stream bottom and banks, the approach topography and soils, and the high water mark. Choose a location that will minimize the chance of stream sedimentation arising from logging as well as hauling operations.

STEP 5. Locate and mark logging road entrance points from public roads.

In some areas, entrance points must be approved by the resident highway engineer. Generally, the law requires that a truck driver pulling onto the highway from a temporary log road be able to see clearly in either direction for a minimum of 200 feet. In addition to safety, operational aspects must be considered when locating an entrance point. Truck turning radius, angle of approach, and direction of travel loaded and empty must be considered. Will "set-out" trailers be dropped off and picked up at roadside? Entrance points should always be located on well-drained, stable soils. Provisions must sometimes be made to keep mud from being transferred onto the highway, in the form of rock, mats or other surfacing material applied at the entrance point.

STEP 6. Locate any other logging road "control" points.

These are points or locations that the logging road must either connect or avoid. Actually, entrance points, stream crossing locations, and log deck locations are all "positive" control points for the haul road network. Examples of "negative" control points might be rock outcrops or gumbo clay flats, areas that the haul road cannot pass through.

STEP 7. Locate and flag the logging road gradeline (in the mountains) or centerline (in the coastal plain).

This step can sometimes be a real challenge, especially in the mountains. A good procedure is to first attempt to plot the gradeline on a topo map, connecting the positive control points while keeping the road at an acceptable grade (Virginia BMP's recommend a maximum 15 percent grade for no more than 200 feet at a time). Ideally, the grade should be kept at 10 percent or less. With a topo map, it is relatively easy to determine the grade of the proposed route between two control points - simply estimate the on-the-ground distance by the map's scale, then divide that into the gain or loss in elevation as estimated by counting the contour intervals between the control points. Adjust (lengthen or shorten) the route on the map until the acceptable grade is reached. Then take the map to the woods, and flag a "trial" gradeline using a slope-determining instrument set at the desired grade and following the proposed map route as closely as possible. If you're lucky, the initial trial gradeline will work as well on the ground as it looked on the map! Unfortunately, however, it often requires some "adjusting" on the ground to make it work.

Locating a centerline on relatively flat coastal plain terrain is usually somewhat easier. Soils are often the main consideration -try to locate the haul road on well-drained, stable soils, with good load bearing capacity, like clay or sandy clay loams with a solid base.

In either case, the gradeline (centerline) location must consider log truck characteristics such as tractor/trailer "tracking" and "tail swing" when laying in curves or switchbacks. The relationship between grade and "loaded" travel direction must also be considered when locating a curve near the bottom of a grade or in a location that will cause the driver to shift gears.

STEP 8. Locate and flag designated skid trails, if necessary.

In general, designated skid trails should be avoided if at all possible, as they greatly increase the environmental impact and chance of erosion and stream sedimentation. They are a "necessary evil" for skidder logging on steep mountain slopes of 35-40 percent or greater, where "direct line" skidding would be too hazardous. Skidder winchline distance is the key factor in locating designated skid trails in the mountains.

STEP 9. Specify logging road construction standards.

There are generally three logging road standards. The most common by far is a "branch" logging road. It is designed as a temporary road that will be "retired" immediately after logging is completed. A branch road is usually not much more than a 10-12 foot wide trail where the surface organic material has been graded off. There is no surfacing, and drainage is handled through a few, well-placed water turn-outs or broad based dips.

A "primary" logging or forest road is designed for permanent, all-weather use. It has a 20-foot subgrade, permanent ditches, cross-culverts, stabilized banks, and occasional crushed rock surfacing. A primary road is expensive and can only be justified on very large timber sales where the road will be used for several years.

In the middle is a "secondary" logging road - narrower subsurface than a primary road, with ditches, but without any surfacing. It is designed for all-weather use, and is a good choice for extended logging jobs that must operate year round.

In specifying logging road standards, the harvest planner must consider cost, the volume of timber to be hauled over the roads, the time of year that the roads will be used, the type of trucks using the roads, the length of road to be built, the available road construction equipment, and the time it will take to construct the roads. In addition, he should consider the use and availability of temporary road stabilizing or surfacing options like crushed rock, geotextiles, or mats (wooden, metal, or rubber). These are best applied at potential "trouble spots" ***before*** a problem occurs.

STEP 10. Specify stream crossing structures, if applicable.

The common choices, from least to most expensive, are a ford, a culvert with dirt fill, a "low-water" bridge, and an elevated timber bridge. The "best" choice depends upon the cost, the stream characteristics, the amount of use anticipated, the load bearing requirements, the area of forestland drained by the stream, the previous "high-water" mark, the time of year the structure will be used, and the environmental impact. A proper stream crossing structure will minimize any disruption to the normal stream flow and pattern - don't try to force a wide, shallow stream through a narrow, deep structure. In addition to the normal structures, a few temporary, re-useable, stream crossing structure alternatives are available. They include the "Dambridge" (a heavy rubber mat that forms a trough when a vehicle crosses, then "floats" on top of the stream when not in use) and a folding steel "portable bridge" that can be towed behind a pickup truck.

STEP 11. Determine the schedule of operations and harvest patterns.

This step is especially critical on a large tract. Is it better to complete the road system first and then begin cutting on the back side, or should you start at the front and build road as you go? The most efficient schedule of operations depends on the tract topography, time of year, current and anticipated weather conditions, road construction requirements, cash flow situation, and outside factors like quota restrictions or mill needs. Equipment, maintenance, safety meetings, and planned holidays or mill shut-downs should be included in scheduling. Goals for daily and weekly production should be set and compared against actual production. Scheduling should be constantly refined and updated as the operation progresses.

STEP 12. Specify tract "close-down" requirements.

These primarily involve the implementation of BMP's that will minimize erosion and stream sedimentation on the tract in the period after harvesting has been completed. They include re-grading ruts, installing waterbars on abandoned roads or designated skid trails, reseeding certain landings and roads, removing any temporary stream crossing structures, scattering brush, opening ditches or water turnouts, and any clean-up necessary to leave the tract in acceptable shape. Many of these operations can be scheduled during "slow" times as harvesting is completed on various parts of the tract, thereby avoiding a massive job at the end. It is important to make the landowner aware of his responsibility to maintain the tract in the environmentally sound condition in which it was left after logging was completed and BMP compliance recorded.

Safety

Safety must remain a constant consideration throughout the harvest planning process. Every decision made by the harvest planner will have safety implications, from the location of a log deck to the scheduling of activities. Plan for a safe operation, and then monitor employees closely to make sure it happens.

Reviewed by Scott Barrett, research associate, Forestry