SS-FOR-6

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Environmentally Sound Forest Harvesting[1]

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Introduction

The term "forest stewardship" may summon to mind a vision of tranquil forest scenes where the forest community gradually changes over time with minimal disruptions. Or it may invoke the image of a forest in which resources are carefully protected and products are prudently extracted with no damage to the resource base. Within one of these contexts many landowners embark on their Stewardship Management Plans, with goals of multiple use management and environmental protection. In their visions and images, "logging is a disruptive affair, even under the best circumstances"(Jones 1993). Yet, timber harvesting (or "logging") is often an integral part of a forest management program. It is a primary method for achieving many goals other than income from timber production. Some of the other benefits derived from harvesting will be reviewed briefly in this paper.

Although landowners may harvest part, or all, of their forest only once or twice in their lifetime, the visible disruption caused by logging makes them uncomfortable with the results. Actually, that disruption may be more a perception of sight and emotions rather than a true environmental degradation. As the landowner, you have many opportunities to reduce the apparent disruption, and to maintain the environmental integrity and beauty of your land. This paper will provide you with some of the important points to consider as you plan these operations with an eye toward meeting your resource management goals in an environmentally sound manner.

Harvesting Objectives

Logging is, of course, the only way to implement objectives that focus on the generation of revenue from timber production. However, it is also a key step in the development of other management goals. For example, if you wish to create new forest stands, whether they are single-species plantations or mixed-species multi-age natural stands, harvesting is generally necessary to create the appropriate site conditions (available sunlight, reduced competitive vegetation, bare mineral soil) for the establishment and growth of new seedlings. The type and amount of regeneration will significantly depend on the harvesting method that is employed. Similarly, harvesting is necessary if you want to alter stand structure, shapes and boundaries to create desirable aesthetic patterns.

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Other objectives might focus on creating openings in forest stands for recreational purposes, enhancing wildlife habitat, or influencing water yields. Logging is essential for removing individual trees or small groups of trees to meet these objectives. Harvesting, is also an important use of the timber resource if you are interested in: converting currently forested land to other purposes, such as cropland or pasture; replacing slow with fast-growing species; or preventing a pest problem from becoming an epidemic. Finally, judiciously controlled harvest operations can help you meet objectives that involve aesthetics and protection of soil, site and stand integrity.

In summary, harvesting trees is a tool for accomplishing many management objectives, and operations can be conducted to protect environmental quality and reduce visual impacts. Key requirements for environmentally sound harvesting will include good planning, reputable contractors, skilled workers, and professional foresters who understand the concepts and application of sound forest practices.

Environmental Effects of Harvesting

Let's briefly consider how harvesting influences various environmental factors. Perhaps the most constant characteristic of all ecosystems is “change”. This change may not be visible on the time scales to which we are accustomed. A clearcut may seem like a permanent change in the landscape, but in time it will return to the type of stand it was before logging. Although more woody biomass is removed in logging than in natural events, many of the changes that follow logging are no different than those that occur after a wildfire or hurricane. Plant and animal communities within the disturbed area shift to species that are best adapted to the new conditions of increased available sunlight, greater temperature extremes and altered species composition. Gradually, through a natural process termed ecological succession, the developing communities in the “disturbed” areas change to plant species that are adapted to shadier conditions, and to animal species that prefer the new plant communities for their food and nesting needs. Eventually, succession results in a forest structure very similar to pre-logging conditions. Tree planting and other silvicultural practices often hasten this process to meet management objectives.

Each stage of succession adds to the biodiversity in a region. If all forests were old growth, there would be far less biodiversity than with forests that include a variety of different successional stages. Similarly, if all forests in a region were young plantations, there would be less diversity than with a mix of both young and old stands. Thus, harvesting may actually enhance the biodiversity across a landscape rather than being a disruption. Biodiversity will be maintained as long as there is a continuous renewing of young stands through harvesting operations or natural disturbances (Figure 1).

Figure 1. Biodiversity achieved through a mix of stand ages.

Vegetation changes that characterize succession after logging, or other disturbances, also signal altered patterns of animal use of the forests. Some wildlife species occur most frequently in open areas, as in a clearcut; other species prefer older natural stands; and still others need a combination of both. Harvesting does not eliminate wildlife habitat, but it alters it for different groups of animal species. In fact, when forest understories are opened partially or completely by logging a flush of grass and herbaceous growth occurs on the forest floor. The new growth increases food sources for many animal species, thereby increasing the likelihood of population growth. Both prey and predator species benefit from these changes.

Aside from the visual effects, and shifts in ecological succession, the next most likely effects from logging are changes in soil and water quality. These can be long-lasting and detrimental changes if proper care is not used in logging operations. Continuous movement of heavy equipment across the same ground can significantly compact fine-textured soils (such as those with clay) when they are wet. Compaction and rutting reduces growth of trees along the edges of tractor trails, and dragging logs along those trails may damage standing trees, creating entry courts for disease organisms and insects. Soil compaction and wounding effects will be especially important in stands that are partially harvested rather than clearcut. The well-drained sands that occur on the majority of forest sites in Florida are much less prone to compaction problems than soils with a moderate clay content or wetlands soils.

Similarly, sediment loads may increase substantially in streams that run through sites with recent logging if waterways are not properly protected. Most of the sediments are eroded from roads and skid trails or improper site preparation after logging, and most can be avoided with appropriate operational procedures, called Best Management Practices (BMPs). Erosion from nonroaded portions of the logged area is unlikely because of the rapid revegetation (grasses, herbs, shrubs) of bare mineral soil exposed during logging.

This brief overview of environmental effects demonstrates that potential, long-term negative effects of logging are largely limited to plant and animal species that occur primarily in older stands, and to soil and water quality. These effects can be greatly minimized by landowners by following three major guidelines, each of which will be discussed in more detail in the rest of this paper:

- **Match the regeneration method to your objectives and common plant communities;**
- **Strictly follow Best Management Practices and related guidelines for environmental or visual quality;**
- **Carefully define the logging contract.**

Regeneration Methods

Landowners may select among various harvesting, or regeneration methods depending on their particular objectives and the species and conditions they desire in the next forest stand (Figure 2).

In the **clearcut method** all trees are harvested for wood products, and the site is usually planted with seedlings. This system works well for regenerating species such as the southern pines and hardwoods that require a great deal of sunlight as seedlings. Since logging equipment is only on site once every 20 to 50 years, there is less opportunity for soil compaction and damage to standing trees. It usually produces more revenue than the other methods, but a portion of the revenue should be allocated to site preparation and planting. If the clearcut is done in small patches or strips, however, seed from the surrounding stand can regenerate the harvested area naturally.

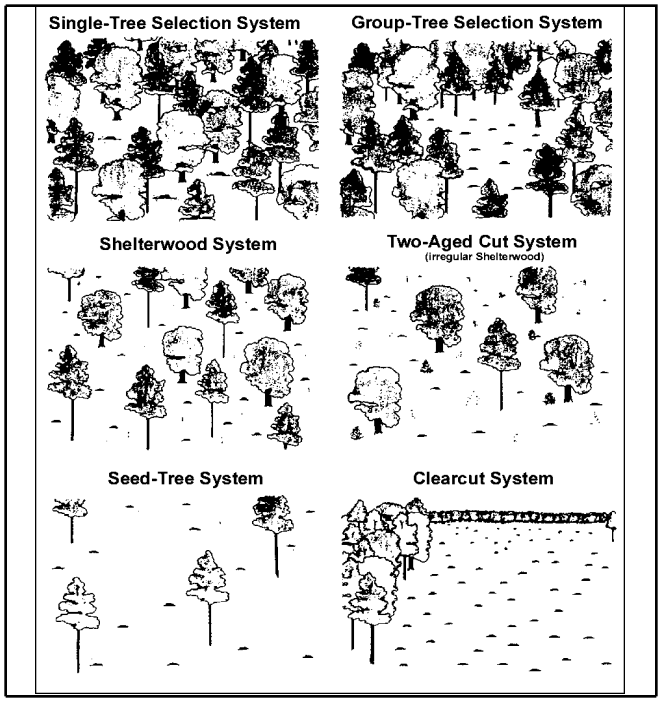

Figure 2. Landowners may select among various harvesting and regeneration methods.

With the **seed tree system**, 10 to 15 healthy trees per acre are left after logging, individually or in clusters, to act as a natural seed source for regeneration. This method combines the advantages of clearcutting with cost savings from not replanting. Usually, however, site preparation such as burning is

necessary to create a good seedbed. Once seedlings are established the seed trees can be removed although they are often left for wildlife or aesthetic objectives, or because of the relatively high cost of harvesting a small number of trees. Heavy winds, lightning and insects may also damage the widely spaced seed trees. If natural regeneration does not occur within a few years, seedlings may need to be planted. Spacing in the new stand may be uneven, requiring some prethinning. Landowners must be sure to leave well-formed, healthy trees or the new stand is likely to be filled with poor quality trees. As with clearcutting, this method is most appropriate for species that tolerate high levels of sunlight. Neither of these two systems are favored for shade tolerant species.

The **shelterwood method** is similar to the seed tree method but requires that more trees be left after the final harvest. The number of residual trees is reached by thinning the stand two or more times. Again, the system relies on natural regeneration from the trees that are left on site. The residual overstory can be removed once the regeneration is established, although the overstory can also be left (irregular shelterwood) until the next major harvest to provide larger trees and diversify stand structure. Whether it is removed may also depend on the value of the residual trees, the cost of logging, and the likely damage to the new stand. This system generally has higher harvesting costs than the first two options. The amount of shade on the forest floor can be varied by the number of trees left to provide seed. Thus, this method can be used for both shade tolerant and intolerant species.

All three of the previous harvesting methods result in essentially even-aged stands. The **selection system** is the only method for creating and maintaining uneven-aged stands. Individual trees or small groups of trees are harvested while minimizing damage to the residual stand. The small openings naturally regenerate by seed fall from surrounding trees. Such selective logging can be accomplished with entries into the stand every 5 to 10 years, which increases the potential for soil compaction and damage to residual trees. It also requires more roads or skid trails than the other three methods. It is the least cost-effective logging system, but the most reliable for regenerating species such as oaks and other hardwoods that prefer shady conditions for seed germination and seedling growth. Group selection (or small patch clearcuts) can be effective for providing visual and microlandscape diversity in your stand. Forest appearances change very little with this method, so it may be valuable when aesthetics are extremely important.

Thinnings are another type of partial harvest in which poor quality trees or entire rows are removed from a young stand. The objective is not to create a new stand; but, rather to provide more growing space for the better trees in the stand, to reduce the density to improve wildlife habitat or recreational opportunities, or to increase visual penetration into the stand and enhance aesthetic qualities.

Although the shelterwood, selection and thinning methods require a great deal of care (and therefore extra cost or less revenue) to protect the trees that are not harvested, they are probably the best methods if your objectives are focused on resources other than timber production. Each system is flexible enough to vary the amount of sunlight reaching the forest floor under residual canopies or in different-sized openings. This flexibility may be important depending on your wildlife, recreation or other objectives.

Primer on Harvesting

A brief description of logging systems and related costs should help in understanding the two other opportunities (BMPs and logging contracts) for environmental protection during harvesting. Although a variety of equipment and systems are available (Shaffer 1994), most logging in Florida utilizes rubber-tired skidders to move logs from stumps to landings where they are loaded on trucks for transport to mills (Figure 3). Tree felling is done manually with chainsaws in some systems, but it is most often accomplished with tractors equipped with hydraulic shears or saws. Feller-buncher tractors have the ability to accumulate several trees as they are cut so they may all be laid together for pick up by the skidder.

Figure 3. Rubber-tired skidder transporting logs to a landing.

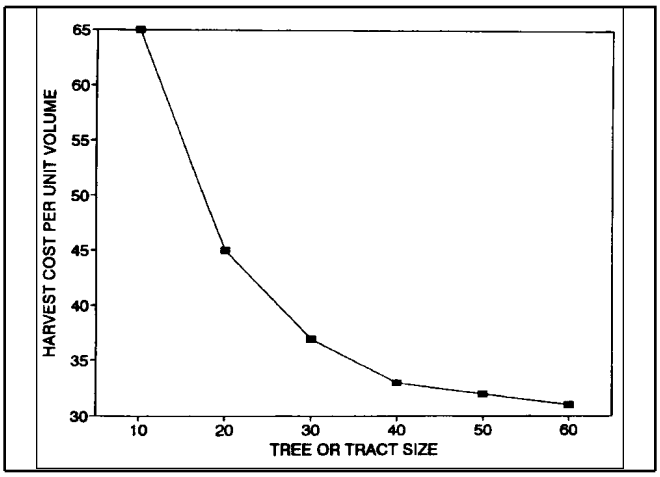

Figure 4. Relationship between harvesting cost and tree or tract size — units not specified.

Variants of this system include: hand or mechanical loading of short bolts of pulpwood after trees are “bucked” into the short sections; farm tractors, forwarders (large trailers), and even horses and mules, rather than skidders for moving logs to roadside; and crawler tractors with winches for very wet locations. Forwarders transport logs off the ground, reducing skid trail damage. Although this system is less productive and somewhat more expensive than skidders, it is the most common system in Scandinavia and is increasing in popularity in thinnings and selection cuts in the South. In mountainous areas, logs are often transported to landings via stationery cable systems, but these have only been used in Florida in certain wetland situations.

Harvesting costs are influenced by the size and types of equipment that are used, size and total volume of timber that is cut, tract size, and distance to the nearest mills. Equipment costs increase with distances that skidders (on site) and log trucks (off site) must transport logs. However, because of economies of scale, they also increase as size of the logging unit, tree size and total timber volume decrease. These general cost trends are illustrated in (Figure 4) that relates harvesting cost per unit of volume to tree and tract size.

Why should you be concerned with harvesting costs? Because they determine the value of your timber. When loggers deliver timber to a mill, they receive the same price whether the trees come from 50 or 5 miles away, or whether they are from a 10-acre or 100-acre tract. Therefore, as harvesting costs increase due to small tree size or some other factor, the portion of the mill price that is left to pay the landowner for stumpage decreases.

The importance of this discussion should be evident. Factors that increase harvest costs will decrease timber value. This is the tradeoff landowners accept when selling timber from small or distant tracts, or in planning for special precautions and conditions during logging. This tradeoff can be minimized by careful pre-harvest planning with professional foresters and forestry consultants. Landowners who have seen the results of thorough planning and good supervision generally agree that environmentally and aesthetically favorable results are possible with little, if any, loss of revenue.

Revenue from the sale can be received as a lump sum, where the landowner is paid in full before logging begins. If you sell your timber this way, you (and the logging contractor) should have a very accurate assessment of the volume and value of timber before bids are invited or agreements are signed. If your sale is not a clearcut you should mark all trees to be cut before the sale. Alternatively, by using the “pay as cut” or “scale” method, you will receive periodic payments throughout the logging operation, based on the amount harvested in that period and the unit price specified in the contract for different product classes. This may be more satisfactory if you do not know the amount of timber volume you are selling, but it requires regular checking to be sure you are paid for what is cut. Tax implications of the two payment methods are significantly different and should be understood

before entering into a timber sale contract. Information regarding current tax laws applicable to timber sales is available through Internal Revenue Service offices, many consulting foresters, the School of Forest Resources and Conservation Extension office at the University of Florida and the National Timber Tax website (www.timbertax.org) which has the new Forest Landowners Guide to the Federal Income Tax.

Whichever payment method you select, you can sell your timber either by requesting sealed bids from a number of timber buyers or by negotiating a sale price with an individual buyer. Sealed bids tend to bring higher prices for the timber, particularly for a good stand of timber. However, negotiations may be your most likely option if you are trying to sell small volumes, are long distances from mills, or would like to customize a contract for your particular situation. With customized contracts you work with the logging contractor for special environmental practices such as post-logging improvement or alteration of landings and skid trails. Negotiating a sale contract also gives the landowner more leeway in selecting a logging contractor with previous experience in special types of harvest. Landowners should check references and previous work as part of the selection process.

Best Management Practices

These guidelines are broadly defined here to include both the practices specified in the Silvicultural BMPs for the state of Florida, as well as other wise practices for ensuring that logging is environmentally sound and that site conditions and wildlife habitat are protected. All appropriate guidelines and practices should be discussed with potential logging contractors before you conclude a sale contract to be sure their equipment and operations will satisfactorily meet your objectives.

Best Management Practices for Silviculture in Florida were first published in the mid 1970's in response to the Federal Clean Water Act of 1972. Those original BMPs were designed exclusively to protect Florida's streams and lakes from potential sources of pollution associated with forestry activities.

In recent revisions, some of the original practices have been retained as part of the continuing strategy to achieve water quality goals. However, many of the BMPs have been expanded with more detail or to address additional water resource features such as sinkholes, small lakes, canals and wetlands. In addition, general ecological considerations and wildlife habitat values have been incorporated in specific BMP objectives.

Harvesting near water

The Silvicultural BMPs for streams, lakes, ponds and other wetlands vary according to adjacent slopes, soil erodibility, size of the stream or wetland, and whether water is present permanently or seasonally. Review your specific situation with a forestry consultant or county forester before harvesting begins, and request a copy of the BMPs from the county forester. Following is a general summary of the BMPs.

All perennial waterways are buffered by a Primary Special Management Zone (SMZ; 35 to 200 feet on each side), with the width dependent on stream and soil characteristics (Figure 5). Within that zone, clearcut harvesting is prohibited except in isolated situations. Even where exceptions exist, **clearcutting is not allowed within 35 feet of the waterway**. Selective harvesting is permitted if logging is conducted in adjacent areas, and as long as the remaining stand is equivalent to at least 50% of a fully stocked stand on that site, and species and diameter distributions are representative of the original stand. Special protection must be given to very large and/or old trees, snags and cavity trees, and trees where part of the canopy overhangs the water. Other harvesting activities that are prohibited within the Primary SMZ are:

- loading decks and landings
- log bunching points
- road construction (except stream crossings)
- mechanical site preparation
- burning on slopes greater than 18%.

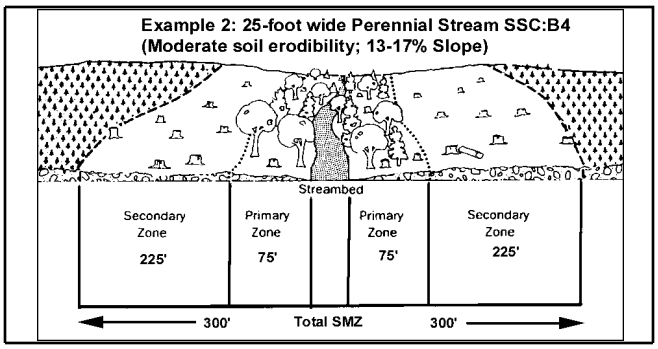

Figure 5. SMZ for a permanent stream.

A Secondary SMZ is required around all intermittent waters, and may be added to the primary SMZ for perennial waterbodies (Figure 6). Width may vary from 35 to 300 feet on each side of the stream. Both clearcut and selective harvesting are permitted within this zone; loading decks, landings, mechanical site preparation, roads (except for stream crossings), and aerial application of chemicals **are not permitted**. A “stringer” of all trees on the immediate stream bank of intermittent streams, lakes and sinkholes must also be retained.

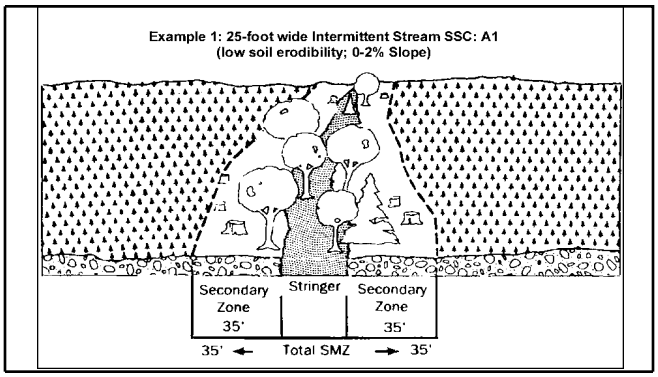

Figure 6. SMZ for a seasonal stream.

The primary goal of BMPs for wetlands other than streams, such as small cypress ponds or large swamps, is to prevent significant change in hydrologic conditions or natural drainage patterns. Harvesting guidelines for wetlands vary by size of the wetland, but generally require retention of: all snags to the fullest extent possible; 1 to 5 live leave trees per acre distributed randomly throughout the area; and selectively cut or uncut portions of smaller wetlands. Wetlands larger than 200 acres may be partially clearcut, subject to the retention of snags and live trees described above. Limit skidding and other heavy equipment operations to dry seasons and low-water conditions. The number of skid trails should be minimized and concentrated on as small an area as possible.

Slash disposal

Slash (tops, limbs, rotten logs) left after logging is often the most undesirable visual effect of the harvesting operation. Slash abundance will be reduced if most of the harvested timber is utilized through sales to mills or removal for firewood or other products. However, slash also represents an important source of organic matter and nutrients for the soil, especially if it is evenly distributed on the site. Limbing and topping trees where they are felled will help achieve this uniform slash distribution. **Windrows and slash piles should be avoided in most situations although they can be used to provide habitat for small animals**. The visual impact of slash can be lessened by lopping branches with saws or by chopping and crushing the material mechanically so it lays close to the ground. This will also hasten the decomposition process. Slash should not be pushed into ponds, piled in swamps, or left in streams, lakes, sinkholes or other waterbodies.

Roads and skid trails

The transportation system for logging operations often represents one of the highest harvesting costs as well as one of the most significant sources for environmental problems. Good prior planning is critical. If you cannot use existing access routes for trucks, locate new roads to benefit all uses of your property, but minimize stream or wetland crossings, number of landings, and the length of new construction.

Landings should be large enough to accommodate the type of equipment you expect to use and the sorting and processing of logs; they should be centrally located to access as much area as possible; and they can be shielded from view by using topography and vegetation as buffers. The road entrance at point C (Figure 7) avoids direct views from the main road into the harvest area, unlike access routes A and B.

Florida's BMPs provide detailed information on road construction, drainage (Figure 8), and maintenance, and they should be carefully studied

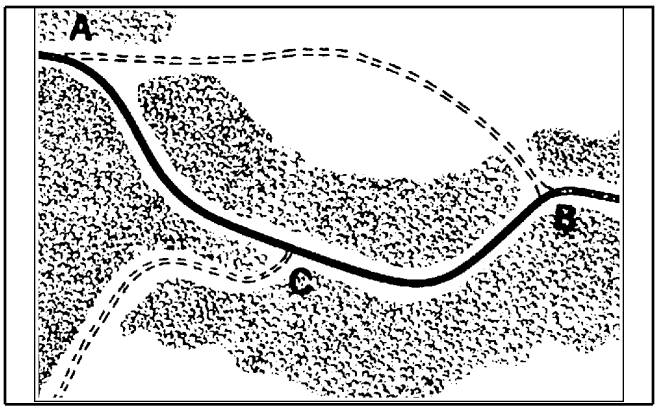

Figure 7. Landing can be shielded from view by using topography and vegetation.

prior to road location and construction. Some of the key features include:

- *Construction during dry periods, and several months prior to use;*
- *Roadside ditches, broad dips and culverts to reduce surface erosion;*
- *Turnouts to divert water from ditches into vegetated areas, not into streams;*
- *Water bars to protect abandoned roads on slopes after harvesting is completed;*
- *Minimum number of stream crossings;*
- *Crossings at right angles to streams at their narrowest points;*
- *Culverts, bridges or hard surface fords for stream crossings;*
- *Mulching or seeding of roadsides and road beds*;
- *Regular road grading and maintenance of drainage features.*

Road construction costs and impacts may be further reduced by several other practices. On perennial wet spots, geotextile fibrous mats reduce the amount of fill and expense to raise the roadbed above the wet area. Trees and brush should be cleared from only the minimum width necessary for construction and traffic needs. All merchantable wood in the right of way should be utilized and unmerchantable materials should be dispersed out of view. Uprooted stumps can be pushed away from the

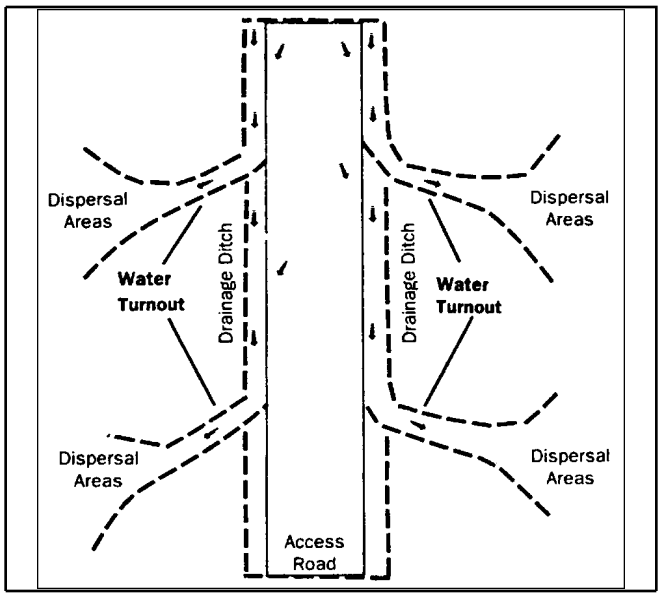

Figure 8. Important features for road drainage.

road and left in upright positions to look more natural. The aesthetic appeal of the road can be enhanced by leaving large attractive trees along the road and around landings, by pruning roadside trees, and with periodic openings in roadside vegetation for views or wildlife habitat.

Logging skid trails also represent potential environmental risks. As with access roads, correct design and use will minimize the problems. Implementing that design requires that you work with the logging contractor to locate skid trails on the ground prior to harvesting (Figure 9). Objectives on wet, clay or organic soils, or on sloping ground, will be to minimize the area covered by trails without driving the logging costs skyward, and to curtail operations during wet weather. Ruts develop on wet roads and trails and become major erosion channels. Trails on slopes should be located along contours to reduce soil erosion, or skidding should be uphill to avoid the convergence of trails (and water) to a central point at the bottom of the slope. Skid trails should never cross streams unless portable bridges or temporary culverts are used.

Concentration of skid trails on well-drained sandy soils is less important. By dispersing skidding across such sites you will minimize disturbance in any one spot, and will reach your objective of crushing residual slash. Well-drained sites are also advantageous during wet weather because timber may be harvested on those sites while it is

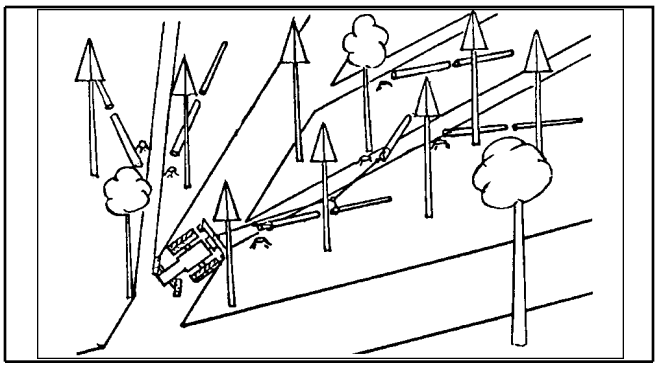

Figure 9. Preplanned skid trails in a partial cut.

inaccessible on poorly-drained areas. This accessibility may translate into higher stumpage prices during rainy seasons. You should allow a longer time period for logging on wet sites to be sure it is done under favorable soil and weather conditions.

Once logging operations are concluded, water bars should be constructed on all sloping trails and roads to reduce potential erosion. Disking, seeding and fertilizing will hasten stabilization and revegetation of these trails as well as those on flat land, and such refurbished trails might be used for recreational purposes and wildlife forage. Cleaning, cultivation and revegetation of landings will also enhance their aesthetic appeal and can serve as valuable food plots for wildlife and parking or turn around areas for recreational vehicles. Include these post-harvest operations in your planning.

Other guidelines

The aesthetic appeal or environmental value of your harvest can be improved through a number of practices. One important consideration is the relationship between your proposed harvest site and surrounding land that may belong to you or your neighbors.

Retention of connecting links of forest cover between various wetlands, hammocks or other forest conditions provides important corridors for wildlife that move from one ecosystem to another (Figure 10). The corridors impart a sense of continuity to the landscape rather than leaving it dissected with straight boundaries between disjunct ecological communities. These residual patches or strips of forest may also serve to break a large contiguous harvest block into several smaller, less noticeable units, with boundaries determined by natural features.

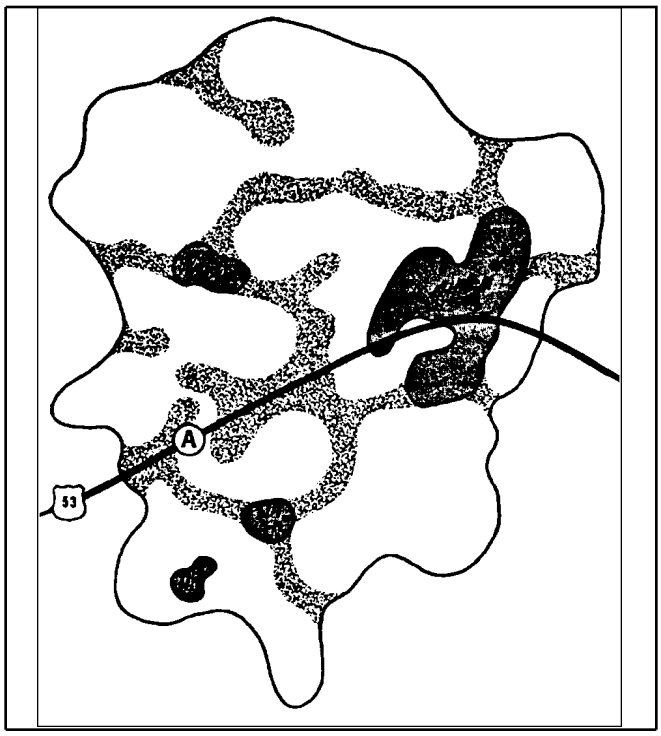

Figure 10. Harvest unit with corridors connecting ponds and adjoining properties.

Snags, logs, and small groups of trees, especially those that produce seasonal food (mast) for wildlife, can also be left randomly throughout the harvested area to provide microsite diversity and wildlife habitat. Irregular shaped boundaries around the harvest unit and along access roads provide a more natural look to the unit, especially if planned in conjunction with corridors, SMZs and retained pockets of mature trees (Figure 11). Although preserving these extra features may slightly reduce income from your timber sale, they will enhance the visible and ecological results of the sale, especially where clearcut or seed tree methods are employed. Partial harvesting along the borders of residual stands will produce a gradual transition between clearcut or seed tree harvest areas and remaining forest rather than an abrupt vegetation change. Use maps and photos during presale planning to help delineate boundaries and these residual features.

Several other logging specifications can also contribute to aesthetic improvements. Requiring low stump heights will increase wood yield and will minimize or eliminate stump visibility in the cleared area (Figure 12). In partial cuts, such as thinnings, trees at curves in skid trails may be damaged as logs are dragged past them. The presence of these

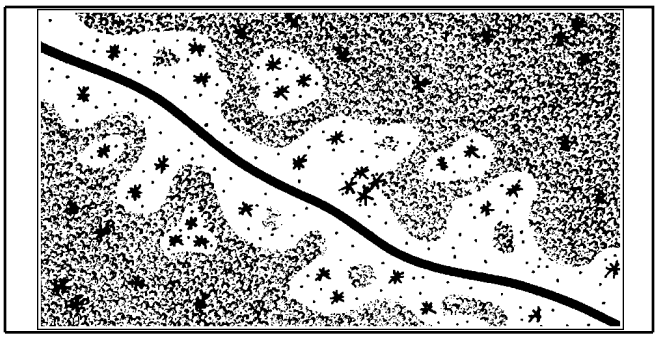

Figure 11. Irregular stand borders and features enhance roadside aestheics.

"bumper" trees will protect surrounding trees from damage. Their removal at the end of the logging operation will reduce the availability of entry courts for unwanted insects and diseases. Also in partial cuts, careful directional felling techniques can be prescribed to reduce damage to remaining trees. If skid trails are to be used for other purposes after harvesting is completed, trees should be felled away from the trails so that tops and limbs are not left on the trails.

Figure 12. Low stumps and residual trees enhance the viewing quality of clearcuts.

Timber Sale Contracts

The third major opportunity available to the landowner for assuring protection of environmental quality during harvesting is the timber sale contract itself. Contracts are a must for any sale unless you are going to cut and transport the trees to the mill yourself. Many timber buyers have standard contract forms they would prefer to use, but most are also willing to discuss specific clauses that you might want to add to the contract. As the seller, you are fully within your right to draft your own contract although it would be wise to have a competent lawyer help you do this. In actuality, since both buyer and seller have specifications and conditions they want in the agreement, your best option may be to work with the timber buyer to develop a contract acceptable to both of you.

The sale contract is your assurance that all of the decisions and practices described previously in this paper are carried out. Some of the obvious items to include in a contract are:

- *Harvest area location and size;*
- *Timber species, sizes, prices and utilization limits;*
- *Harvesting method, start and end dates;*
- *Tree marking and selection by landowner or professional forester, not logging contractor (except in clearcuts);*
- *Payment method and schedule;*
- *Insurance requirements;*
- *Compliance with BMPs, environmental regulations, and local ordinances;*
- *Removal of litter, garbage and hazardous materials;*
- *Road and landing location, maintenance and posttreatment;*
- *Penalties for damages and failure to meet contract specifications.*

Perhaps less obvious, but reasonable and acceptable for inclusion in a contract, are:

- *Specific logging practices and equipment (acceptable or prohibited);*
- *Skid trail rehabilitation;*
- *Slash disposal requirements and procedures;*
- *Directional felling and acceptable levels of residual stand damage;*
- *Restrictions due to weather or other factors;*
- *Stump height and use of bumper trees;*

- *Protection of snags, old logs and residual clumps of trees;*
- *Cleanup of logs and brush pushed over during road construction.*

All anticipated specifications should be identified prior to bids or negotiations so that potential buyers can estimate all harvesting costs. As more constraints are added to a contract, harvesting costs will likely increase, thereby reducing stumpage bids and prices. Jones (1993) estimated the cost of addressing aesthetic concerns during logging at 5 to 6 percent of gross stumpage. Most costs were associated with rehabilitative practices such as disking and seeding. Reductions in stumpage represent an important tradeoff for enhancing environmental conditions after logging but should minimize the need for post-logging efforts to correct undesirable situations. “Remember, price is not everything; quality workmanship and attainment of forest management objectives are equally important” (Jackson 1994).

Conclusion

Harvesting operations are one of the primary tools by which a landowner attains objectives for natural resource management. Although the operations are, by nature, disruptive, they certainly do not need to hinder ecological or environmental functions and processes. Carefully conducted operations can even enhance aesthetic qualities of a forest stand. Wise selection of the appropriate regeneration method, application of BMPs and other environmental guidelines, and carefully-negotiated timber sale contracts are your keys to environmentally sound harvesting.

Disciplined decision-making, prudent planning and conscientious control will allow you to conduct your harvesting operations with positive ecological and aesthetic results.

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