

Assessing the Financial Effects Associated with Implementing Minnesota's Timber Harvesting and Forest Management Guidelines

A report to the
Minnesota Forest Resources Council
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Contents

<u>Objective 1: Assessing the Financial Effects of Guideline Compliance</u>	2
<u>Methods</u>	2
<u>Increase in Harvest Planning</u>	3
<u>Reduction in the Volume Harvested per Unit of Area</u>	4
<u>Reduction in Operating Productivity</u>	5
<u>Reduction in the Available Operating Time</u>	6
<u>Additional Activities or Cost Factors</u>	6
<u>Practices that have the Potential to Reduce Cost</u>	10
<u>Overall Guideline Implementation Costs</u>	11
<u>Summary and Conclusions</u>	13
<u>Objective 2: Who Pays for Applying Forest Management Guidelines?</u>	15
<u>Approach</u>	15
<u>Markets and Market Structure</u>	16
<u>Minnesota Forest Industry Structure</u>	17
<u>Landowners</u>	17
<u>Loggers</u>	18
<u>Mills</u>	19
<u>Market Behavior</u>	19
<u>Contracts</u>	19
<u>Bidding</u>	20
<u>Pricing</u>	20
<u>Owners' reaction to cost increases</u>	22
<u>Logger's reaction to cost increases</u>	22
<u>Inferences from Observation</u>	23
<u>Applications of the Economic Story</u>	24
<u>Practice guidelines will lead to stumpage price increases</u>	25
<u>Public agencies need to lower the reserve prices to keep the industry going</u>	25
<u>Mills use procurement zones to schedule product flows</u>	26
<u>Discounted stumpage prices won't help loggers</u>	27
<u>Policies to Compensate for Guidelines Compliance Costs</u>	27
<u>Summary</u>	29
<u>Objective 3: Methods used to Encourage Voluntary Compliance with Timber Harvesting Practices in the United States and Canada</u>	31
<u>Methods</u>	31

<u>Results</u>	32
<u>Case Studies of Incentive Programs</u>	34
<u>California</u>	34
<u>Florida</u>	35
<u>Indiana</u>	35
<u>Kansas</u>	36
<u>New York</u>	36
<u>Virginia</u>	37
<u>Washington</u>	37
<u>Summary and Conclusions</u>	38
<u>Attachment 3-1: Survey Cover Letter</u>	39
<u>Attachment 3-2: Survey Respondent Information</u>	40
<u>Attachment 3-3: Follow-up Post Card</u>	49
<u>Attachment 3-4: Summaries of each Survey Question</u>	50
<u>Objective 4: Summary of Riparian Timber Harvesting Guidelines in the United States</u>	64
<u>Methods</u>	64
<u>Results</u>	65
<u>Objective 5: Recommendations for Further Study and Next Steps</u>	97
<u>Impact of Forest Management Guidelines on Timber Harvesters (Objective 1)</u>	97
<u>Who Pays for Implementation and How are Those Costs Passed Along (Objective 2)</u>	97
<u>Next steps</u>	98
<u>Literature Cited</u>	99
<u>Attachment 1: Timber Harvesting Riparian Guidelines in Oregon</u>	105
<u>Attachment 2: Timber Harvesting Riparian Guidelines in Washington</u>	142

Background

Complying with Minnesota's Timber Harvesting and Forest Management Guidelines in addition to normal operating procedures could result in both direct and indirect financial effects. Direct effects are out-of-pocket costs, such as temporary crossing structures, erosion control structures, providing leave logs, and additional time required for planning. Indirect economic effects result from modified sale attributes such as harvest intensity, harvest layout, harvest timing, and average skidding distance. Many of these effects will add cost; however, some may be neutral or even decrease cost. The extent to which the timber harvester is able to pass those additional costs on to landowners or consuming mills is unknown.

This report provides insight into several issues related to the costs of applying forest management guidelines. Specific project objectives are noted below. This report dealt only with the financial implications of harvest practice change: those expenditures and revenues that show up in the accounts of participant landowners and firms. It did not address the full economic implications of change: those benefits and costs that are external to the market participants. The second class of effects, often not quantified and almost always not monetized (and, so, not useful for practical decision making) are properly the subject of a different—and far more ambitious—intellectual undertaking.

1. Summarize published literature about how a timber harvester's operational efficiency, labor and capital requirements, cost structure, and profitability are impacted by applying forest management guidelines. The summary focuses on impacts of applying riparian and wildlife guidelines.
2. Assess and summarize existing knowledge about the economic structure and performance of the timber production, harvesting, and delivery markets. Summarize features of markets in which any additional cost for guideline implementation may be passed on to landowners or mills. Itemize necessary information for the state to identify who really pays for guideline implementation.
3. Review the mechanisms that are used by states and Canadian provinces to encourage landowners, foresters, and timber harvesters to apply timber harvesting and forest management practices.
4. Summarize information about riparian guidelines for the various states.
5. Identify and provide recommendations for follow-up studies and next steps for Forest Resource Council consideration.

Objective 1: Assessing the Financial Effects of Guideline Compliance

Implementing Minnesota's timber harvesting and forest management guidelines in lieu of normal operating procedures may result in both direct and indirect economic effects. Direct economic effects are out-of-pocket costs, such as additional time required for planning and preparation, purchase of temporary stream or wetland crossing structures, installation of erosion control structures, seeding exposed areas, and redistributing slash across a harvest site. Indirect economic effects are an indirect result of changes in attributes of the harvest that are associated with implementing the guidelines, such as changes in harvest intensity, harvest layout, average skidding distance, infrastructure, and length of the logging season. Many of these effects will add cost; however, some may be neutral or even decrease costs.

Vasievich and Edgar (1998) asked 21 logging businesses in Minnesota to report a range of production costs for common harvesting situations. Most respondents provided a low and high value to represent costs for producing wood at an on-site landing. Hauling costs to the mill were excluded from the study. The low to high cost range reported for each of the logging situations was \$5 to \$7 per cord. That margin represented the average cost differential between the least restrictive and most restrictive operating conditions for logging within a forest type. As some of that difference could be due to timber and site differences within a forest type, Vasievich and Edgar (1998) felt that it was reasonable to assign half of the average margin (\$3) to operational constraints, such as those that might be imposed by the proposed guidelines. While that study represented the first effort to assess the financial effects to logging contractors of implementing Minnesota's timber harvesting and forest management guidelines, limited data was available for use during the analysis.

Under objective 1, we summarize existing literature about how operational efficiency, labor and capital requirements, cost structure, and profitability are impacted by applying forest management guidelines. Under objective 2, we consider the question of who ends up paying these costs.

Methods

Each guideline within Minnesota's forest management guidebook (Minnesota Forest Resources Council 1999) was assessed to determine its probable operational and cost impacts. Many of the guidelines result in similar types of changes to a harvesting operation. These changes were grouped into categories of effects and a review of the literature was conducted to summarize existing information. While most of the categories of effects result in increased costs, the last one identifies practices that may reduce costs. The specific categories of effects that were assessed are noted below.

- Increase in harvest planning

- Reduction in the volume harvested per unit of area
- Reduction in operating productivity
- Reduction in the available operating time
- Additional activities or cost factors
 - Erosion control
 - Stream crossings
 - Wet area crossings
 - Disposal of logging slash
 - Road closing or obliteration
- Practices that have the potential to reduce cost

Although the literature contains information about aerially-based cable yarding systems, that information was used sparingly in this summary because those systems are not currently operational in Minnesota. Instead, the summary focuses on studies of ground-based skidding and forwarding systems which are typical of mechanized logging operations in Minnesota. The limited number of studies reported below which did assess cable yarding systems are identified as being that type of system.

Using a literature review to calculate costs and benefits associated with implementing the guidelines is difficult and should only be viewed as a rough estimate. Each contractor is unique because of differences in factors such as equipment configuration, level of mechanization and capitalization, labor requirements, salaries and benefits paid, preferred species, and markets. Because of differences in landowner objectives and on-the-ground site conditions, each harvest area is unique and therefore requires different levels of guideline implementation. Therefore, this summary addresses specific practices and their probable economic effect without trying to derive an average dollar value for the average harvest area and logging contractor. That would be a major undertaking requiring more information than is currently available. Unless specified differently, all costs presented below have been projected from the year they were developed to year 2000 US dollars using an average annual rate of inflation of 3 percent.

Increase in Harvest Planning

Some level of planning is required prior to initiating a timber harvest. The main things that must be decided are where to build roads, where to put landings or decking areas, where to locate main skid trails, where to locate stream and wet area crossings and what type of crossing structure is needed at each location, and identifying resources and site conditions that may require special attention.

The guidelines recommend intensive planning as a way to minimize the site impacts associated with forest operations. This concept is frequently cited in the literature (Aldentun 1991, Jamieson 1996, Krag et al. 1991, McKee et al. 1985). Shaffer and Meade (1997) analyzed differences between loggers trained in harvest planning concepts and loggers that were not. They found that the trained group had a significantly higher mean rate of best management practices

(BMP) implementation, greater landowner satisfaction, and less weather-related downtime than the untrained group. This allowed the trained loggers to produce for an additional 7 days per year (Shaffer and Meade 1997). Blinn (2000) reported that contractors who had attended a water quality guideline education program were more likely to have increased their rate of guideline application. The cost associated with achieving the amount of pre-operational planning recommended in the BMP guidelines for Virginia was estimated by Shaffer et al. (1998) to be \$3.36 per harvested acre.

Reduction in the Volume Harvested per Unit of Area

Many guideline recommendations affect the amount of area available for harvest or the intensity of the harvest (trees harvested per acre). These include the retention of trees to protect cultural resources, retaining leave trees and travel corridors for wildlife, retaining forest cover in riparian management zones, limiting apparent harvest size by leaving patches for visual considerations, and providing coarse woody debris across the harvest area. Most of the literature which has addressed this factor has compared harvesting cost and productivity of clearcutting operations to other silvicultural prescriptions which leave varying levels of residual standing timber. All of those studies report decreased productivity and increased operating costs when harvesting in stands where there is residual standing timber.

Between 0.2 and 8.5 percent of the total merchantable wood was retained for structural features (i.e., leave trees, snags, and coarse woody debris) within seven timber sales on the Blue River Ranger District of the Willamette National Forest in Oregon (Weigand and Burditt 1992). For an average clear-cut with no retention trees, 50 - 60 thousand board feet (MBF) could be yarded per day with an aerial skyline system. When two or three trees per acre were retained, it was reported that production declined by as much as 15 MBF per day. The study reported that while purchasers state their aversion to sales having retention management, their dislike does not seem strong enough to change bidding behavior. Concerns about timber scarcity were cited as being the principal factor in overcoming the aversion to sales with leave tree, snag, and coarse woody debris retention.

Kluender et al. (1992) reported that felling and skidding productivity was highest for clearcutting (100 percent removal), intermediate for shelterwood (73 percent removal), and lowest for single-tree selection (31 percent removal). As compared to clearcutting, felling productivity decreased by 8.9 percent and grapple skidder productivity by 14.8 percent under the shelterwood system. Felling productivity decreased by 13.3 percent and grapple skidder productivity by 27.2 percent under the single-tree selection system as compared to clearcutting. Felling and skidding costs increased as the amount of residual timber increased. As compared to clearcutting, felling costs were 9.9 percent higher for the shelterwood system and 15.8 percent higher for the single-tree system; grapple skidding costs were 13.6 percent higher for the shelterwood system and 32.8 percent higher for the single-tree system.

Brummel (1993) and Shaffer et al. (1993) reported that group selection (patch sizes less than 2 acres) in hardwood stands in Virginia decreased productivity while increasing costs as compared to clearcutting. As compared to clearcutting, productivity under group selection decreased by 16.5 percent for a feller-buncher and skidder system and by 25 percent for a chain saw fell and skidder system. Mississippi loggers stated that their average cost of clearcutting increased 47 percent from \$9.72 per ton from the stump to a truck to \$14.33 for thinning operations (Ray et al. 1994). Total planning and logging cost for two-story and group-selection (½-acre openings) increased 16.4 percent and 2.4 percent, respectively, over clearcutting in 100- to 125-year-old second-growth Douglas-fir stands in Oregon. Estimated harvest costs in Montana for alternative silvicultural systems that favor retention of some large trees in clearcuts and group selection openings ranged from 2.3 percent to 19.3 percent higher than average logging costs for clear-cut prescriptions (Keegan et al. 1995). Group selection can also increase road building and road maintenance costs as well as administrative costs (Brummel 1993, Gingras 1997).

Some studies have reported that the removal intensity and tree size do not impact harvesting cost and profitability. Kluender and Stokes (1999) report that while the intensity of removal is an important consideration in stands with low average stem diameters, such as in a first thinning, the intensity of removal is not very important in later thinnings. Keegan et al. (1995) suggested that logging costs associated with alternative silvicultural prescriptions were a minor factor in determining the feasibility of timber harvests.

Reduction in Operating Productivity

Many guidelines have the potential to reduce the productivity of a harvesting operation by limiting machine travel or increasing average skidding distances. These include recommendations to limit the location and amount of skid trails, direct trafficking in wetlands and near water, minimize the amount of road construction, minimize the number of landings, or screen roads and landings for aesthetic reasons. These factors tend to increase skidding distances which will directly correspond with an increase in skidding cost. The lower productivity associated with longer skid distances may further affect system economics by changing the productive balance of other phases of the on-site operations.

When addressing the economics of skidding, the cost of building and maintaining forest roads must also be factored in as the two are intrinsically tied through a direct spatial relationship (Larsson and Rydstern 1968). If it assumed that there will be fewer roads under the guidelines, skidding costs will go up. However, road building and maintenance costs should go down to a degree that approximates the added cost of skidding. The result should be only minor variations in overall cost (Larsson and Rydstern 1968). This might explain why no references could be found in the literature addressing added skidding costs relative to changes in road location when following forest management guidelines.

Lickwar et al. (1992) acknowledged that road location would likely change to keep roads away from water features and estimated a cost of \$1750 per mile to relocate roads in Georgia,

Alabama, and Florida. No attendant changes to skidding costs were assumed. Shaffer et al. (1998) also estimated the cost associated with relocating roads to satisfy the guidelines in Virginia. Their median cost estimate was about \$850 per mile, which represented the additional cost of locating and constructing haul roads to BMP specifications. No mention was made of resulting changes in skidding costs. The economic effect associated with limiting machine travel in the riparian management zone (along with the cost of flagging the boundary of the zone and the cost of marking trees) was estimated by Shaffer et al. (1998) to be about \$80 per riparian management zone. Smidt (2000) noted a 10 percent increase in maximum skid distance to use an acceptable stream crossing point. As a result, skidding costs increased 1.47 percent.

Reduction in the Available Operating Time

Several guidelines recommend delaying harvesting activities to protect soils or wetlands or to minimize disruption to recreational users in sensitive areas. This can limit the time available for operating, including the season of operation. Where winter provides frozen soil conditions, forest managers may decrease the number of summer sales because of concerns associated with soil compaction and rutting. While the manager's concerns may be valid, there are major financial impacts to the contractor which are not considered (e.g., unemployment costs, retention of employees, equipment costs, ability to work throughout most of the year).

Contractors typically have large sums of money tied up in equipment and need to maintain steady cash flows to pay back their equipment loans and to retain labor. Funds to pay back those loans are only generated when the equipment is operating. Limiting the time available for operating can cause serious economic hardship for contractors. The magnitude of this effect will depend on many factors, including site and stand conditions, weather conditions, the equipment being used, the availability of operable sites for the equipment, and what operators normally did prior to the guidelines. No information could be found in the literature relative to the economic effect this might have on harvesting contractors. Good planning as recommended in the guidelines can increase the time available for operating (Shaffer and Meade 1997).

Additional Activities or Cost Factors

Many guidelines are recommended to mitigate operational impacts. These include erosion control measures (such as mulching, seeding, fertilizing, armoring, diversion ditches, water bars, silt fencing, straw bales, etc.), stream crossings, wet area crossings, disposing of debris in visually sensitive areas, and closing and/or obliterating access roads to protect sensitive areas. The additional costs associated with conducting those activities are described below.

Erosion control

There are many different practices and materials used to stabilize exposed soils after forest operations. Mulching with slash, straw, bark, wood chips, sawdust, or other mulch materials helps to protect the soil from the energy of the wind and water, slowing the process of erosion. Mulch also helps retain soil water to improve the regeneration that will hold the soil particles together

more permanently. Many manufactured mulches come in mats called erosion blankets. The cost of mulching in the southeast was estimated by Lickwar et al. (1992) to be about \$75 per ton of mulch with an application rate of about 2 tons per acre of disturbed soil. Many manufactured mulches come in mats (often called erosion blankets) with the mulch held together with some type of netting material. One of these blankets consisting of coconut fiber and three layers of UV-stabilized polypropylene netting cost about \$100 for a roll that is 6.5 feet wide and about 55 feet long (Gillies 1999).

Seeding is a common practice along with mulching to revegetate the site as quickly as possible with the preferred plant mix, normally native species. Veverka (1998) reports an average seed cost for native grasses in California of \$6 to \$13 per lb with an application rate of 20 lbs per acre required to get good cover. Haney (1998) reports seed costs for east Texas of from \$0.50 to \$4.25 per lb with application rates from 4 to 30 lbs per acre, depending on the seed type. In the southeast, Lickwar et al. (1992) report a seed cost of \$1.50 per lb with an application rate of 30 lbs per acre. Sage and Tierson (1975) estimate the cost of seed to be about \$34 per acre with a spreading cost of about \$17 per acre. Huyler and LeDoux (1995) report a landing and skid trail seeding costs of \$14.80 and \$6.91 per acre, respectively. Shaffer et al. (1998) report a seeding and mulching cost of \$285 per landing. Woodman and Cabbage (1994) report a cost of \$657 per mile for roads and landing stabilization through seeding.

Some erosion blankets already contain seed, alleviating the added cost of applying seed. Depending on site conditions, fertilizing along with seeding and mulching can improve seeding establishment. It has been shown to improve vigor the first year of application, but the effect was short-lived (Maynard and Hill 1992). If used, fertilizer costs about \$270 per ton with an application rate of about 800 lb per acre (Haney 1998, Lickwar et al. 1992). Haney (1998) also reports a spreading cost of \$40 per acre for seed and fertilizer. Smidt (2000) reports the cost of seeding, fertilizing, and mulching to be \$4.50 per acre.

Other stabilization measures that are sometimes used in areas where revegetation is not desirable or is not expected to be effective include netting, gravel, rock rip rap, and retaining walls. The cost of these measures is quite variable and not well-reported in the literature. Some are quite expensive and the cost would not normally be expected to be borne by the harvesting contractor.

Water bars and broad-based dips are used to remove water from the surface of roads and heavily used trails in sloped terrain. They work by stopping the downhill movement of water and releasing it into vegetated areas where soils are not very erosive. The difference between water bars and broad-based dips is essentially the length of the structure and the depth and height of the berm created. Broad-based dips are designed to drain water off of the road while allowing continued active use of the road by vehicles. Water bars are normally used after the road has been closed and will not be used again for some time. The number of water bars or broad-based dips that would be installed varies by the length and amount of slope present. Individual state guidelines contain information about the spacing of water bars and broad-based dips.

The cost to install a single water bar in Texas was estimated to be about \$8.30 (Haney 1998). In Virginia, Shaffer et al. (1998) estimate the cost of a water bar to be about \$16 and a broad-based dip to be about \$26.50. Lickwar et al. (1992) estimated the cost of a water bar in the southeast to be about \$30 and the cost of a broad-based dip to be about \$60. Smidt (2000) estimated that it cost \$8 to install a water bar. In Vermont, the estimated cost of a water bar was about \$17.39 (Huyler and LeDoux 1995). In Georgia, Woodman and Cabbage (1994) report that water bar installation costs \$26.27 on retired forest roads and \$17.91 on retired skid trails and that broad-based dips cost \$29.85.

Lead-off ditches serve a very similar purpose as water bars and broad-based dips except that they begin on the side of the road and direct water away from the road prism and streams. Shaffer et al. (1998) estimate the cost of a lead-off ditch to be about \$10.50. Haney (1998) estimated the combined cost of an individual water bar and lead-off ditch installation to be \$12.50. The total number of ditches needed will depend on site characteristics. Hornbeck et al. (1986) recommend a diversion ditch and water bar spacing of 300 meters divided by the percent of grade.

Silt fencing and straw bales are often used to filter runoff before it reaches water courses. Ploetz (1998) reports that silt fencing is one third to one half as expensive as hay bales for the same length covered.

Stream crossings

Crossing streams with roads and skid trails is probably the largest single source of sediment introduced to streams during forest operations (Rothwell 1983). Therefore, improving the way this is done can result in major reductions in stream sedimentation. The main methods used to cross streams are fords, culverts, and bridges. The method selected often depends on the size of the stream, the type of stream (e.g., protected stream vs. not protected), and how often it needs to be crossed relative to the cost of the method. Fords are the cheapest option with culverts a close second and bridges the most expensive (Taylor et al. 1999b). Sedimentation of the stream, on the other hand, is greatest with fords, then culverts, and nearly non-existent with a well-designed and installed bridge (Taylor et al. 1999a).

The costs associated with using bridges for stream crossings is highly variable depending on the size of the bridge, the materials used to make the bridge, whether or not it is a commercial bridge and has been engineered, the length of time the bridge is used at any one site, and the number of times the bridge is reused. The cost of a log stringer bridge built in about four hours with on-site materials and equipment will be minimal (Hancock 1987). Grabinski (1993) reported that the cost of constructing and installing a log stringer bridge that could hold up to 118,000 lbs was \$8000. The cost per installation would depend on how many times the bridge was reused. Bates (1995) reports that a small sawn stringer bridge in two panels can be purchased for \$1850. Kittredge and Woodall (1997) report on the design of a small sawn stringer bridge in two panels that costs less than \$2000. Taylor et al. (1999a) reports on two engineered glulam timber bridges, one for skidders that costs \$8,200 and one for truck traffic that costs \$15,300. Taylor (1994) also

makes a comparison between the cost per installation of a 30-foot long glulam bridge if it was used 10 times (\$3000), two 72-inch diameter culverts (\$5200), three 36 inch diameter culverts (\$2900), and an armored ford using GeoWeb and gravel (\$8300). On a cost per use basis, the timber bridge was very competitive. Engineered steel bridges are also available in varying sizes and costs. Zawacki (1991) reports on a 30,000 lb capacity steel bridge that costs about \$11,500. Smidt (2000) reported that the cost to use a portable skidder bridge at one site was \$792. Blinn et al. (1998) discuss various bridge options, along with their construction and installation requirements and costs.

Lickwar et al. (1992) calculate the cost of a single culvert installation in the southeast as \$620 plus the cost of the pipe. Pipe costs vary from \$8 per foot for 18-inch diameter pipe to \$21 per foot for 48-inch diameter pipe. If needed, gravel for the installation costs about \$22 per ton. In contrast, Haney (1998) calculated the installation cost for a culvert to be about \$250 in east Texas. Pipe costs, however, were more expensive, ranging from \$9 per foot for 18-inch diameter pipe to about \$26 per foot for 48-inch pipe (Haney 1998). Gravel in east Texas cost about \$34.50 per ton (Haney 1998). Huyler and LeDoux (1995) reported that culvert installation in Vermont cost \$290. Shaffer et al. (1998) found much cheaper costs in Virginia for the various stream crossing methods. The median cost for a ford was estimated to be about \$160, a culvert about \$210, and a temporary bridge about \$780. Woodman and Cabbage (1994) report that in Georgia, each culvert installation costs \$955 in the Lower Coastal Plain, \$1015 in the Upper Coastal Plain and Piedmont, and \$1194 in the Mountain region.

Wet area crossings

Crossing wet areas with roads or skid trails is a source of soil impacts. These impacts can be lessened or negated with the use of corduroy or other crossing structures such as wood mats, expanded metal grating, plastic pipe mats, tire mats, slash, or wood aggregate (Blinn et al. 1998). Using a geotextile below any of the options enhances its flotation. A 12.5-foot by 360-foot roll of non-woven geotextile costs about \$400 (Blinn et al. 1998).

Corduroy is commonly constructed using on-site materials. Wood mats come in a variety of designs that can be laid down across the area of soft soil and allow crossing. Costs for an 8-foot by 16-foot section run from about \$250 for a mat constructed on-site to about \$400 for a commercial pallet (Blinn et al. 1998). Hislop (1996) also calculated costs of \$370 to \$660 (including installation and removal) for different wood mats. Expanded metal grating can also be used to cross soft soils. Individual 4-foot by 8-foot grates cost about \$110 (Blinn et al. 1998).

Plastic pipe mats constructed from polyvinyl chloride (PVC) or high density polyethylene (HDPE) pipes can be used to cross soft soils (Moll 1996a). The cost for a 4-foot by 12-foot pipe mat is about \$210 (Blinn et al. 1998). Tire mats are heavy rubber mats made from the sidewalls and treads of used truck tires. The mats are available in many sizes and cost ranges from about \$150 to \$300 for mats about 9-foot wide by 30-foot long (MacGregor and Provencher 1993). Slash and wood aggregate can also be used to protect soft ground from trafficking. Chips or hog fuel are a frequently used wood aggregate due to their availability for some forest operations. The

cost of these treatments is normally minimal when available.

Equipment modifications that reduce ground pressure can also be used to cross soft soils without causing excessive impacts (Blinn et al. 1998). These include equipment with tracks, dual tires, wide tires, bogies, tire tracks, central tire inflation, or that is lightweight. The initial cost of these options varies considerably, but will normally be relatively high (Blinn et al. 1998). However, if calculated on the basis of volume produced while in use and contrasted against possible cost savings from extending the operating season, the cost for these options could be quite low.

Disposal of logging slash

Disposing of logging slash for the purpose of reducing visual impacts is recommended in the guidelines, especially in areas classified as most sensitive. If slash disposal as a planned site preparation operation is performed by the harvesting contractor, the slash is normally dragged back to the cut area using the grapple on the skidder. Desrochers (1999) found that this operation consumed about 3 percent of the productive time for the skidder, amounting to about \$120 per acre (assuming US\$1 = CAN\$1.60).

Road closure or obliteration

Road closure and/or obliteration are recommended in some cases to satisfy the wishes of the landowner(s), to maintain site productivity, or to protect endangered, threatened, and special concern species, sensitive communities, cultural resources, or water features. Access control can be as easy and inexpensive as a pile of dirt or rock constructed by on-site equipment as they are leaving the site. This option normally costs between \$50 and \$500 (Moll 1996b). It can also be as elaborate as a large, metal gate costing from \$500 to \$5000 (Moll 1996b). The cost of a gate is normally borne directly by the landowner.

Obliterating a road consists of recontouring the area to the previous land form, removing drainage structures, reshaping channel crossings, and revegetating with native species (Moll et al. 1996). Costs for obliterating forest roads are about \$3600 to \$9000 per mile (Moll 1996b).

Practices that have the Potential to Reduce Cost

The high degree of planning recommended in the guidelines has the potential to reduce cost for the harvesting contractor in a number of ways that have not been quantified within the literature. Good road, landing, and skid trail location can increase productivity, extend the operating season, and reduce road, landing, and skid trail maintenance and repair requirements (Blinn 2000). Minimizing the area occupied by roads, landings, and skid trails will also minimize the cost associated with their construction and maintenance. However, the associated increase in skidding costs will likely all but balance these reductions (Larsson and Rydstern 1968).

Blinn (2000) summarized information from a study of Minnesota logging contractors which assessed the extent to which water quality guidelines had changed their practices after the

program was initiated in 1990. Across the 40 practices included within the study, an average of 41 percent of the respondents indicated there had been “no change” in their application of the water quality guidelines from 1990 through 1994. For the 14 guidelines where “no change” in application rate was the most frequently selected option, those guidelines may have been providing some gain (financial or otherwise) to the logging contractor prior to the program’s introduction in 1990. Examples of some of the guidelines where the “no change” response was most frequently selected include “Minimize the total road mileage required to meet the landowner’s objectives,” “Cross streams at right angles,” and “Stabilize temporary road surface during sale activity.”

Leaving unmerchantable wildlife trees, shade trees, and snags which previously had to be removed is another area of potential cost savings. Although these trees can sometimes be dangerous, they can also be costly to remove. The economic benefits associated with leaving them has not been addressed to our knowledge in the literature.

Overall Guideline Implementation Costs

The literature contains several articles which indicate that the application of forest management guidelines adds costs to operation. The focus of those studies was on protecting water quality. While the studies generally include the value of residual timber within the riparian management zones as a cost or value foregone, the summary information presented below does not include those costs as they are generally borne by the landowner and not the logging contractor.

In a study of harvesting operations on National Forests in the Midwest, Ellefson and Miles (1985) found net revenue reductions for timber harvesting contractors of 1.2 percent for redesigning landing and skid trail locations, 5 percent for culverts, 7.3 percent for water bars, 9.7 percent for broad-based dips, and 15.9 percent for seeding and fertilizing. Requiring all four practices led to an average increase in harvesting cost of 4.2 percent, with an associated decrease in net revenue of nearly 38 percent (Ellefson and Miles 1984, 1985). In a similar study of a single timber sale on slopes of 30 - 60 percent in southeastern Minnesota, Ellefson and Weible (1980) estimated the marginal cost of redesigning skid trail locations and the seeding of landings to be about \$10.96 per acre, resulting in a net revenue reduction of about 52 percent. Huyler and LeDoux estimated that the application of water diversions on skid trails with an average slope of 15 percent, installation of a culvert, and seeding of a landing and the skid trails increased the cost of a rubber-tired skidder operation by 9.8 percent.

In the southeast, Lickwar et al. (1992) estimated an overall BMP cost of about \$17.70 per acre (\$3.33 per MBF and 2.78 percent of gross revenue) where the current BMPs were followed and \$29.77 per acre (\$5.60 per MBF and 4.68 percent of gross revenue) for stricter protection. The stricter standards required more extensive revegetation of sites and more extensive application of other erosion control measures. Across the 22 sites, the most expensive BMPs were usually 1) installation of broad-based dips, 2) installation of water bars, and 3) application of seed,

fertilizer, and mulch. In Kentucky, Smidt (2000) estimated an overall cost of \$41.83 per acre (\$21.23 per MBF and 10.67 percent of gross harvest revenue) to establish an appropriate stream crossing and to close the sale after building water bars and seeding, fertilizing, and mulching exposed areas. In Texas, Haney (1998) estimated that the current BMPs cost about \$105 per acre (\$21.78 per MBF and 9.95 percent of the gross harvest revenue). Shaffer et al. (1998) estimated costs for the Virginia coastal plain, Piedmont, and mountains of \$8.60, \$27.30, and \$31.05 per acre, respectively. Statewide, the cost was \$20.05 per acre. The per acre costs increased as the size of the timber sale decreased.

In Georgia, Cabbage and Lickwar (1991) estimated costs for current BMPs to be about \$28.35 per acre (\$4.57 per MBF and 4.2 percent of gross harvest value) and about \$32.65 per acre (\$5.25 per MBF and 4.8 percent of gross harvest value) for stricter protection across 10 sites. The most expensive BMPs were 1) seed, fertilizer, and mulch application, 2) installation of broad-based dips, and 3) installation of water bars. In another study in Georgia, Woodman and Cabbage (1994) estimate average BMP costs for forest industry to be about \$29.44 per acre (\$1.33 per cord). Costs for nonindustrial private holdings were higher at about \$50.23 per acre (\$2.24 per cord) because it was reported that they own and harvest more forestland with inherently higher BMP costs than industry. BMPs related to stabilizing roads, skid trails, and landings were reported to be the largest cost element for both landowner groups. In California, Gasser (1985) estimated direct logging cost increases from forest regulation to be about \$31.20 per MBF harvested.

Similar increased cost effects have been noted in British Columbia. In one study, overall operating costs increased by 32 percent (Thibodeau 1994, 1995). In another study, delivered cost increased by \$3 per cord (Patterson 1997).

Assuming that guideline application costs would be passed on to landowners in the form of lower bid prices for stumpage, Kittredge et al. (1999) compared more than 5 years of quarterly stumpage prices in Massachusetts and Connecticut. Massachusetts has comprehensive statewide forest cutting practices regulations whereas Connecticut does not. No difference in stumpage prices was detected between sales in the two states, casting doubt on the conventional wisdom that harvest practice regulations necessarily depress stumpage values (Kittredge et al. 1999) because loggers were unable to shift costs. Different results were obtained in two studies of bid prices for timber sales in the Northern and Intermountain regions of the National Forest System (Benson and Niccolucci 1985, Niccolucci and Schuster 1990). In the first study, Benson and Niccolucci (1985) estimate that logging cost allowances for nontimber resources were \$28 per MBF, along with a reduced bid price of \$12.50 per MBF, for a total cost of \$40.50 per MBF. In the second study, the statistical high bid for 224 timber sales was reduced by about \$33.45 per MBF for the Northern Region and about \$20.18 per MBF in the Intermountain Region (Niccolucci and Schuster 1990). The administrative cost associated with managing for nontimber resources during sale preparation and harvesting was not assessed. Gasser (1985) noted that logging contractors have successfully passed on to landowners most of the increased costs associated with implementing California's Forest Practice Act.

Summary and Conclusions

Many studies have documented additional costs associated with applying forest management guidelines. While most studies do not explicitly state that logging contractors bear those additional costs, this summary has focused on operational guidelines which are implemented by those contractors. Implementing those guidelines will increase a contractor's costs and reduce their profitability unless they are able to pass along those additional costs to another entity (i.e., the landowner or the consuming mill).

Most of the studies were conducted in the southeast or west and focused on guidelines which are designed to mitigate impacts to water quality. There is considerable variation in reported costs between some of the studies due to differences in factors such as site and stand conditions, equipment used, owning and operating costs of equipment, and standards to which the guidelines were applied. Therefore, the direct application of results to Minnesota may be limited. While several studies have considered some aspects of riparian zone management and soil productivity, there is little information which is pertinent to wildlife habitat or cultural resource guidelines. The impact of limiting the season of operation has not been assessed.

Because of the focus on water quality best management practices around the country, the literature reports that the most expensive guidelines are those related to stabilizing roads, skid trails, and landings, especially in areas where topography is not level. Those activities also were frequently rated during water quality BMP implementation monitoring in Minnesota (Phillips et al. 1994). Water bar installation is reported to cost between \$8 - \$30 per occurrence. Installation of a broad-based dip costs between \$26.50 - \$60. Seeding of roads, skid trails, and landings is reported to cost between \$2 - \$260 per acre. While no studies quantified the benefits, pre-activity planning can result in better locations for roads, skid trails, and landings which can reduce some operational costs.

Selective harvesting in areas with residual standing trees leads to decreased system productivity and increased costs as compared to clearcutting due to increased felling and skidding time. Felling and skidding productivity decreased by approximately 8 - 27 percent and costs increased by approximately 2 - 47 percent using selection harvesting approaches. Where clearcutting has been prescribed and contractors have an option, they should be conscious of the impact that working in leave tree clumps or riparian management zones will have on their productivity and system costs. As those areas tend to be relatively small on most sales, the overall impact on a logging contractor can be minimized during sale design by incorporating sufficient upland areas on the site where those guidelines would not be implemented.

Several studies reported that the application of water quality best management practices reduced gross harvest revenues by 2.78 - 10.67 percent. The application costs ranged from \$8.60 - \$105 per acre and \$1.33 - \$9.90 per cord (assuming that 1 MBF = 2.2 cords). Most of the reported values were in the range of \$20 - \$33 per acre and \$1.33 - \$2.55 per cord. Costs would be higher where additional practices (e.g., cultural resources, wildlife habitat) are implemented.

Some studies report that decreases in productivity and increases in logging costs associated with implementing additional guidelines were not strong enough to change bidding behavior on timber sales. Those studies noted that as concerns about stumpage availability continued or even grew, bidding behavior did not change significantly because logging firms need to acquire stumpage to stay in business. However, those results were more short-term in nature and hadn't studied long-term bidding trends. If development and retention of profitable and environmentally responsible logging businesses is a key component of forest sustainability, further consideration of the impact of forest management guidelines on a logging business is necessary.

Because logging businesses and site and stand conditions are so variable across Minnesota, it is not possible to present one value which represents the total additional cost of guideline application under all situations. To get a true picture of the costs to logging contractors associated with guideline implementation in Minnesota, very detailed on-the-ground study of individual sites and practices is necessary to quantify the marginal cost of implementing the most frequently occurring guidelines under a variety of circumstances. Results from the state's implementation monitoring program could be used to identify the guidelines which occur most frequently. Through the development of appropriate spreadsheet tools or regression models, contractors could predict site-specific guideline application costs for their equipment.

Objective 2: Who Pays for Applying Forest Management Guidelines?

In Objective 1, we asked whether there is agreement among researchers about the costs associated with all or parts of the Minnesota practice guideline suite. There appears to be no such agreement. The specific per-cord cost that has come to permeate the Minnesota debate was, as the author of the original report clearly noted, a crude estimate drawn from an informal survey of 21 loggers. We have no evidence that this number reasonably holds for any Minnesota logger in any real world harvest situation.

But hold this lack of evidence aside. What if there really are such timber harvest cost increases? Who, ultimately, pays for them? It's useful to restate the question: Is Minnesota's forest industry so structured that loggers are unable to pass cost increases either upward or downward in the production chain?

If the industry were perfectly competitive, in either a theoretical or legal sense, this question could be fairly straightforwardly answered. All costs would be shared among resource suppliers (landowners) and resource demanders (consumers), depending upon relative bargaining power. Of course, it is unlikely (although unproven) that the state's forest industry is perfectly competitive. So the question of cost shifting (we'll also call it cost imposition or cost transfer) has to be addressed indirectly through an examination of the industry's economic structure.

It turns out that most of the necessary information for such an analysis is lacking. We cannot answer the question as posed. We can, however, highlight some of the characteristics of non-competitive markets, anticipate how market players (owners, loggers, mills) might behave under such situations, and suggest ways that the state might augment its support of the industry by instituting ongoing monitoring of costs, prices, timber flows, and industry participants. Only with better forest industry economic data will the state ever be able to approach the question of cost transfer in anything but the most cursory fashion.

Approach

The core of the Minnesota forest practice guidelines policy debate is a concern/assertion that loggers will bear the additional costs of complying with the guidelines because they can't pass the cost on to the landowner as lower stumpage prices (if the logger is acting as an independent) or to the mills as higher delivery prices (whether or not the logger is under contract). The characterization of status quo is crucial to the guidelines compliance cost debate. If the guidelines are intended to stimulate harvest practices above and beyond those currently legal and considered sufficient, then the state has traditionally been comfortable paying for these changes. If, however, current practices are considered unfair, imposing costs on the rest of society, then the state has traditionally been comfortable requiring new practices, regardless of costs to private parties.

A further concern is that smaller independent loggers, who are said to have thinner margins (less profit per harvest unit) because of higher internal costs or inability to secure higher sales prices, will be especially threatened by higher harvest costs, to the point that they will be driven out of business.

Economists prefer to analyze cost transmission as a function of market structure (the number, size, and scope of participating firms) and market conduct (how these firms behave in markets, especially with respect to pricing and production decisions). In the report, we will not address questions of market performance (whether or not the results of market activity are good or bad). Presumably, the optimal condition is one in which increased costs are borne by consumers (in the case of environmental services increased over the status quo) or by the landowner (in the case of environmental services brought up to desired levels). Are there particular market conditions that, if evidenced, would permit us to infer that increased harvest costs are unlikely to be shifted from the loggers who incur them initially? We necessarily base our analysis on existing industry data only; no new data collection was possible, given project budget constraints.

Our efforts here constitute only an initial stab at the question of forest industry structure and performance. The paucity of data restricts us to only the most sweeping of pronouncements from our investigation. The best we can do is provide a starting point from which subsequent data gathering, analysis, and policy making might depart.

Markets and Market Structure

The central tenet of industrial organization analysis is that market behavior is shaped (at least in part) by market structure. The incidence of costs (who ends up pocketing the expense) depends on ability to pass on costs, which is in turn controlled by relative bargaining position, which is ultimately driven by constraints (including budget) on behavior. The arena within which structure is studied, the market, is a clearly delineated set of firms that compete to provide a clearly defined set of substitutable products.

Because of the wide range in forest industry structure throughout Minnesota, no single economic story is likely to be told about cost transfer. This is no different than in other industries characterized by heterogeneity in production or products, but it is made more difficult in this case because of the longstanding tradition of considering all these products and all forestlands as a homogenous single market—"The forest industry".

There is absolutely no consensus—none ever having been sought, as far as we can tell—about proper market delineation in Minnesota's forest industry. If there were, we could then describe the structure of each market by counting the number and size (product volume) of firms, number of distinguishable products, the number of output buyers and input sellers, interlinking ownership with each of the major (non-substitutable) timber products. From this, we would

proceed to a more detailed analysis of how product volumes move through the various processing stages, how prices are formed at each stage, etc.

Minnesota Forest Industry Structure

We could find no conventional structure-conduct-performance studies of the forest industry, in Minnesota or elsewhere. Indeed, our research has been severely hampered by a lack of industry data in detail sufficient to characterize its structure, let alone judge its performance. This may come as a surprise, given the extensive administrative infrastructure (county, state, and federal) that exist to aid and monitor forest management. There is indeed a wealth of data available for public timber sales, but there is hardly any for private sales. There is no census of forestry, for example, by which we might obtain information about, say, the number of loggers, or the flow of wood across state lines, or the number of both private and public sales, or a market-weighted average price for privately-sold timber of various grades in various regions.

So what do we know about the industry? The story can be told quickly: Each year, several hundred parcels are harvested by a few hundred loggers who then sell the wood to a few tens of mills. There simply aren't that many businesses in the Minnesota forest industry. (By way of comparison, Minnesota has eighty thousand farms, each of which is harvested each year by several tens of thousands of farmers who sell to a few tens of processors.)

The standard characterization of the industry, based not so much on economic analysis as on commonsense observation, is that the mere handful of buyers (mills) exercise market control over all prior processing stages. Such market power can arise through a combination of circumstances that, essentially, limit timber marketing choices. Loggers might lack choice about where they deliver wood because of high delivery costs or high search (transaction) costs. Even if they can sell into several markets, they might find difficulty because alternative buyers have locked up supply contracts in advance.

We briefly summarize here the existing market data, separated by the three principal stages of production: landowners, loggers, and mills. These data, we must stress, provide an insufficient basis by which to credibly delineate product markets or to assess firm behavior within those markets. We know who owns forest land, we know who (most of) the loggers are, and we know where and (roughly) how big the mills are. But we know very little about how these players are linked up. We cannot say with any precision who sells how much of what to whom for how much. Without such data, we are left to apply economic reasoning more than to extend empirical analysis.

Landowners

Minnesota has roughly 17 million acres of forest land, of which 14.7 million acres were judged to be timberland, of commercial quality, in 1990. Just over half of the timberland is in public hands: state 21 percent, county 17 percent, and federal 14 percent. Industry accounts for only 5 percent of this land base. The bulk of the remaining 40 percent is in the hands of small

private landowners (USDA, 1995). Landholdings and landowners differ by (among other features) the type of land/timber, its location, the stand size, the experience/information the owner brings to the table, and the bargaining flexibility (often, a function of short-run income constraints) the owner has.

Each year, an estimated 200,000 acres of Minnesota’s land is harvested. Half the total harvested acres is on private nonindustrial land, ten percent is on industry land, and the remainder is on public (federal, state, and county) lands (Puettmann et al., 1998). While there are thousands of individual landowners (the vast majority of who own small acreages), only some hundreds of harvests are scheduled each year. Small, private owners may contract for only one sale in their lifetimes, while some county, state, and federal agencies might arrange several sales each month.

Loggers

There exists no complete enumeration of Minnesota loggers. The Minnesota Logger Education Program, a professional organization primarily responsible for the diffusion of the new practices and techniques involved in logging, has 300 - 400 members. These are said to harvest about 80 percent of the wood in Minnesota. The majority reside in the northern part of the state (Table 2-1), but they may harvest timber 100 miles or more from their homes.

There may be as many as 1,000 other full and part-time loggers, predominately sole operators who process wood with limited equipment and capital investment. They range from people who cut on a part time basis to those trying to make a living as a logger but for one reason or another do not have any affiliation with the MLEP.

Table 2-1: Geographic Distribution of MLEP Members

Region	Percent
NC	30
NW	20
NE	43
SE	7

Source: Minnesota Forestry Association, 2000 and Minnesota Logger Education Program

In our discussions with industry participants, there was wide-ranging agreement that there have been substantial changes in the Minnesota forest industry recently, although their length and nature is not agreed upon. The shifting economics of logging is identified as the main factor in driving this process. Most observers felt that the era of small-scale operations is fading. Mechanization and the increased capital costs that naturally follow have driven up the price of being in the business. It is rare (the exception being in the southeastern part of the state) to find many chainsaw operations anymore. Instead, loggers have turned to more expensive equipment, for reasons of both economy and safety. The extent of mechanization can vary widely, depending upon the physical nature of the site, the desires of the landowner, and the demands of the ultimate buyer.

Opinions vary as to the benefits derived by loggers from this mechanization. For example, while mechanization may lead to increased gross revenues for loggers, the extra overhead may actually cut into profit. Mechanization may be necessary for business survival and yet not result in enhanced profitability over the long term.

Mills

A recent statewide directory (Minnesota Department of Natural Resources, 1999) lists six major paper mills, three recycled paper mills, three hardwood specialty mills, and six oriented strand board plants. (Another six mills in Wisconsin purchase some wood from Minnesota.) While there are some 400-500 sawmills, only twenty three have capacities above 3000 MBF. Paper (34 percent), oriented strand board (32 percent), and lumber (15 percent) are the two largest end products. Only 7percent is exported in unfinished form.

Timber moves throughout the state depending on type and need. Mills try to ensure that transport distance is minimized. However, some observers stated that the average distance has been increasing, perhaps due to a natural ebb and flow of available timber to harvest, or to an overall reduction in the amount of land available for harvest each year because of reductions in harvest from public forests, or to a conscious procurement policy on the part of the mills.

Market Behavior

The form of contracts and the structure of auctions can greatly influence, and be influenced by, relative bargaining positions. In turn, this can affect who bears any guidelines compliance costs.

Contracts

When the traditional forest industry contract model which accounts for perhaps half of total statewide procurement, a logger first contracts with a landowner for harvest, at a stated stumpage price. Once harvested, the wood is (if only temporarily) under the logger's ownership. Then the logger (now also a wood owner) contracts with a mill at a stated delivery price, at which time the mill takes over ownership.

This ownership model is said to be shifting to a new type. Here, the mill itself secures the right to make the harvest and then subcontracts the work out to loggers. The logger is responsible only for harvest and delivery (usually by a specific date) to the mill. The mill owns no equipment and (usually) no trucks, and the logger never has even temporary title to the wood.

In another variant, also said to be gaining force, a mill first contracts with a logger for delivery of a stated volume of wood, at a stated price. Only then does the logger contract with landowners for harvest, either through cruised stumpage or scale-based contracts. Under these terms, the logger knows the delivery price prior to knowing harvest costs (until contracts are signed with owners).

We have no consistent data on the specifics of any of these arrangements. We don't know how flexible the terms are or who bears the risks of changes in the economic, physical, or institutional environments. Such data would help us assess the relative bargaining position of each party, which would in turn help us estimate who ends up paying for guideline compliance.

Bidding

Stumpage prices are set by private negotiation or at public auction. In general, among public landowners, the Forest Service uses sealed bids, the MDNR uses oral auctions, and the counties a mixture. Smaller private owners (the only large private owners are forest product corporations, which generally hire loggers as contract employees and so are able to internalize all prices) are said to rarely go to auction. This is not surprising, since such sales are likely to be rare in the lifetime of any single owner. Auctions take time and money to run, and smaller owners may decide that auctions are not worth the trouble.

In a similar fashion, smaller loggers who take intermediate ownership of the harvested timber (the first model discussed above) can sell to the mill either by direct contract, through auction, or by taking whatever the mill offers upon delivery. There appears to be few logger-to-mill auctions in Minnesota, the loggers evidently preferring the certainty of an advance sale or the low transaction cost of always delivering to the same mill.

Pricing

The price paid to landowners is determined by two methods: one based on the estimate of what will be cut (stumpage) or one based on actual harvest (delivered or scale price). The first method involves a professional forester evaluating and appraising the value of standing timber that will be harvested. The logger and the landowner (or timber rights owner) then agree on a price based on quantity (by species) that will be cut. The second method is to set no firm quantities prior to harvest but to agree on a price for what is eventually delivered. These two pricing arrangements can obviously have substantial different effects on the ultimate question of who bears any extra costs from guideline compliance.

We have good stumpage price data for public sales, published each year by the Minnesota Department of Natural Resources (Table 2-2). On average, these prices have risen considerably over the past few decades, exceeding inflation indexes (Table 2-3).

Use of these reported average prices may lead to the wrong inferences about prices in private sales. Because private sales are said to be less structured and to involve considerable lack of information, particularly among landowners, we might expect there to be even more departure from competitive market behaviors. Actual prices for private sales might be expected to vary more widely about their mean, and the mean itself can probably not be expected to be consistent with that from public sales.

Table 2-2: 1999 Minnesota Stumpage Prices: All Public Agencies, Major Species

Sawtimber	Volume (MBF)	Average Price (\$/MBF)
Aspen	62,237	\$86
Jack Pine	14,600	124
<u>Red/White Pine</u>	<u>15,821</u>	<u>199</u>
All Species	121,941	101
Pulpwood	Volume (cords)	Average Price (\$/cord)
Aspen	684,398	\$23
Birch	83,335	8
Balsam Fur	71,452	12
Black Spruce	83,702	21
<u>Jack Pine</u>	<u>72,535</u>	<u>24</u>
All Species	1,122,433	20
Fuelwood	Volume (cords)	Average Price (\$/cord)
All Species	17,631	\$6

Source: MDNR, 2000

Table 2-3: Minnesota Stumpage Price Index (1992=100)

Year	Index
86	46.0
87	47.3
88	51.7
89	63.7
90	80.9
91	86.2
92	100.0
93	118.9
94	180.6
95	212.2
96	194.9
97	217.9
98	241.3
99	249.4

Source: MDNR, 2000

Owners' reaction to cost increases

If complying with practice guidelines imposes costs on some lands, these lands will be shifted downward in the market's priority harvest list. Other, now relatively cheaper, lands will take their place. But even the higher-cost lands will be harvested, eventually, so long as their total harvest costs don't exceed the expected sales price (net of delivery cost). A stylized example shows the extent of the loss attributed to guidelines compliance. (This and subsequent analysis assumes that landowners, loggers, and mills make decisions strictly on the basis of net financial position. All other considerations are left out for purposes of clarity.)

In a world without guidelines, the owner would be paid stumpage price P . Complying with the guidelines costs G , and some other income-producing use of the land results in a profit of S . Without guidelines, $G = 0$ and $P > S$, so the owner decides to harvest the land.

If the logger is able to shift the added costs of following new practice guidelines to the owner, the reduced stumpage price will reflect the added cost. If the new price $P - G < S$, the owner will choose not to harvest and will instead exercise the other use option and make S . In that case, the loss to the owner is not the cost of the guideline, but rather the foregone income $P - S$. So if we observe that an owner decides not to harvest, if guidelines apply, we can infer that the unobserved cost of compliance, G , is greater than the owner's loss, $P - S$. If, on the other hand, we observe the owner going ahead and harvesting anyway, we can infer that the owner's loss from the guidelines is G .

It is clear from this that a landowner who has "close" income-generating alternatives will be more likely to cancel harvest, and bear cost $P - S$, rather than bear the cost of guidelines compliance. Conversely, an owner without close options (or an owner unfamiliar with making these kind of decisions) will be more likely to harvest and, as a result, bear the full cost of the practice. This holds true no matter what the source of the increased cost—whether it be more intensive equipment use, less wood harvested per acre, or higher management expenditures.

Logger's reaction to cost increases

Complying with voluntary price guidelines may change the timing of harvest on particular parcels (because some parcels will be affected more by guidelines than will others), but the changes will have no effect on who does the logging unless loggers differ by ability to actually comply with new guidelines or by capacity to bear any increased costs that cannot be passed on.

Consider a logger who previously would have paid stumpage price P_0 to gain access to a stand of timber that is now subject to the guidelines. For technical/engineering reasons, it now costs the logger ($C + G$) to cut the same amount of wood that would have been cut prior to the guidelines at cost C .

Why not pay the landowner new stumpage price $P_1 = P_0 - G$? This transfer would stick, that is the owner would still decide to harvest and bear the cost G , if $P - G > S$, as discussed above. But the owner might instead use the land for some other purpose, and earn S , or choose to hold the timber off the market until a higher future offer (appropriately time-discounted) emerges so that $P_F > P_1$. Or the landowner might sell to some other logger at a higher stumpage rate $P_2 > P_1$. In the latter two cases, the guidelines compliance cost is not shifted. Our logger would not gain access to that land.

Are either of these latter two actions likely? If the landowner expected timber prices to increase at a rate faster than whatever discount rate is used, then it would pay to wait things out, because the present value of future sales, P_F , exceeds P_0 , the present price. Timber prices, as we saw in Table 3, above, are increasing at such a rate that P_F will likely exceed P_0 at many reasonable discount rates. So why would we observe any landowners deciding to harvest? Why don't they all wait until they can get P_F ? Perhaps because each landowner has a different discount rate, a different cost of waiting. Someone who needs the money now, shown by a very high discount rate, will prudently harvest now. Other financially prudent landowners, with lower discount rates, are probably already holding their lands off the market in the expectation of higher future prices.

Why might some other logger be able to bid a higher stumpage price, P_2 ? Perhaps this second logger has a different cost structure, one characterized by a lower cost per unit harvested $C_2 < C$. This logger can offer more money to the owner, and still make money: $P_2 - (C_2 + G) > 0$.

It could also be the case that the second logger does not follow the practice guideline in the first place, it being voluntary with no penalty for noncompliance, so a higher stumpage price can be offered because there is no compliance cost increase.

A third possibility is that the second logger has no viable alternative enterprises in which to employ own capital and labor. This logger may be willing to even take a loss, $P_2 - (C_2 + G) < 0$, (at least in the short run) in order to secure the contract and thereby stay in the business at least a little while longer. In conventional economic theory, costs include financial profit, a return on capital that could be otherwise invested, and returns to own labor. So our profit squeezing second logger might cut first into own wages, then into financial profit, then into personal wealth (savings and capital). As long as this logger's returns cover at least average costs, this strategy is financially prudent in the short run, although it spells long time financial ruin.

Inferences from Observation

All we really ever see (or can potentially see, given suitable investment in information) in a timber market is the product type/grade, product volume, product price, sale location, and buyer location. Everything else we wish to know about the functioning of the timber market we have to infer from these rudimentary data.

In a competitive market, properly defined by product substitutability within its boundaries, it is economic distance alone that differentiates wood from different lands. (“Distance” here is shorthand for harvest, delivery, and handling costs.) Costs should be inversely related to price. If we observe this, then we can infer that at least some competition exists in the market.

If observed differences in stumpage prices are strictly a function of geographic distance, then we can further infer either that there are no additional costs from guideline compliance cost or that such costs are being passed to the landowner or borne by the logger—but not shifted to the mill. We might conclude that loggers cannot transfer costs if we observe that:

- different loggers exhibit different cost structures for the same level of harvest on the same type of lands.
- some loggers do and some loggers don't follow the practice guidelines on similar environmentally sensitive lands.
- some loggers are recording negative economic profits consistently in their awarded contracts.
- environmentally sensitive lands, subject to the guidelines, are being held from harvest.

In a competitive market, too, we would expect there to be only one stumpage price across all harvests. Otherwise, loggers and/or mills would flock to the lower price products, leaving some landowners with no one to sell to. In the forest products industry, such a situation would show up as a single price for stumpage, once we adjust for product type/quality (or isolate on single product type/quality) and distance to the mill. However, McDill et al. found no such uniformity. Rather, they found timber prices to be relatively uniform across distance without adjusting for hauling costs.

McDill inferred from this that the mills were price discriminating (paying more to some sellers, presumably more distant sellers) in order to streamline delivery schedules. (This, if true, is similar to the government-run milks marketing orders, which administer prices so that all milk farmers are in effect at equal distance from the plant.) Mills are presumed to be able to price discriminate because they have market power, so loggers can't pass guidelines—induced costs upward to the mills—unless the mill is faced with a supply shortfall.

Applications of the Economic Story

Even though we lack detailed market structure data, we can still apply economic logic to contentions made about the dynamics of the Minnesota forest industry and about the implications of proposed policies. We choose four such "stories." The full list, of course, is endless. These, however, represent several strands of the ongoing debate.

Practice guidelines will lead to stumpage price increases

Some analysts assert that practice guidelines will not change the amount of land harvested but will change volume recovery per acre and so increase per acre harvest costs. This in turn would cause stumpage prices to increase. Under what market conditions might these events play out? One first must assume that the amount of land harvested is not price sensitive, that owners choose to harvest based on, perhaps, the age of the stand or on some non-price consideration. At the same time, one must assume that mill demand is not price sensitive either, that volume demands will not go down in the face of higher stumpage prices (if the mills see them) or that they will not pay more for wood in the face of reduced production volumes.

Why wouldn't lower harvest levels and higher harvest costs instead lead to lower, not higher, stumpage prices? Perhaps some loggers cannot carry the higher costs without lowering stumpage prices, while others can do so. This will lead to less business for those loggers who cannot make money at current stumpage prices. They will go out of business, leaving the industry to those who can—and do—operate at lower profit margins. If, further, the remaining firms do not expand their operations (because of capacity constraints) to take over all the harvests of the existing firms, even those that do not require application of the price guidelines, then there will be an overall reduction in the amount of wood harvested for market.

All the above is in the short run. In the longer run, in a competitive market, and in a properly defined market without close product substitutes, any shortfall in wood production will draw out of the mill an increase in the price paid which would lead to an increase in the stumpage rate. This will draw in a set of lands that were unprofitable to harvest under the previous lower prices. If the mill has possibilities for substitution, on the other hand, lands on which guidelines are applied will be even less desirable for production. On these, the stumpage price can be expected to go down.

Public agencies need to lower the reserve prices to keep the industry going

It is sometimes argued that public agency foresters should periodically reduce auction reserve prices (the minimum acceptable price) in order to "stimulate bidding." The underlying rationale here is that the original reserve price lies above the maximum that some or all loggers are willing or able to bid. By lowering it, more loggers will enter the auction.

Does this make economic sense? It depends on whether or not the agency is trying to cover its costs. A reserve price, if it is to meet the test of economics, should be set at a level that meets or exceeds the cost of growing the trees to a point where they are ready for market. This should cover administration, management, input, and opportunity costs. If it acts like any producer, the agency needs to at least cover its average costs in the short run and its presumably (higher) marginal costs in the long run.

Lowering the reserve cost, then, can lead to a non-sustainable long-run financial position for the agency. If this is done only occasionally, then profits from other sales (or taxes) could

cover these losses. In general, it makes sense to lower the reserve price if (1) it actually does lead to some logger getting a bid that would otherwise not be awarded; (2) if the new contract keeps that logger in business; (3) if the lost revenue (from the below-cost sale) is the most cost efficient way to keep the logger in business; and (4) if society wants to keep loggers in business.

The concern about too few bidders (the flip side of the desire to help keep more loggers in business) suggests that the agency worries that the outcome of a poorly attended auction, however conducted, will be sub-optimal because the bidders might collude. Lowering the reserve price helps in this situation only it entices so many new bidders that collusion is no longer possible. But if only a few bidders were likely to cover the original reserve price, the addition of higher cost bidders who have no chance of winning a bid may not be a sufficient to inhibit collusion among the “serious” bidders.

Mills use procurement zones to schedule product flows

It is widely known that mills sometimes use a zone pricing scheme, under which owners of timber farther away from the mill are paid a higher price to compensate for additional hauling costs. This is done to stagger harvests so that material flow is smoothed over time. Wood that is farther from the mill (in geographic distance) may be ready to harvest sooner than is closer wood, so its "economic distance" is closer. As stands are harvested, as road conditions change, as mill product mix changes, so does economic distance. So it makes sense to sometimes pay more for wood from remote locations. (This points out the problems of only looking at stumpage prices when we examine the industry—they're only a portion of the mill's procurement cost.)

Could a mill exhibit such behavior if it did not have market power? If there were competing mills, each trying to manage product flow over time, each would sometimes offer a premium for geographically distant wood, depending upon its own calculation of its own economic distances. The owner/logger of any given source of wood would face a range of price offers and will presumably sell to that mill which offered the highest price at that location. Out-bid mills would be adversely affected only if that source happened to be its priority (closest economically) source as well.

At other locations, the same bidding would take place, with the highest bidder taking the harvest. As long as there exist several possible wood sources, it could happen that no direct price confrontation occurs, that each mill is able to satisfy its own product demands by working down its individual ideal scheduling list. If, however, wood sources are few, relative to aggregate mill demand, then some source could at some point be at the top of the lists of two or more mills. Only then might we expect to see a competitive bidding up of the price. The bargaining position of the landowner/logger is improved vis à vis the mills. Each directly competing mill is willing to pay a premium, up to (but no more than) the difference between the economic distance costs of the stand and the next stand down that mill's list. A mill with no "close seconds" will be willing to pay a premium higher than a mill with good options. The winning bid when there is "real" competition of this sort, then, will be by the mill with fewer options, all else equal.

It is clearly in the mills' joint interest, that, each be faced with as many separate wood sources as possible, so as to minimize the situations in which direct competition is required to secure product. Extending this logic to situations in which loggers buy from the landowner and sell to the mill, mills would prefer that there be more loggers rather than fewer, so that head-to-head competition is minimized. (This, of course, will have to be balanced against the transaction costs of dealing with more, presumably smaller transactions rather than a few large transactions).

If there is little or no inter-mill competition, if a mill has substantial market power, it can set prices by procurement zones with impunity—within a range. Even a monopolist cannot set a price lower than the landowners' opportunity cost, else the stand will not be harvested at all.

Discounted stumpage prices won't help loggers

A variant of lowering the reserve price is for the agency to discount the stumpage price on lands requiring the new practice guidelines. The discount could be a payment to the loggers or a set reduction on the successful bid. A recent newspaper story reported that some loggers feel that this would not work, that the discounts would "quickly disappear since the auction price of timber would simply go up accordingly." (This is similar to arguments that most agricultural subsidies, even if paid directly to farmer tenants, ultimately go to the landowner, because annual rents rise with the subsidy.)

Loggers who could not compete without the discount might decide to go ahead and bid if the discount is to be paid to the winner. With no discount, the winning bidder would pay enough to cover increased harvest costs from guideline compliance. A discount means that this same bidder will simply make more profit. Previously unsuccessful bidders would indeed make of a profit—if they win the bid. But they will not win. They will still finish behind the previously successful bidder—unless the latter do not receive the discount for some reason of policy.

So a discount will do nothing to change the ordering of bids. The winning bid will be higher, of course, up to the amount of the discount, if that's what it takes the previously successful bidder on top. Nor will a discount change the fact that the money would eventually end up in the hands of the landowner unless the loggers could make more profit elsewhere, and so mount a credible threat that they might not bid at all. A discount will do nothing to alter the eventual orderings of bidders, although it may increase the number of bidders.

Policies to Compensate for Guidelines Compliance Costs

As we talked through these results with industry observers and participants, we frequently heard the argument that the state should just go ahead and reimburse loggers a flat amount for every cord/ton of wood they harvest. Embedded in this prescription is the "knowledge" that loggers cannot pass additional harvest costs either up or down the wood processing chain. We have discussed the conditions under which such cost sticking might occur, and we have argued

that there is essentially no empirical data that one could marshal to either support or refute its existence.

Lack of evidence notwithstanding, some assert that a reimbursement mechanism should simply be put in place while we await better data. If it is eventually proven that costs really do not stick with loggers, then we are only out a few years worth of subsidy. And if it is eventually proven that costs stick, then it is better that we act now, before even more loggers lose their jobs. So goes the argument.

Let's look briefly into how such a reimbursement program actually might work. Here we draw on the long history of subsidies to American farmers and on the sometimes perverse outcomes they have engendered. Several seemingly trivial questions need to be addressed if a logger subsidy program is to be considered both cost-effective and fair.

If the payment is to be considered a reimbursement for actual costs incurred, then some proof of extra cost may be required. But how? Do loggers have to show invoices, pay books, etc.? Should there be different amounts paid depending on the type of land harvested, so only wood from stands that require extra practices is eligible for the payment? That would require that the state monitor each sale/harvest so that lands are certified in some manner. Should payments only go to smaller loggers, those presumed to be less able to bear additional operations costs? What, then, is to be considered "small?"

Any payment will of course tend to favor that activity against which it is applied. So, for example, a payment only to small loggers will provide an incentive for loggers to restructure (split apart) their businesses to be able to meet the payment threshold. A payment only to wood from environmentally sensitive lands, if higher than actual additional costs, will provide an incentive to over-harvest sensitive lands. And a payment based on actual expenditures will favor the development of a second set of account books into which firms load eligible expenditures. None of these outcomes are cost effective or fair.

We suspect the state, for reasons of administrative practicality, would choose to recommend a flat per-ton payment made to all loggers, regardless of where they harvest or how they harvest. This will necessarily separate practice compliance from practice reimbursement. As a result, some loggers will receive money they do not need. Others will get less than their actual expenditures. But the lower administration and compliance costs of a flat rate payment scheme may be felt to be of sufficient import to outweigh these distribution concerns. (Minnesota's \$4/cropland acre payment to farmers in 1999 is a good example of a policy designed to not require much information and to be cheap to administer—at the cost of being very effective.)

The state might instead decide on a direct payment subsidy program to individuals who meet certain eligibility criteria. For example, the state could pay a fixed amount to any logger who gains certification by participating in some state or university management program. This way,

operations would not receive larger payments simply because they are larger, and administration costs are kept relatively low.

Or the state might focus public dollars on long run structural impediments to competition in the timber industry. Possible foci include full price and volume reporting, improved job relocation, more open auctions, subsidized equipment purchasing, mandated (not optional) practices, and a registry of certified loggers. The goal would be to increase competition by reducing non-priced variability and increasing occupational flexibility.

These policy prescriptions call to mind the striking similarity between the forest industry and the hog industry. In both there is an absence of publicly available price data, an increasing proportion of production controlled by vertically integrated firms, and a lack of consistent volume/quality information. To counter what it believes to be a structural imbalance in the hog industry, Congress has just mandated a public price reporting system for hog slaughter, with the intent of better informing producers about marketing opportunities and to disclose evidence of collusion among meat packers, if any. Could the same be done for forest products? Another example of policies designed to deal with problems of economic structure is in the canning crops (sweet corn and peas) industry, where farmers are permitted to join together to collectively bargain with vegetable processors. Could landowners and/or loggers use the same law (appropriately revised) to bargain with mills for better terms of trade?

Summary

Are voluntary guidelines compliance costs borne by the logger? We do not know. But we have shown that there are market structure conditions under which we might expect such cost sticking to occur. Briefly, the less competitive is the market, the more likely it is that loggers will bear compliance costs.

Are Minnesota forest product markets competitive? Again, we do not know. Based on the limited market evidence we have on hand, however, we can make the following provisional judgments:

1. It is unlikely that loggers would be able to pass compliance costs on to the mills in the form of higher delivered prices, because the mills have too much market power (by virtue of their large size and small numbers) and too many alternative wood sources both within and outside the state.
2. It is likely that loggers would be able to pass compliance costs on to landowners in the form of lower stumpage prices, however.
 - a) Small private landowners do not have many alternative income options from their lands. If they need money, they need to harvest. Production will gravitate to non-sensitive sites to the extent that owners of sensitive sites balk at lower stumpage prices
 - b) Large public landowners will accept lower stumpage prices on their environmentally sensitive lands without hesitation. To do otherwise would be an

implicit argument that the broader public benefits of guidelines compliance do not exceed the costs of compliance.

So, if we are pushed to pronouncement based on scattered data and on the economic reasoning followed in this portion of the report, we would conclude that guidelines compliance costs are likely to be borne ultimately by the landowner, not by the logger or the consumer.

Objective 3: Methods used to Encourage Voluntary Compliance with Timber Harvesting Practices in the United States and Canada

As states and provinces develop practices to mitigate impacts from forest management activities, they may use one or more techniques to encourage implementation of the practices on-the-ground. Some of the possible techniques include cost-share payments, technical assistance, grants, loans, and educational programming. To better understand the range and utility of the techniques, a survey was conducted of state and provincial forest land management organizations in the United States and Canada.

Methods

A mailed survey of key state and provincial forest land management organizations was conducted in 2000 to collect information related to methods used to encourage compliance with timber harvesting practices. Several individuals reviewed drafts of the survey and cover letter prior to mailing of the final questionnaire. The questionnaire was submitted to the Center for Survey Research at the University of Minnesota and reviewed by the Human Subjects Committee for approval before it was mailed. The final survey consisted of 13 questions as well as a cover page that asked for information about the respondent. The survey questions addressed factors such as the extent to which voluntary and regulatory approaches are used to implement timber harvesting guidelines within the state or province; the topical or issue areas addressed by those guidelines; the strategies that are used to encourage implementation of the guidelines by landowners, foresters, and loggers; the effectiveness of various strategies to encourage implementation; and an open-ended question to allow respondents to provide additional information about the application of timber harvesting guidelines.

The final cover letter (Attachment 3-1) and questionnaire (Attachment 3-2) were mailed to the 50 State Foresters in the United States as well as the department heads of provincial forest management organizations in Canada on February 11. While the cover letter was sent to those organizational administrators, it requested them to give the survey to appropriate staff within their organization to complete and return. On February 18, a post card (Attachment 3-3) was sent to everyone on the mailing list to either thank them for returning their completed questionnaire or to remind those who had not yet returned it. A second cover letter and copy of the survey were sent to non-respondents on March 13. Follow up phone calls were made to non-responding states beginning in May.

Information from the survey was summarized and key trends were highlighted. Individual comments that were submitted to provide additional detail about a respondent's answer to a particular question are listed below the corresponding summary information.

In addition to the mail survey, seven states (i.e., California, Florida, Indiana, Kansas, New York, Virginia, and Washington) were contacted via the telephone to obtain more detailed information about their incentive programs. Each of the selected states had a program that appeared different from the norm. When selecting states, an attempt was made to identify states in different areas of the United States. Each contacted state was asked the questions noted below. Information from those case studies is summarized by state.

1. What is the structure of the program and how does it work?
2. How much does the program cost annually?
3. How is the program funded?
4. Who implements the program?
5. Who is the program targeted at?
6. What is the effectiveness of this program?
7. Are there any drawbacks to this program?
8. Is there any legislation for the program?

Results

Forty-five (45) states and five (5) Canadian provinces responded to the survey. All of the responses were complete and could be used in the analysis. Despite repeated attempts, five states did not provide survey results. Survey respondents generally tended to be individuals with programmatic responsibility for overseeing development and implementation of best management practices and other forest management guidelines on state or provincial forest lands.

Of the 51 responses, 50 (98 percent) have timber harvesting guidelines for their state or province (Attachment 3-4, Question 1). Of the respondents, only the province of Prince Edward Island does not have timber harvesting guidelines.

Fifty-two (52) percent of the responding states and provinces have voluntary timber harvesting guidelines, 42 percent apply them within a regulatory framework, and 6 percent apply them using both voluntary and regulatory approaches (Attachment 3-4, Question 2). A state's or province's timber harvesting guidelines aren't always applied across all land ownerships (Attachment 3-4, Table 1). Tribal entities and landowners within the "Other" category do not apply the state's or province's guidelines in at least 40 percent of the cases. When guidelines are applied, state and provincial forest lands and lands managed by the "Other" category more frequently apply them voluntarily. A regulatory approach is most frequently used for federal forest land management, local units of government, private industry, nonindustrial private land holdings, and tribal entities. Application of the guidelines through regulatory approaches was most frequently cited for nonindustrial private and private industry lands. Coastal states tend to apply the guidelines using regulatory approaches, especially those programs that address water quality.

Almost all of the respondents had timber harvesting guidelines that address water related issues (Attachment 3-4, Table 2). Programs which address riparian zone management, water quality, or wetlands protection existed for at least 90 percent of the respondents. At least 25

percent of the respondents did not have timber harvesting guidelines that address soil productivity, wildlife management, visual quality, or cultural resources. Regulatory approaches are more prevalent for guidelines that address water quality and wetlands protection. Voluntary approaches are most prevalent for visual quality, riparian zone management, cultural resources, soil productivity, and wildlife management. While a wide variety of issues were included within the “Other” category (e.g., slash management, old-growth forests, high elevation forests, fragile ecosystems), regulatory approaches to implementation were most common.

A variety of approaches are used to encourage landowners, foresters, and loggers to apply timber harvesting guidelines (Attachment 3-4, Table 3). While each strategy is targeted to at least one group, technical assistance and educational programming are clearly the most frequent approach for each group and had the highest reported effectiveness (Attachment 3-4, Tables 3 - 6). At least 92 percent of the respondents noted that educational programming was used to encourage each group to apply the guidelines (Attachment 3-4, Table 3). The effectiveness of those programs was reported to be highest for foresters and loggers and the second highest for landowners (Attachment 3-4, Tables 4 - 6). At least 73 percent of the respondents used technical assistance as a strategy to target each group (Attachment 3-4, Table 3). That approach was most effective with landowners and the second most effective with foresters and loggers (Attachment 3-4, Tables 4 - 6). While cost-share payments to landowners was the only other strategy that was frequently cited as being used, there was negligible use of grants, loans, premiums paid for products, or preferential access to contracts for any group (Attachment 3-4, Table 3). Cost-share payments were reported to have a medium level of effectiveness for landowners (Attachment 3-4, Table 4).

When asked to rate whether the benefits of the various strategies are worth the investment, educational programming and technical assistance were again the most highly rated (Attachment 3-4, Tables 7 - 9). While educational programming was rated as being the strategy that was most worth the investment for foresters and loggers, technical assistance was rated slightly higher than educational programming for landowners. Cost-share payments were rated as providing a mid-level of benefits as compared to costs for landowners.

California, New York, and Vermont reported discontinuing one or more strategies to encourage compliance with timber harvesting guidelines within the last 5 years (Attachment 3-4, Question 12). Information about those discontinued programs is noted below.

California — The state’s cost-share program for landowners spent \$30 million total between 1986 and 1994. The program was canceled in 1995 during economic hard times but restarted in 1999 at a funding level of approximately \$2 million per year. Current benefit-cost ratios for the program are perceived to be very high. However, other strategies (i.e., tax credits and tax deductions) are even more favorable economically. Politically though, the current program is acceptable.

New York and Vermont — Termination of the federally funded Stewardship Incentives Program (SIP) which was targeted to nonindustrial private landowners has limited their ability to provide technical assistance and cost-sharing and to get best management practices properly applied on-the-ground. SIP funding was eliminated 2 years ago. The benefits of SIP exceeded the investments. [The authors note that termination of this program had a similar effect in all states.]

Case Studies of Incentive Programs

Information from the various case study states is summarized below. While each state was asked all of the questions, they were not able to respond to all questions because of the range of respondent programs.

California

The California Forest Improvement Program encourages private and public investment in, and improved management of, California forest lands and resources. This focus is to ensure adequate high quality timber supplies, related employment and other economic benefits, and the protection, maintenance, and enhancement of a productive and stable forest resource system for the benefit of present and future generations. The program is administered through the California Department of Forestry and Fire Protection (CDF).

The program scope includes the improvement of all forest resources, including fish and wildlife habitat, soil, and water quality. It provides technical assistance to private forest landowners, forest operators, wood processors, and public agencies. Approximately \$2.5 million in funds is available as cost-share assistance to private forest landowners, Resource Conservation Districts, and non-profit watershed groups. An additional \$530,000 goes to cover salaries and administration of the program through the CDF.

Forest landowners can be reimbursed up to 75 percent of their expenses for preparation of a management plan, site preparation, tree purchase and planting, timber stand improvement, fish and wildlife habitat improvement, and land conservation practices. The property must contain 20 to 5,000 acres having or be capable of supporting at least 10 percent tree cover and the zoning must allow forest resource management. The 20-acre limit does not apply to erosion control or fish and wildlife habitat improvement projects. Ninety percent cost-share rates are provided for lands damaged by wildfire, insects, disease, wind, floods, landslides or earthquakes in the last 10 years. The minimum project size for tree planting or thin/release work is five acres. Any work required under California's Forest Practice Act is not eligible for funding through the program. Planting or thinning of trees for use as Christmas trees, greenery or firewood is not eligible. A Registered Professional Forester must conduct project supervision. Information about the program is available on the Internet at http://www.fire.ca.gov/improvement_program.html.

The aspects of the program that work well were determined when a study was contracted to determine how landowners learn about how to manage their property. It was determined there are four stages of learning, “I don’t know that I don’t know”, “I know that I don’t know”, “I know that I know”, and “I can just do it.” As a result the CDF attempt to gear their programs and activities to these four levels of landowner learning. Their ultimate goal is to not do the work for them but to teach landowners how to be good stewards of the land and continue improving their land without CDF involvement.

Florida

A "Master Logger" Program is required for any logger who wishes to buy timber on state lands. This program includes logger safety issues, as well as a best management practices (BMP) training course. Costs are incurred by the loggers when taking the course. Annual re-certification is required. Some Florida forest industries are requiring that the wood products they purchase come from a "Master Logger".

Inspections are conducted every 2 years in the form of a random survey of harvest sites. Landowners are contacted and an evaluation of harvest activities on their property takes place. The most recent survey was completed in 1999 and showed 96 percent compliance.

Indiana

Logging operations are eligible to apply for cost-share dollars through the Indiana Department of Natural Resources Division of Forestry that will help defray the expense of best management practices (BMP) installations on harvest sites, depending on the location and timing of the harvest. Limitations are based on specific grant parameters and available dollars. The available cost-share on each harvest operation is 75 percent of the actual cost of implementing the BMPs on the operation, not to exceed \$650.00. Eligible cost-share expenses include:

1. Person hours (planning, layout, construction)
2. Equipment hours
3. Supplies (mulch seed, stone, culverts, etc.)
4. Equipment rental (timber bridge).

The program is funded through 1) the Indiana Department of Environmental Management using Clean Water Act Section 319 funds through the US Environmental Protection Agency (targeted to high priority watersheds) and 2) the Great Lakes Commission (targeted to 13 counties in the northern part of the state). It involves a logger initially contacting the Improved Harvesting Practices Forester (IHP Forester), who works for the Indiana Department of Natural Resources Division of Forestry, to schedule an on-site pre-harvest planning meeting. During that meeting, they walkover the site and look at topographic maps to determine the best location for infrastructure (e.g., forest roads, skid trails, landings) as well as stream crossings. The IHP

Forester makes recommendations about the location and number of water diversions as well as other practices to mitigate impacts to water quality.

Immediately prior to beginning the harvest, the logger is required to notify the IHP Forester again who will visit the site during the actual harvest operation as well as during sale closure. During closure, the IHP forester uses Indiana's implementation monitoring sheet to rate each practice as well as its effectiveness. During that evaluation, the IHP Forester is able to provide a lot of one-on-one education about each practice which facilitates improving practices in the long-run. The logger then submits an invoice showing what was done on the site, the amount of time required, and costs. The IHP Forester then makes a determination about the level of cost-share payment to be given to the logger.

Indiana has waived the need to receive a stream crossing permit those instances where a logger properly uses a temporary bridge to accomplish the crossing. That has resulted in an increased use of bridges on crossings.

Kansas

Kansas has state and federally funded cost-share programs for landowners. The Kansas State Conservation Committee funds the state program. Funding is designated for wetland and riparian area recovery and management. The federal programs are the Conservation Reserve Program (CRP) and the Wetlands Reserve Program (WRP), both funded by the Natural Resources Conservation Service (NRCS). The Technical Service Agency of the Kansas State Division of Forestry provides assistance to landowners implementing riparian and wetland management practices.

Landowners who take part in these programs are supervised by the Technical Service Agency along with a member of the NRCS and/or the CRP if part of the funding comes from a federal program. Inspections of the management plan are required to determine best management practice compliance.

The cost-effectiveness of these programs is rated high with regards to water quality and the establishment of permanent vegetation in riparian areas. An increase in program interest will increase the cost-effectiveness. A recently passed state law awards landowners a tax break if they meet or exceed the minimum riparian management zone width of 150 feet. According to the program, land that would otherwise be designated as "cropland" (which is in the highest tax bracket) is treated as "wasteland" (which is in the lowest tax bracket) for tax purposes. The effectiveness of this program has not yet been determined.

New York

Premiums are offered to loggers for their delivered products if they have completed a Sustainable Forestry Initiative (SFI) course in logging safety and best management practices

(BMP) training. The program is funded in part by the New York State Forest Products Association and in part from a grant from the Forest Service. Annual costs are approximately \$10,000 – \$15,000. Close to 1200 loggers have gone through the course and nearly 400 have been certified to receive the premiums.

Virginia

The Virginia Agricultural Best Management Practices Tax Credit Program provides an incentive to landowners voluntarily install agricultural best management practices (BMPs) in accordance with an approved conservation plan. The purpose of the program is to reduce the amount of nonpoint source (NPS) pollution entering the state's streams, rivers and estuaries. The program is administered through the Soil and Water Conservation Districts (SWCDs).

Any individual or corporation engaged in agricultural production for market who has in place a soil conservation plan approved by the local SWCD is allowed a credit against the tax imposed by Sec. 58.1-320 of an amount equaling twenty-five percent of the first \$70,000 expended for agricultural best management practices by the individual. "Agricultural best management practice" means a practice approved by the Virginia Soil and Water Conservation Board which will provide a significant improvement to water quality in the state's streams and rivers and the Chesapeake Bay, and is consistent with other state and federal programs that address agricultural, nonpoint-source-pollution management. It includes forestry practices.

The program's tax credit is allowed only for expenditures made by the taxpayer from funds of his/her own sources. The amount of such credit cannot exceed \$17,500 or the total amount of the tax imposed by this chapter, whichever is less, in the year the project was completed, as certified by the Board. If the amount of the credit exceeds the taxpayer's liability for the taxable year, the excess may be carried over for credit against income taxes in the next five taxable years until the total amount of the tax credit has been taken.

Washington

On July 3, 2000 Washington initiated the Small Forest Landowner Forestry Riparian Easement Program (Chapter 222-21 WAC) to provide monies for up to 50 years to an individual, partnership, or any non-governmental corporate or other legal entity that complies with the state's riparian management guidelines. The purpose of the program is to allow the state to acquire easements from those forest landowners along riparian and other areas of value to the state for the protection of aquatic resources. The compensation offered to the small landowner is 50 percent of the fair market value of the qualifying timber that is lost by the landowner from the regulatory requirement to provide leave trees. Program funds are appropriated by the legislature.

To participate in the program, a landowner must first complete an application. It is only after completion of harvest operations that the actual "set-up" of the easement can take place. Someone from the Small Forest Landowner Office within the Washington Department of Natural

Resources will then make routine inspections to the property over the next 50 years to ensure that the landowner is complying with the state's riparian area guidelines. It is at that time the easement value is assigned for the next 50 years.

As this is new program, very few landowners have inquired about it. Employees were recently hired to run the program so it will become better defined soon. However, there is much optimism as to the future effectiveness of this program.

Summary and Conclusions

All but one of the 51 responding states and provinces have developed timber harvesting guidelines. Voluntary approaches to implementation are used by slightly more than half of the respondents. State and provincial organizations are more likely to implement their guidelines through voluntary approaches. Federal, local units of government, private industry, nonindustrial private, and tribal entities more frequently use regulatory mechanisms.

Guidelines that address water quality related issues (i.e., riparian management, water quality, and wetlands) are the most common and tend to be implemented using regulatory approaches. Soil productivity, wildlife management, visual quality, and cultural resources are less frequently addressed and are generally implemented using voluntary approaches.

Technical assistance and educational programming are used most frequently and have the highest reported effectiveness in encouraging landowners, foresters, and loggers to apply timber harvesting guidelines. Both of those methods also provide the highest level of benefits for the level of investment. It is, perhaps, not surprising that respondents would report that technical assistance and educational programming are effective and provide high levels of benefits given that there appear to be few other programs which are being applied.

Cost-share payments are the only other incentive option that receives even a moderate level of use. The forest products industry and government are both funding cost-share programs with industry programs largely targeted to loggers and governmental programs targeted to private landowners. The industry may have limited ability to fund such cost share-programs as they need to compete within worldwide markets where similar incentives are generally not offered elsewhere.

The case studies of individual states suggest that tax incentives and cost-share programs are a new and emerging tool for encouraging application of forest management guidelines. Those programs provide financial incentives to landowners to compensate them for benefits from guideline application that largely accrue to society (e.g., clean water, visual quality, protection of cultural resources). Cost-share programs could also compensate loggers for applying specific guidelines that provide no direct benefit to the logging business owner (e.g., installation of water diversions, selection harvesting in a riparian management zone). As guidelines largely provide societal benefits, public funding of tax incentives and cost-share programs may be appropriate.

Attachment 3-1: Survey Cover Letter

Office (612) 624-3788
E-mail: cblinn@forestry.umn.edu

February 11, 2000

Name
Address
City, State Zip

Dear Person's name:

We are conducting a study to assess the financial effects associated with implementing Minnesota's recently updated timber harvesting guidelines. As a part of the study, we are collecting and summarizing information about how states and provinces encourage the voluntary use of timber harvesting practices (i.e., Best Management Practices, guidelines, and regulations). A second part of our study involves summarizing some of the key information about the various riparian management zone (RMZ), streamside management zone (SMZ), and shade strip guidelines for streams, lakes, wetlands, and other water bodies.

The enclosed survey will help us identify and assess the various methods states and provinces use to encourage voluntary compliance with their timber harvesting guidelines. We are also interested in learning about the incentives that are used by states and provinces to encourage compliance with regulatory and voluntary programs. Please forward a copy of this survey to anyone that might provide input to our study. Please return the completed survey by March 3. All responses will be kept confidential. A self-addressed envelope is enclosed to facilitate the return of your completed survey.

To facilitate our summarizing the RMZ, SMZ, and shade strip guidelines, we would appreciate receiving a copy of your current Best Management Practices or timber harvesting guidebook.

We appreciate your participation in this survey. We will be happy to provide a copy of the executive summary of our final report if requested. If you have any questions about the survey, please contact us at 612-624-1224 (Marsha Mlinar) or 612-624-3788 (Charlie Blinn).

Sincerely,

Marsha Mlinar
Graduate Research

Charlie Blinn
Professor and Extension Specialist

Attachment 3-2: Survey Respondent Information

Name:

Position Title:

Primary job responsibility:

Extent of your jurisdictional area (e.g., statewide, provincial):

Organization name:

Mailing address:

Telephone number:

FAX number:

E-mail address:

Date:

Would you like an executive summary of the results of this study? NO YES

Please return completed survey by March 3, 2000 to:
Marsha Mlinar
Department of Forest Resources — Box 35
University of Minnesota
1530 Cleveland Avenue North
St. Paul, MN 55108

**Assessment of Methods used to Encourage Voluntary Compliance
with Timber Harvesting Practices**

For each question below, please consider the state or province in which you work when answering the question. Please use additional space if needed.

1. Does your state or province have timber harvesting guidelines? (Please check the most appropriate response.)
 No (Please proceed to Question 13)
 Yes (Please proceed to Question 2)

2. In general, please characterize your state’s or province’s timber harvesting guidelines. Are they generally voluntary or regulatory? (Please check the most appropriate response.)
 Voluntary (i.e., a voluntary set of practices)
 Regulatory (i.e., the state or province has rules or regulations which govern the application of timber harvesting practices)

3. In general, how are your state’s or province’s timber harvesting guidelines applied on the ownerships noted below. For each landowner group, indicate whether it generally applies the guidelines voluntarily (V), through regulations (R), not at all (NA), or if you don’t know (DK). (Please circle the most appropriate response for each landowner group).

<u>Landowner group</u>	<u>Voluntary</u>	<u>Regulatory</u>	<u>Not applied</u>	<u>Don’t know</u>
Federal land management agency	V	R	NA	DK
State or provincial	V	R	NA	DK
Local (e.g., county)	V	R	NA	DK
Private industry	V	R	NA	DK
Nonindustrial private landowners	V	R	NA	DK
Tribal	V	R	NA	DK
Other (please specify) _____	V	R	NA	DK
_____	V	R	NA	DK
_____	V	R	NA	DK
_____	V	R	NA	DK

4. In general, what are the topical areas, issues, or programs that are addressed through your state's or province's timber harvesting guidelines? For each topical area, note whether it is generally applied voluntary (V), through regulations (R), or if it does not apply (NA). (Please circle the most appropriate response for each topical area, issue, or program.)

<u>Topical area, issue, or program</u>		<u>Voluntary (V), Regulatory (R), or Not Applicable (NA)</u>		
Water quality		V	R	NA
Wetlands		V	R	NA
Visual quality (aesthetics)		V	R	NA
Riparian management zones, streamside management zones		V	R	NA
Cultural resources (e.g., archaeological sites, cemeteries)	V	R	NA	
Soil productivity	V	R	NA	
Wildlife habitat, wildlife management		V	R	NA
Other (please specify) _____	V	R	NA	
_____		V	R	NA
_____		V	R	NA

5. For those topical areas, issues, or programs identified in Question 4, what strategies are used to encourage compliance or implementation by landowners, foresters, and loggers? As each strategy may or may not be targeted to all landowners, foresters, or loggers (e.g., landowners who own more than some minimum number of acres or hectares; landowners, foresters, or loggers who belong to a particular organization; landowners who have a management plan), please note any criteria that will help us better understand the focus of each strategy. Use additional paper as needed or provide other documentation. (For each strategy, please check all target audiences that apply.)

Strategy used to encourage compliance	----- Target audience -----					
	Landowners		Foresters		Loggers	
Cost-share payments	Yes	No	Yes	No	Yes	No
Technical assistance	Yes	No	Yes	No	Yes	No
Grants	Yes	No	Yes	No	Yes	No
Loans	Yes	No	Yes	No	Yes	No
Educational programming	Yes	No	Yes	No	Yes	No
Premium prices paid for products	Yes	No	Yes	No	Yes	No
Preferential access to contracts	Yes	No	Yes	No	Yes	No
Other (please specify)	Yes	No	Yes	No	Yes	No
	Yes	No	Yes	No	Yes	No
	Yes	No	Yes	No	Yes	No
	Yes	No	Yes	No	Yes	No

6. **For those strategies which are targeted to landowners**, how would you rate the effectiveness of each strategy identified in Question 5 for increasing compliance with your timber harvesting guidelines? (NA = Not applicable, 1 = Low effectiveness, 4 = High effectiveness)

<u>Strategy used to increase compliance</u>	<u>NA</u>	<u>Effectiveness</u>			
		<u>Low</u>			<u>High</u>
Cost-share payments	NA	1	2	3	4
Technical assistance	NA	1	2	3	4
Grants	NA	1	2	3	4
Loans	NA	1	2	3	4
Educational programming	NA	1	2	3	4
Premium prices paid for products	NA	1	2	3	4
Preferential access to contracts	NA	1	2	3	4
Other (please specify) _____	NA	1	2	3	4
_____	NA	1	2	3	4
_____	NA	1	2	3	4
_____	NA	1	2	3	4

7. **For those strategies which are targeted to foresters**, how would you rate the effectiveness of each strategy identified in Question 5 for increasing compliance with your timber harvesting guidelines? (NA = Not applicable, 1 = Low effectiveness, 4 = High effectiveness)

<u>Strategy used to increase compliance</u>	<u>NA</u>	<u>Effectiveness</u>			
		<u>Low</u>			<u>High</u>
Cost-share payments	NA	1	2	3	4
Technical assistance	NA	1	2	3	4
Grants	NA	1	2	3	4
Loans	NA	1	2	3	4
Educational programming	NA	1	2	3	4
Premium prices paid for products	NA	1	2	3	4
Preferential access to contracts	NA	1	2	3	4
Other (please specify) _____	NA	1	2	3	4
_____	NA	1	2	3	4
_____	NA	1	2	3	4
_____	NA	1	2	3	4

8. **For those strategies which are targeted to loggers**, how would you rate the overall effectiveness of each strategy identified in Question 5 for increasing compliance with your timber harvesting guidelines? (NA = Not applicable, 1 = Low effectiveness, 4 = High effectiveness)

<u>Strategy used to increase compliance</u>	<u>NA</u>	<u>Effectiveness</u>			
		<u>Low</u>			<u>High</u>
Cost-share payments	NA	1	2	3	4
Technical assistance	NA	1	2	3	4
Grants	NA	1	2	3	4
Loans	NA	1	2	3	4
Educational programming	NA	1	2	3	4
Premium prices paid for products	NA	1	2	3	4
Preferential access to contracts	NA	1	2	3	4
Other (please specify) _____	NA	1	2	3	4
_____	NA	1	2	3	4
_____	NA	1	2	3	4
_____	NA	1	2	3	4

9. Considering the level of investment made in each strategy identified in Question 5 for increasing compliance **among landowners**, please rate whether the benefits are worth the investment. (NA = Not applicable, 1 = Low effectiveness where the level of investment greatly exceeds the payoffs, 4 = High effectiveness where the level of payoffs greatly exceeds the investment)

<u>Strategy used to increase compliance</u>	<u>NA</u>	<u>Investment exceeds benefits</u>		<u>Benefits exceed investment</u>	
Cost-share payments	NA	1	2	3	4
Technical assistance	NA	1	2	3	4
Grants	NA	1	2	3	4
Loans	NA	1	2	3	4
Educational programming	NA	1	2	3	4
Premium prices paid for products	NA	1	2	3	4
Preferential access to contracts	NA	1	2	3	4
Other (please specify) _____	NA	1	2	3	4
_____	NA	1	2	3	4
_____	NA	1	2	3	4
_____	NA	1	2	3	4

10. Considering the level of investment made in each strategy identified in Question 5 for increasing compliance **among foresters**, please rate whether the benefits are worth the investment. (NA = Not applicable, 1 = Low effectiveness where the level of investment greatly exceeds the payoffs, 4 = High effectiveness where the level of payoffs greatly exceeds the investment)

<u>Strategy used to increase compliance</u>	<u>NA</u>	<u>Investment exceeds benefits</u>			<u>Benefits exceed investment</u>
Cost-share payments	NA	1	2	3	4
Technical assistance	NA	1	2	3	4
Grants	NA	1	2	3	4
Loans	NA	1	2	3	4
Educational programming	NA	1	2	3	4
Premium prices paid for products	NA	1	2	3	4
Preferential access to contracts	NA	1	2	3	4
Other (please specify) _____	NA	1	2	3	4
_____	NA	1	2	3	4
_____	NA	1	2	3	4
_____	NA	1	2	3	4

11. Considering the level of investment made in each strategy identified in Question 5 for increasing compliance **among loggers**, please rate whether the payoff is worth the investment. (NA = Not applicable, 1 = Low effectiveness where the level of investment greatly exceeds the payoffs, 4 = High effectiveness where the level of payoffs greatly exceeds the investment)

<u>Strategy used to increase compliance</u>	<u>NA</u>	<u>Investment exceeds benefits</u>			<u>Benefits exceed investment</u>
Cost-share payments	NA	1	2	3	4
Technical assistance	NA	1	2	3	4
Grants	NA	1	2	3	4
Loans	NA	1	2	3	4
Educational programming	NA	1	2	3	4
Premium prices paid for products	NA	1	2	3	4
Preferential access to contracts	NA	1	2	3	4
Other (please specify) _____	NA	1	2	3	4
_____	NA	1	2	3	4

NA	1	2	3	4
NA	1	2	3	4

12. Are there any strategies that were discontinued within the last five years, which were previously used to encourage compliance or implementation of timber harvesting guidelines by landowners, foresters, or loggers within your state or province? If so, please A) briefly describe each program, B) indicate when and why it was terminated, and C) describe whether the benefits from the program were worth the investment.
- No (Please go to Question 13)
Yes (Please provide the requested information about each program)
13. Is there anything else that you would like us to know about the voluntary application of timber harvesting guidelines within your state or province?

Thank you for your time and cooperation. Please return your completed survey as soon as possible in the enclosed return envelope to the address noted below, or via email. **Also, please send under separate cover a copy of your current Best Management Practices or timber harvesting guidebook.**

Marsha Mlinar
Department of Forest Resources — Box 35
University of Minnesota
1530 Cleveland Avenue North
St. Paul, MN 55108
Email: mlin0002@tc.umn.edu

Attachment 3-3: Follow-up Post Card

February 18, 2000

Dear Forest Manager:

Recently we mailed you a survey regarding how your states, provinces, and other large management organizations encourage the voluntary use of certain forest management practices. We are very interested in hearing about your experiences and opinions with respect to these issues.

If you have already returned the survey, thank you. If not, we would like to encourage you to do so by March 3, 2000.

Thank you for your time.

Marsha Mlinar, Graduate Research Assistant
Charles R. Blinn, Professor and Extension Specialist
University of Minnesota, Department of Forest Resources

Attachment 3-4: Summaries of each Survey Question

Question 1. Does your state or province have timber harvesting guidelines? (Please check the most appropriate response.)

Number of respondents: 51

Yes: 98 percent

No: 2 percent

Additional comments: Georgia has both voluntary and regulatory guidelines. Where turbidity or water temperature standards have been violated because best management practices (BMPs) were not followed, there is a violation of state law. State law in Georgia has determined certain sensitive sites where BMPs are mandatory (river corridors, mountaintops, water supply watersheds). Hawaii's guidelines are voluntary on private lands, regulatory on state lands. Montana's Streamside Management Zone's are both regulatory and voluntary. Rhode Island has voluntary guidelines, but when harvesting in wetlands or their buffers, regulatory guidelines come into place. Virginia indicated voluntary guidelines, but has a law that restricts sediment deposition to streams resulting from harvesting activities ("Bad Actor Law"). Nova Scotia's guidelines are generally voluntary, but provincial lands have mandatory guidelines by policy and not by regulation.

Question 2. In general, please characterize your state's or province's timber harvesting guidelines. Are they generally voluntary or regulatory? (Please check the most appropriate response.)

Number of respondents: 51

Both: 6 percent

Voluntary: 52 percent

Regulatory: 42 percent

Georgia – Their program is regulatory where turbidity or water temperature standards have been violated because best management practices (BMPs) were not followed, is a violation of state law. State law has determined certain sensitive sites where BMPs are mandatory (river corridors, mountain tops, water supply watersheds).

Question 3. In general, how are your state’s or province’s timber harvesting guidelines applied on the ownerships noted below. For each landowner group, indicate whether it generally applies the guidelines voluntarily (V), through regulations (R), not at all (NA), or if you don’t know (DK). (Please circle the most appropriate response for each landowner group.)

Table 1. Application method for timber harvesting guidelines by various landowner groups within states and provinces.

Landowner group	Number of respondents	Response rate (percent)			
		Voluntary	Regulatory	Not Applied	Don’t Know
Federal land management ¹	51	31	37	22	10
State/provincial ²	51	57	41	2	0
Local (e.g., county) ³	51	39	45	16	0
Private industry ⁴	51	41	51	6	2
Nonindustrial private	51	35	59	6	0
Tribal ⁵	51	10	40	40	10
Other (specify) ⁶	2	33	0	67	0

¹**Alaska** – Alaska’s federal owners must meet or exceed state standards but are subject to state standard only through Coastal Zone requirements.

Georgia – Through NEPA, the US Forest Service is required to meet or exceed state best management practices (BMPs).

Oregon – Must meet or exceed state BMPs.

Quebec – The federal government applies their own laws and regulations on federal land in each province.

²**Georgia** – The state is required to follow Georgia Environmental Policy Act mandates.

Minnesota – Regarding state ownership: guidelines adopted as policy on DNR administered lands (but still voluntary in law).

New York – Regulatory guidelines applied via contract provisions on State Forest timber sales.

Nova Scotia – These lands are mandatory by policy, not regulation.

³**Georgia** – Many local governments require permits and implementation of BMPs in river corridors, mountaintops, and water supply watersheds.

New York – Some localities have local timber harvesting regulations which vary widely. Some include certain BMPs.

Quebec – In municipalities and county regional municipalities, regulations are not applied at large.

⁴**New York** – Some localities have local timber harvesting regulations which vary widely. Some include certain BMPs.

Quebec – Applies to forest industries operating on public lands.

⁵**Alaska** – Native Corporations must meet the standards of the Forest Resources and Practices Act, but Native allotments to individuals are federal trust land and not directly subject to the act.

Quebec – Native Nations.

⁶**Alaska** – State Trust Land.

California – All non-federal commercial timber lands. Large areas of wetlands, riparian zones, and oak woodlands have tree crops, but are not commercial timber lands, so no regulations apply.

Minnesota – Regarding state ownership, the guidelines were adopted as policy on Department of Natural Resource administered lands (but still voluntary in law).

Question 4. In general, what are the topical areas, issues, or programs that are addressed through your state’s or province’s timber harvesting guidelines? For each topical area, note whether it is generally applied voluntary (V), through regulations (R), or if it does not apply (NA). (Please circle the most appropriate response for each topical area, issue, or program.)

Table 2. Topical areas, issues, or programs addressed through state or provincial timber harvesting guidelines.

Topical area	Number of respondents	Response rate (percent)			
		Voluntary	Regulatory	Not Applied	Don’t Know
Water quality ¹	51	45	51	4	0
Wetlands ²	51	41	49	10	0
Visual quality ³	51	49	16	33	2
Riparian management ³	51	55	43	2	0
Cultural resources ⁴	51	39	26	33	2
Soil productivity	51	57	16	25	2
Wildlife management ⁵	51	47	24	29	0
Other ⁶	11	18	73	0	9

¹**Tennessee** – The state has voluntary best management practices (BMPs). The Forestry Division provides technical assistance to help loggers/foresters/landowners correctly apply BMPs. If pollution occurs from harvesting operations, the Tennessee Department of Conservation has regulatory authority to enforce Tennessee’s water quality laws. The Forestry Division and the Tennessee Department of Environment and Conservation have Memorandums of Understanding (MOUs) to outline cooperative efforts in addressing water quality problems relative to silvicultural activities.

²**California** – Wetlands in commercial timber lands are regulated.

Minnesota – Wetlands and cultural resources – some aspects required by law.

³**Alaska** – Varies by landowner.

Georgia – Some counties do not mandate uncut buffers adjacent to property lines and streams.

⁴**Missouri** – Cultural resources are under outside authority.

Oregon – Applied through another agency’s authority.

⁵**Alaska** – Varies by landowner.

Quebec – Aquatic birds, bird colonies living on cliff, heron colonies, bird colonies living on islands, fish habitat, specific mammals (like Caribou and Deer), muskrat and bear.

⁶**California** – Coastal Zone has extra set of regulations; Scenic highways and any park have special regulations; Wild, Scenic, and Recreational Rivers have special regulations; fire hazard and fire protection are very important issues and are regulated.

Georgia – Mountain tops; water supply reservoirs/watersheds.

Manitoba – General cutting practices; cut block design; buffers and buffer management; roads, trails and landings; watercourse crossings, drainage; debris disposal; campsites, waste disposal, fuel storage; forest fire protection.

Montana – Both streamside management zone (SMZ) law and BMPs address soil and water quality. SMZ law is regulatory and BMPs are voluntary.

New Hampshire – High elevation forests; old-growth forests; rare plants and natural communities.

North Dakota – Grazing.

Northwest Territories – Tourism values; recreation resources and protected areas.

Nova Scotia – Soil losses due to site disturbance.

Oregon – Treatment of slash; air quality; chemical use; high hazard landslide sites; road construction and maintenance.

Quebec – Fragile ecosystem and ecological site.

South Dakota – Liability insurance; slash disposal.

Question 5. For those topical areas, issues, or programs identified in Question 4, what strategies are used to encourage compliance or implementation by landowners, foresters, and loggers? As each strategy may or may not be targeted to all landowners, foresters, or loggers (e.g., landowners who own more than some minimum number of acres or hectares; landowners, foresters, or loggers who belong to a particular organization; landowners who have a management plan), please note any criteria that will help us better understand the focus of each strategy. Use additional paper as needed or provide other documentation. (For each strategy, please check all target audiences that apply.)

Table 3. Strategies used to encourage compliance or implementation of timber harvesting guidelines by various groups within states and provinces.

Strategy	Number of respondents	Response rate by group (percent)					
		Landowners		Foresters		Loggers	
		Yes	No	Yes	No	Yes	No
Cost-share payments¹	51	55	45	2	98	6	94
Technical assistance²	51	92	8	73	27	76	24
Grants³	51	18	82	4	96	14	86
Loans	51	2	98	0	100	0	100
Educational programming⁴	51	92	8	92	8	94	6
Premium prices paid for products	50	4	96	6	94	12	88
Preferential access to contracts⁵	51	4	96	6	94	18	82
Other (specify)⁶	6	60	40	70	30	80	20

¹**California** – Cost-share programs are for reforestation, timber stand improvement, prescribed fire, soil conservation, wildlife, fisheries, and road improvements only.

Minnesota – The cost-share monies for landowners are for reforestation and timber stand improvement. It requires a Forest Stewardship Plan prepared by a certified plan writer which provides an opportunity to inform landowners of the guidelines, but – no cost-sharing to implement guideline practices (e.g., aesthetics, water quality protection, etc.), only for forest management activities such as tree planting or timber stand improvement.

North Dakota – 60/40 payment to landowners.

Nova Scotia – Cost-share payments for silviculture required: commitment to guidelines.

Tennessee – The cost-share monies are very limited and for practical purposes do not substantially address BMP implementation.

²**North Dakota** – For all parties involved – technical assistance with management plans.

³**North Dakota** – For foresters: grants for short-term contracts. Small Business Administration grants to loggers.

⁴**North Dakota** – For all parties involved – workshops.

⁵**Oklahoma** – Major timber companies are requiring that company and contract loggers attend best management practices (BMP) training and comply with BMP guidelines. In some cases, contract and price preference are given to those most in compliance. This trend is growing and is strongly encouraged, though not a part of the state’s BMPs.

⁶**Maine** - Preferential access to contract for landowners, foresters and loggers, varies with company policies-not a state mechanism (i.e., company purchasing wood requires training/certification of loggers).

Oklahoma – Major timber companies are requiring that company and contract loggers attend BMP training and comply with BMP guidelines. In some cases, contract and price preference are given to those most in compliance. This trend is growing and is strongly encouraged, though not a part of the state's BMPs.

South Dakota – The state maintains a register of professional foresters. All referrals for professional forestry assistance are made from this register. Professionals listed on the register release information regarding forest management incentives and opportunities. Qualifications are a B.S. in forestry or 4 years experience writing forest management plans. For specific programs, loggers are required to provide proof of liability insurance to be included on the state's reference list.

Tennessee – Some forest industries are requiring logger training before they buy wood.

⁷California –

- A. Awards and recognition events: for landowners and foresters.
- B. Forest Products Marketing Commission: for landowners.
- C. Professional associations for each group: meetings and workshops.
- D. University Co-op extension: for all parties.
- E. State University workshops: for all parties.

Georgia – American Forest and Paper Association's (AF&PA's) Sustainable Forestry Initiative master timber harvesters list provided to landowners.

Manitoba – Timber inspections for loggers; Operational meetings, annual operating plan reviews, and regular discussions (casual) for foresters.

New Mexico – Law enforcement.

North Carolina – Preferential access to some mills for loggers.

Nova Scotia – Requirement by contract, license, lease agreement on Crown Land for loggers.

Question 6. For those strategies which are targeted to landowners, how would you rate the effectiveness of each strategy identified in Question 5 for increasing compliance with your timber harvesting guidelines? (0 = Not applicable, 1 = Low effectiveness, 4 = High effectiveness)

Table 4. Effectiveness of various strategies used to increase landowner compliance with timber harvesting guidelines within states and provinces.

Strategy	Number of respondents	Average effectiveness rating	Response rate for each level of effectiveness (percent)				
			Level 4	Level 3	Level 2	Level 1	Level 0
Cost-share payments¹	50	1.80	18	28	10	4	40
Technical assistance	51	2.80	27	53	4	4	12
Grants	51	0.54	4	8	6	2	80
Loans	51	0.04	0	0	0	4	96
Educational programming	51	2.50	12	53	21	2	12
Premium prices paid for products	51	0.20	2	2	2	2	92
Preferential access to contracts	51	0.10	0	2	2	0	96
Other (specify)²	2	3.50	66	17	17	0	0

¹**Kentucky** – Ranked it at an effectiveness of 2, because there is not enough money in the program.

New York – When SIP (Federal Stewardship Incentive Program) existed this was very effective, currently “Not Applicable”.

Washington – New, not sure how effective it will be.

²**New Mexico** – Law enforcement.

Question 7. For those strategies which are targeted to foresters, how would you rate the effectiveness of each strategy identified in Question 5 for increasing compliance with your timber harvesting guidelines? (0 = Not applicable, 1 = Low effectiveness, 4 = High effectiveness)

Table 5. Effectiveness of various strategies used to increase forester compliance with timber harvesting guidelines within states and provinces.

Strategy	Number of respondents	Average effectiveness rating	Response rate for each level of effectiveness (percent)				
			Level 4	Level 3	Level 2	Level 1	Level 0
Cost-share payments	51	0.18	2	2	2	0	94
Technical assistance	51	2.24	22	35	16	0	27
Grants	51	0.20	2	4	0	0	94
Loans	51	0	0	0	0	0	100
Educational programming	51	2.73	23	53	10	0	14
Premium prices paid for products	51	0.12	0	4	0	0	96
Preferential access to contracts	51	0.18	0	6	0	0	94
Other (specify) ¹	4	3.09	46	18	36	0	0

note: **Washington** – Does not separate foresters as a distinct group. Their relationship with landowners as employees or consultants directs all programs toward the landowner.

¹**California** –

- A. Awards and recognition events: for landowners and foresters.
- B. Forest Products Marketing Commission: for landowners.
- C. Professional associations for each group: meetings and workshops.
- D. University Co-op extension: for all parties.
- E. State University workshops: for all parties.

Georgia – Georgia Board of Registration for Foresters requires best management practices (BMPs).

Manitoba – 4-Casual discussions; 3-operational meetings; 2-annual operating plan reviews.

New Mexico – Law enforcement.

Question 8. For those strategies which are targeted to loggers, how would you rate the overall effectiveness of each strategy identified in Question 5 for increasing compliance with your timber harvesting guidelines? (0 = Not applicable, 1 = Low effectiveness, 4 = High effectiveness)

Table 6. Effectiveness of various strategies used to increase logger compliance with timber harvesting guidelines within states and provinces.

Strategy	Number of respondents	Average effectiveness rating	Response rate for each level of effectiveness (percent)				
			Level 4	Level 3	Level 2	Level 1	Level 0
Cost-share payments	51	0.25	2	4	2	2	90
Technical assistance	51	2.41	21	39	16	6	18
Grants	51	0.39	4	4	6	0	86
Loans	51	0.02	0	0	0	2	98
Educational programming	51	2.61	22	39	27	2	10
Premium prices paid for products	51	0.39	6	4	2	0	88
Preferential access to contracts	51	0.69	12	6	2	0	80
Other (specify)¹	6	3.60	70	20	10	0	0

note: **Washington** – Does not separate loggers as a distinct group. Their relationship with landowners as employees or consultants directs all programs toward the landowner.

¹**California** –

- A. Awards and recognition events: for landowners and foresters.
- B. Forest Products Marketing Commission: for landowners.
- C. Professional associations for each group: meetings and workshops.
- D. University Co-op extension: for all parties.
- E. State University workshops: for all parties.

Georgia – Sustainable Forestry Initiative logger complaint list.

Manitoba – Timber inspections.

New Mexico – Law enforcement.

North Carolina – Preferential access to mills.

Nova Scotia – Contract requirement.

Question 9. Considering the level of investment made in each strategy identified in Question 5 for increasing compliance **among landowners**, please rate whether the benefits are worth the investment. (0 = Not applicable, 1 = Low effectiveness where the level of investment greatly exceeds the payoffs, 4 = High effectiveness where the level of payoffs greatly exceeds the investment)

Table 7. Relative level of benefits for various strategies used to increase landowner compliance with timber harvesting guidelines within states and provinces.

Strategy	Number of respondents	Average benefit level	Response rate for relative level of benefits (percent)				
			4	3	2	1	0
Cost-share payments	50	1.68	16	30	4	6	44
Technical assistance	50	2.88	34	48	4	0	14
Grants	50	0.34	2	6	4	0	88
Loans	50	0.06	0	0	2	2	96
Educational programming	50	2.76	26	48	14	0	12
Premium prices paid for products	50	0.16	2	2	0	2	94
Preferential access to contracts	50	0.00	0	0	0	0	100
Other (specify)¹	2	3.67	83	0	17	0	0

note: **Arkansas** – Indicated that it was not possible to measure the relative level of benefits.

¹**California** –

- A. Awards and recognition events: for landowners and foresters.
- B. Forest Products Marketing Commission: for landowners.
- C. Professional associations for each group: meetings and workshops.
- D. University Co-op extension: for all parties.
- E. State University workshops: for all parties.

New Mexico – Law enforcement.

Question 10. Considering the level of investment made in each strategy identified in Question 5 for increasing compliance among foresters, please rate whether the benefits are worth the investment. (0 = Not applicable, 1 = Low effectiveness where the level of investment greatly exceeds the payoffs, 4 = High effectiveness where the level of payoffs greatly exceeds the investment)

Table 8. Relative level of benefits for various strategies used to increase forester compliance with timber harvesting guidelines within states and provinces.

Strategy	Number of respondents	Average benefit level	Response rate for relative level of benefits (percent)				
			4	3	2	1	0
Cost-share payments	50	0.06	0	2	0	0	98
Technical assistance	50	2.24	18	44	10	0	28
Grants	50	0.16	2	0	4	0	94
Loans	50	0.00	0	0	0	0	100
Educational programming	50	2.96	34	46	8	0	12
Premium prices paid for products	50	0.20	2	2	2	2	92
Preferential access to contracts	50	0.16	0	4	2	0	94
Other (specify) ¹	3	3.00	56	11	22	0	11

note: **Arkansas** – Indicated that it was not possible to measure the relative level of benefits.

¹**California** –

- A. Awards and recognition events: for landowners and foresters.
- B. Forest Products Marketing Commission: for landowners.
- C. Professional associations for each group: meetings and workshops.
- D. University Co-op extension: for all parties.
- E. State University workshops: for all parties.

Maine – Casual discussions, operational meetings, and annual operating plan reviews.

New Mexico – Law enforcement.

Question 11. Considering the level of investment made in each strategy identified in Question 5 for increasing compliance among loggers, please rate whether the payoff is worth the investment. (0 = Not applicable, 1 = Low effectiveness where the level of investment greatly exceeds the payoffs, 4 = High effectiveness where the level of payoffs greatly exceeds the investment)

Table 9. Relative level of benefits for various strategies used to increase logger compliance with timber harvesting guidelines within states and provinces.

Strategy	Number of respondents	Average benefit level	Response rate for relative level of benefits (percent)				
			4	3	2	1	0
Cost-share payments	50	0.26	4	2	2	0	92
Technical assistance	50	2.42	22	42	14	0	22
Grants	50	0.18	0	2	6	0	92
Loans	50	0.00	0	0	0	0	100
Educational programming	50	2.88	32	44	14	0	10
Premium prices paid for products¹	50	0.48	8	4	2	0	86
Preferential access to contracts²	50	0.68	10	8	2	0	80
Other (specify)³	5	2.00	22	0	56	0	22

note: **Arkansas** – Indicated that it was not possible to measure the relative level of benefits.

¹**Michigan** – American Forest and Paper Association (AF&PA) members only.

²**Maine** – Benefits exceed investment, but it causes some bad feelings in the logging community.

Manitoba – Timber inspections - as a part of cost-benefit realities and the forest management responsibilities of License holders, we are exploring "audit" systems to replace periodic timber inspections.

Michigan – AF&PA member companies only.

³**California** –

- A. Awards and recognition events: for landowners and foresters.
- B. Forest Products Marketing Commission: for landowners.
- C. Professional associations for each group: meetings and workshops.
- D. University Co-op extension: for all parties.
- E. State University workshops: for all parties.

Georgia – Sustainable Forestry Initiative logger complaint list.

Manitoba – Timber inspections - as a result of cost-benefit realities and the forest management responsibilities of License holders, we are exploring "audit" systems to replace periodic timber inspections.

New Mexico – Law enforcement.

Nova Scotia – Contract requirement.

Question 12. Are there any strategies that were discontinued within the last five years which were previously used to encourage compliance or implementation of timber harvesting guidelines by landowners, foresters, or loggers within your state or province? If so, please A) briefly describe each program, B) indicate when and why it was terminated, and C) describe whether the benefits from the program were worth the investment.

Number of Respondents: 51

Yes: 6 percent

No: 94 percent

California – The state’s cost-share program spent \$30,000,000 total between 1986 and 1994. It was cancelled in 1995 during economic hard times. It was restarted in 1999, at about \$2,000,000 per year. Current benefit-cost ratios are perceived to be very high, but other strategies, (i.e., tax credits and tax deductions) are even more favorable economically. Politically though, the current program is acceptable.

New York – Federal Stewardship Incentive Program (SIP) cost-sharing was eliminated. That program had been a major benefit and motivator to encourage BMP use. Benefits definitely exceeded investments.

Vermont – Termination of the Federal cost-share program for Stewardship Incentive Practices (SIP) has limited their ability to provide technical advice and get proper practices on the ground during logging. SIP was removed from the federal budget 2 years ago.

Question 13. Is there anything else that you would like us to know about the voluntary application of timber harvesting guidelines within your state or province?

- **Alabama** - As with many Government programs, money is limited. We could do much more to educate landowners if we could devote more people to the task. We provide cost-share payments to landowners to carry out some best management practices (BMPs) needs to be considered.
- **Arkansas** - The effectiveness of implemented BMP guidelines.
- **California** - New rules may become less flexible and more costly. Other agencies (i.e., water quality and wildlife) are now collaborators and seek major new restrictions. Political climate favors such changes after sixteen years of little change.
- **Colorado** - For survey purposes it would be helpful to define "timber harvesting guidelines". I'm not sure you'll get consistent understanding of what you are asking otherwise. That may be purposeful.
- **Delaware** - 1. Mandated reduction or elimination of sediment in waters. 2. Voluntary BMP application by forest product operators.
- **Florida** - Program is semi-regulatory, with enforcement of violations of guidelines as they relate to water quality impact only.
- **Hawaii** - The timber industry is just developing at this time and the need for harvesting regulations will become more of a need in the near future.
- **Iowa** - There is a need to increase outreach to all audiences. Cost-share funds are good incentives for landowners.
- **Manitoba** - The forest practices initiative our branch has recently begun includes forest industry representation on committees with government representatives to develop new guidelines for specific practices. We are currently working on forest roads, understory protection, pre-harvest surveys, and delimiting at the stump. Each forest management License holder submits Standard Operating Procedures

(Practices) for approval with their long-term plans. These are approved by the Province and also guide forestry operations.

- **Minnesota** - There is public expectation that the logging and resource management community will implement the guidelines as a cost of doing business without reimbursement.
- **New Jersey** - The guidelines themselves are voluntary, however they do have regulatory foundation especially concerning waterways, wetlands and erosion control.
- **New York** - Voluntary guidelines are backstopped by water quality and wetlands regulations and permit requirements. If water quality is damaged (e.g., sedimentation, pollution with chemicals) then there's a violation and penalty. Based on performance (water quality) rather than use of BMPs.
- **Nova Scotia** - The Nova Scotia Department of Natural Resources is in the process of regulating certain aspects of the existing voluntary guidelines regarding harvesting (e.g.; establishment of riparian zones, leaving wildlife clumps, coarse woody debris) on all private land, but it hasn't happened yet (target year: 2000).
- **Quebec** - Timber harvesting guidelines (RNI) have been in operation (by law) since 1996. No modifications since 1996.
- **Rhode Island** - Technical assistance appears to work the best in our state. This is primarily due to the part that all logging operations (legal, that is) are required to notify our Department prior to the start of their operation. At this point, the serving forester personally meets with each forester or logger in charge of operation and addresses the specific concerns for that site.
- **Saskatchewan** – Most forest lands are owned and administered by the Provincial government. Private forests are negligible. Federal forests are mostly National Park lands, where no harvesting occurs.
- **South Carolina** - Our BMPs are voluntary in that my agency has no statutory authority to enforce them. However, if a silvicultural operation causes an in-stream impact, the South Carolina Department of Health and Environmental Control can initiate enforcement action. Also, through the Sustainable Forestry Initiative, forest industry requires our BMP training for their contractors.
- **Tennessee** - The answer to question 8 concerning preferential access to contracts as far as loggers go...it is a very volatile topic in Tennessee.
- **Utah** - Currently, there is no effective compliance monitoring and evaluative program addressing the level of application and effectiveness of the state's Forest Water Quality Guidelines for non-point source pollution. The state is in the initial stage of developing such a program. However, funding and staffing constraints continue to be an on-going issue for program implementation.
- **Vermont** - Acceptable management practices for water quality are implemented using a team approach which includes loggers as a member of the team checking reported problems. This involvement of peers works well to get voluntary compliance.
- **Virginia** - Virginia generally has a voluntary BMP program for forestry. There is a silvicultural Water Quality Law, which addresses the deposition of sedimentation to state water from timber harvesting operations and requires corrective measures. Several localities in the Chesapeake Bay Area have adopted the Chesapeake Bay Act, which allows an exemption for forestry operations if BMPs are utilized; this is a locality (county) issue.
- **Washington** - Our program is regulatory in design, however, to make it more effective we use as many educational opportunities as possible.
- **Wisconsin** - While compliance is largely voluntary, compliance is required on Department properties, such as State forests, and lands enrolled in the Managed Forest Law Program since 1995. In addition, all 29 counties enrolled in Wisconsin's County Forest Law program have adopted water quality BMPs. The majority of Wisconsin's industrial forest land is enrolled in the Managed Forest Law Program and the American Forest and Paper Association's Sustainable Forestry Initiative which requires water quality

BMP compliance and logger training as a condition of membership. Forestry water quality BMPs are currently being applied in forest management practices on over 7 million acres of Wisconsin's forest land.

Objective 4: Summary of Riparian Timber Harvesting Guidelines in the United States

Riparian areas are among the most important and diverse parts of a forest ecosystem. Some of the benefits associated with riparian areas include retaining nutrients and sediment and maintaining water quality; flood control and regulation of stream flow; ground water recharge; bank, channel, and shoreline stabilization; maintaining moderate temperatures through shading; creation of structure through input of fallen trees; input of energy in the form of leaves, twigs, fruit, and insects; wildlife travel corridors; unique and diverse habitats; recreational and scenic opportunities; potential locations for cultural resources; and production of forest products.

States developed forest management Best Management Practices (BMPs) in response to the federal Clean Water Act of 1972. Those BMPs included riparian management zone (RMZ), streamside (or special) management zone (SMZ), stream protection zones, and buffer strip guidelines where management practices are modified to protect water quality adjacent to various types of water bodies. While those BMPs do address impacts to water quality, they generally did not consider the broader range of ecological functions associated with a riparian area. As a result, some states have revised their guidelines to address those additional functions and values. The purpose of this report is to summarize the current riparian timber harvesting guidelines within the US.

Methods

To understand the range of riparian guidelines, the cover letter which accompanied the guideline implementation incentives survey requested a copy of each state's forest management guidelines. A second letter was sent to non-respondents on March 13 which reiterated that request. Electronic mail messages were sent to non-respondents if they had returned their survey but not a copy of their guidebook. For several of the states where it wasn't possible to obtain a copy of their guidebook, information was obtained from a web site maintained by the Southern Forestry Extension Service (www.usabmp.net). That site contains links to several of the various state BMP guidebooks. For each state, where relevant information was obtained, it was summarized to identify the water bodies that are addressed by the guidelines, the minimum width of the management zone, the minimum amount of timber to leave after timber harvesting, any additional timber harvesting considerations that are addressed within the guidelines, and other considerations.

When compiling the summary, every attempt was made to focus the information presented on the particular water bodies that each state defined as being a part of their RMZ, SMZ, stream protection zone, or buffer strip guidelines. Where a guidebook contained information about water bodies that were not included within their management zone definition, those additional water bodies were excluded from the summary. As an example, Kentucky has separate sections within

their guidebook for streamside management zones and sinkholes. As sinkholes are not included within their definition of streamside management zones, the summary presented below for Kentucky does not include any information about sinkholes.

Results

Guidelines are reported for 48 states in Tables 4-1 and 4-2 and Appendices 1 and 2 (at the end of this document). The guidelines for California, Oregon, and Washington are presented in Table 4-2 and Appendices 1 and 2 because the information for those states couldn't be easily summarized within Table 4-1. Guidelines for Arizona and Kansas were not available.

As stated in most guidebooks, the focus of their riparian guidelines is on the protection of water quality. Several states noted consideration of additional riparian functions and values. Guidelines for those states generally have a wider management zone, higher residual timber specifications, and/or other additional guidelines. Also, as some of the guidelines are only contained within administrative rules, they are both lengthy and tedious to interpret.

Some states have written their guidelines to both specify the recommendation as well as the associated rationale. The reason for putting both components close together may be to make sure that readers understand the purpose of each guideline. Some states specify desired future conditions within the riparian area. Few states have separate guidelines for even- and uneven-age management or have regionally or landowner-specific guidelines. Many states provide values for minimum width but note that the actual width should be determined during an on-site evaluation which considers factors such as size and type of water body, topography, soils, vegetative cover, and special site conditions.

All states have guidelines which address perennial streams. While most states also have guidelines for intermittent streams, they are frequently less stringent than the perennial stream guidelines. Ephemeral streams are rarely addressed within the guidelines. Designated trout streams are identified separately in some states. Other water bodies which are addressed include wetlands, lakes, ponds, and seeps.

A 50-foot minimum management zone width from either the edge of the water body or the ordinary high-water mark was frequently noted. Filter strip widths may be the same, higher, or lower than the management zone width. Most states increase the width of the management zone and filter strip with increased slope. Some states also increase zone width with stream width or in areas where domestic water supplies could be impacted. None of the states increase the width of the management zone with decreasing stream size. Some states divide the management zone into two different strips or zones where the one closest to the water's edge has additional management restrictions (e.g., less timber can be removed, less equipment trafficking) as compared to the outer strip or zone.

Minimum residual basal area¹ values were generally in the range of 50 - 75 ft² per acre or 50 - 75 percent crown closure². A few states do not specify a minimum residual basal area, leaving that determination up to the managing forester to decide on-the-ground. An even distribution was usually noted where there was a guideline indicating how to distribute residual timber within the management zone.

Many states specify one or more additional guidelines that are designed to limit operations within the riparian management zone. While some of those guidelines are found in most guidebooks (e.g., locate roads, skid trails, landings, and sawmills outside of the management zone whenever possible; establish fueling and maintenance areas outside of the management zone whenever possible; minimize stream and wetland crossings; cross streams at a right angle to the channel; maintain sufficient ground cover to trap sediment; do not move slash into or pile slash within the management zone; keep slash away from water bodies and other areas where it might be moved into the water body; prescribed burning, aerial application of herbicides, and mechanical site preparation are not allowed), others were found in less than half the cases but more than ten. While the most frequent guidelines are not included in Table 1, some of the more unique but still relatively common guidelines are highlighted below. Some of those relatively common guidelines include:

- use directional felling techniques to direct tree falling away from the water body,
- avoid felling trees directly into the water body

¹Basal area is the cross-sectional area of a live tree at 4.5 feet above ground. Basal area may be measured in square feet per tree or square feet per acre.

²Crown closure identifies the degree to which the forest floor is shaded by tree crowns when the sun is directly overhead. Complete crown closure occurs when the crowns of trees touch and effectively block sunlight from reaching the forest floor.

- use a cable skidder or cable yarder to move the tree out of the management zone,
- keep all heavy equipment out of the management zone whenever possible,
- retain trees that provide bank stabilization or shade directly to the water body,
- do not use a stream channel as a skid trail or road, and
- promote long-lived tree species appropriate to the site.

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
Alabama	Perennial streams	35	50 percent crown cover	---	Widths should be increased to account for erodibility of soil and steepness of slope. If wildlife is a major objective, a minimum width of 50 feet is recommended.
	Intermittent streams	35	Maintain filter strip	---	Widths should be increased to account for erodibility of soil and steepness of slope. If wildlife is a major objective, a minimum width of 50 feet is recommended.
Alaska ²	Private lands along a Type A water body within the coastal spruce or hemlock forest region	66	No harvesting allowed	---	Slope stability standards apply to 100 feet from the water body
	Private lands along a Type B water body within the coastal spruce or hemlock forest region	100 feet to the stream or the break of the slope, whichever area is smaller	No harvesting allowed	---	Slope stability standards apply to 100 feet from the water body

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
	Private lands along a Type C water body within the coastal spruce or hemlock forest region where the width of the water body is > 13 feet at the ordinary high water mark or > 8 feet at the ordinary high water mark if the channel is incised	100 feet to the stream or the break of the slope, whichever area is smaller	Retain timber that is uneconomical to harvest and market	---	Slope stability standards apply to 100 feet from the water body
	Private lands along a Type D water body within the coastal spruce or hemlock forest region where the width of the water body is > 13 feet at the ordinary high water mark or > 8 feet at the ordinary high water mark if the channel is incised	50 feet to the stream or the break of the slope, whichever area is smaller	Retain timber that is uneconomical to harvest and market	---	Slope stability standards apply to 50 feet from the water body
	Private lands within the Interior spruce-hardwood region north of the Alaska Range	100	Not specified.	---	Harvests within the management zone must protect fish habitat and surface water quality from significant adverse effects.

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
	Private lands within the Interior spruce-hardwood region north of the Alaska Range	100	Not specified.	—	Harvests within the management zone must protect fish habitat and surface water quality from significant adverse effects.
	State lands within the coastal spruce or hemlock forest region	100	No harvesting allowed within 100 feet adjacent to an anadromous or high value resident fish water body. Between 100 and 300 feet from the water body, timber harvest must be consistent with the maintenance of important fish and wildlife habitat.	—	Slope stability standards apply within 100 feet from the water body on anadromous and high value resident fish waters and tributaries to these waters with < 12 percent gradient and within 50 feet of other tributaries to anadromous and high value resident fish waters.
	State lands within the Interior spruce-hardwood region north of the Alaska Range	100	No harvesting allowed adjacent to an anadromous or high value resident fish water body unless the Division determines that adequate protection remains for the fish habitat.	—	Slope stability standards apply within 100 feet from the water body on anadromous waters and within 50 feet of other tributaries to anadromous waters.

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
	State lands within the Interior spruce-hardwood region south of the Alaska Range	300	No harvesting allowed within 100 feet adjacent to an anadromous or high value resident fish water body. Between 100 and 300 feet from the water body, timber harvest must be consistent with the maintenance of important fish and wildlife habitat.	---	Slope stability standards apply within 100 feet from the water body on anadromous and high value resident fish waters and tributaries to these waters with < 12 percent gradient and within 50 feet of other tributaries to anadromous and high value resident fish waters.
	Other public lands within the coastal spruce or hemlock forest region	100	No harvesting allowed adjacent to an anadromous or high value resident fish water body	---	Slope stability standards apply within 100 feet from the water body on anadromous and high value resident fish waters and tributaries to these waters with < 12 percent gradient and within 50 feet of other tributaries to anadromous and high value resident fish waters.
	Other public lands within the Interior spruce-hardwood region north of the Alaska Range	100	No harvesting allowed adjacent to an anadromous or high value resident fish water body unless permission is granted by the Commissioner	---	Slope stability standards apply to 100 feet from the water body on anadromous waters and within 50 feet of tributaries to anadromous waters
	Other public lands within the Interior spruce-hardwood region south of the Alaska Range	100	No harvesting allowed adjacent to an anadromous or high value resident fish water body	---	Slope stability standards apply to 100 feet from the water body on anadromous waters and within 50 feet of tributaries to anadromous waters
Arizona	No information available				

Table 4-1. Summary of timber harvesting riparian guidelines in the United States					
State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
Arkansas	Perennial and intermittent streams	Site specific, as determined by forester	Not designated. Leave enough trees and understory vegetation to prevent an increase in water temperature	---	Use selection harvesting practices.
California	Streams and lakes (at least one acre in size)	See Table 2	See Table 2	See Table 2	See Table 2
Colorado	Perennial and intermittent streams, lakes, and ponds	50 feet from the ordinary high water mark	Not specified.	Directionally fell trees away from the water body. Limb or top trees above the high-water mark. Do not operate equipment on stream banks. Suspend the lead end of a log during skidding whenever possible. Use cable skidders when ground-based equipment is employed.	Width extends beyond 50 feet to include wetlands along the stream bottom and in areas of steep slopes or erosive soils. Leave hardwoods, and shrubs.
Connecticut	Perennial and intermittent streams	30	Not specified.	Avoid use of ground-based equipment	Widths should be increased for slope up to a 100-foot wide zone
Delaware	Perennial and intermittent streams	50	60 ft ² /acre equally divided among diameter classes (or 60 percent of the overstory) that is well-distributed through the management zone.	---	Widths should be increased for slopes exceeding 10 percent.

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
Florida	Perennial streams, perennial lakes, and perennial sinkholes	Primary zone: 35 feet Secondary zone: 10 feet for streams less than 20 feet wide or where slope is 3 - 7 percent	Primary zone: 50 percent of a fully stocked stand. Secondary zone: No harvesting restrictions	Primary zone: No trees can be harvested in stream channels or on the immediate bank of the water body. Secondary zone: No roads or landings.	Primary zone widths should be increased for stream widths of 20 feet or more. Secondary zone width increases with increasing slope. Maximum total management zone width is 300 feet where slope exceeds 12 percent. Repeated entry into a harvested Primary zone in short time intervals for additional harvesting is prohibited.
	Intermittent streams, intermittent lakes, and intermittent sinkholes	Primary zone: Not specified Secondary zone: 35 feet	Not specified. Leave trees on or near the bank.	Minimize heavy equipment operation in or around the water.	Secondary zone width increases for slopes exceeding 2 percent up to a maximum of 300 feet when slope exceeds 12 percent. Favor retaining hardwood species, and potential den trees and snags.
	Outstanding Florida Waters, Outstanding National Resource Waters, and Class I Waters (sources of domestic water supply)	Primary zone: 200 feet Secondary zone: 100 feet for streams where slope exceeds 12 percent	Primary zone: 50 percent of a fully stocked stand. Secondary zone: No harvesting restrictions	Primary zone: No trees can be harvested in stream channels or on the immediate bank of the water body. Secondary zone: No roads or landings.	Maximum total management zone width is 300 feet where slope exceeds 12 percent. Repeated entry into a harvested Primary zone in short time intervals for additional harvesting is prohibited.
Georgia ³	Perennial streams	40	50 ft ² /acre or 50 percent canopy cover	---	Widths should be increased for slopes exceeding 20 percent. Avoid cutting stream bank trees.
	Intermittent streams	20	25 ft ² /acre or 25 percent canopy cover	---	Widths should be increased for slopes exceeding 20 percent. Avoid cutting stream bank trees.

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
	Trout streams	100	Option A: First 25 feet is a no-harvest zone and the remaining 75 feet has 50 ft ² /acre or 50 percent canopy cover OR Option B: 50 ft ² /acre evenly distributed if a qualified professional is consulted	Avoid any activity within 25 feet of the stream	Widths should be increased for slopes exceeding 20 percent. Avoid cutting stream bank trees.
	Ephemeral streams	---	---	Minimize soil disturbance	---
Hawaii	Perennial and intermittent streams, ponds, perennial flowing natural springs, and all springs and reservoirs serving as domestic water supplies	Slightly erodible soil: 35 feet Erodible soil: 35 - 50 feet	50 ft ² /acre or 50 percent of the original crown cover, evenly distributed. Clearcutting is prohibited.	---	Widths should be increased for slopes exceeding 5 percent.

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
Idaho	Perennial and intermittent streams and lakes	75 feet from high-water mark for a Class I stream or lake 30 feet from high-water mark for a Class II stream (few if any fish-no domestic use)	75 ft ² /acre	Use directional falling to keep timber out of creeks. Do not limb trees in or over streams. Near streams use whole tree skidding. Skidding equipment is not allowed within the management zone. Use cable on tractors/skidlers or cable yarding systems.	Width should be increased beyond 75 feet above major domestic water intakes. For each 1,000 of stream length, certain minimum numbers of trees and snags by diameter classes are required within 50 feet of Class I and 30 feet of Class II streams. An approved site-specific riparian management prescription is required prior to conducting activities within the management zone around a lake.
Illinois	Perennial streams and lakes	50	Not specified	Operate wheeled or tracked harvesting equipment within the management zone only when the ground is dry or frozen. If the ground is not dry, restrict equipment use to roads and stream crossings while working within the management zone.	Widths should be increased on areas of highly erodible soil or where slopes exceed 9 percent.

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
	Intermittent streams	25	Not specified	Operate wheeled or tracked harvesting equipment within the management zone only when the ground is dry or frozen. If the ground is not dry, restrict equipment use to roads and stream crossings while working within the management zone.	Widths should be increased on areas of highly erodible soil or where slopes exceed 9 percent.
Indiana	Perennial streams	Streams under 20 feet wide: 50 feet Streams 20 - 40 feet wide: 75 feet Streams > 40 feet wide: 200 feet	Retain 50 percent canopy cover that is well-distributed. Cut few, if any trees within 15 feet of the water's edge.	Directionally fell trees away from water and winch them to a skid trail located outside of the management area when necessary.	---
	Intermittent streams and sinkhole openings	25	---	Directionally fell trees away from water and winch them to a skid trail located outside of the management area when necessary.	---

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
	Water supply reservoirs and their perennial streams	75	Retain 50 percent canopy cover that is well-distributed. Cut few, if any trees within 15 feet of the water's edge.	Directionally fell trees away from water and winch them to a skid trail located outside of the management area when necessary.	---
	Other lakes and ponds	35	Retain 50 percent canopy cover that is well-distributed. Cut few, if any trees within 15 feet of the water's edge.	Directionally fell trees away from water and winch them to a skid trail located outside of the management area when necessary.	---
	Ephemeral streams	None	None	Minimize soil disturbance, crossings, and channel blockages. Avoid diverting runoff from skid trails and roads into the channel.	---
Iowa	Perennial and intermittent streams and lakes	50	Not designated. Minimize harvesting.	Limit use of wheeled equipment within the management zone.	Widths should be increased for streams wider than 20 feet.
Kansas	No information available				
Kentucky	Perennial and intermittent streams, lakes, and ponds (< 15 percent slope next to bank)	25	50 percent of original tree overstory	Minimal disturbance to understory trees and shrubs	---

Table 4-1. Summary of timber harvesting riparian guidelines in the United States					
State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
	Perennial and intermittent streams, lakes, and ponds (> 15 percent slope next to bank)	55	50 percent of original tree overstory	Minimal disturbance to understory trees and shrubs	---
	Cold water aquatic (designated waters having the potential to carry trout)	60	75 percent of original tree overstory	No disturbance to understory trees and shrubs	---
	Perennial streams, ponds, and sloughs in wetlands	50	50 percent of original tree overstory	Minimal disturbance to understory trees and shrubs	---
	Intermittent streams	0	0 percent of original tree overstory	Minimal disturbance to understory trees and shrubs	---
Louisiana	Perennial streams, bayous, and lakes	50	Not designated. Provide an adequate canopy to maintain normal water and shade conditions.	Do not remove trees from banks, beds, or steep slopes if removal will destabilize soil and degrade water. Consider using wide-tire skidders, forwarders, cable skidders, and tracked equipment to minimize soil disturbance.	Increase width to 100 feet when stream size is more than 20 feet wide.
	Intermittent streams	35	Not specified	---	---
	Ephemeral streams	Not specified	Not specified	---	---
Maine	Perennial streams	Not specified	Not specified	---	Width is determined by the forester based on on-site conditions

Table 4-1. Summary of timber harvesting riparian guidelines in the United States					
State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
Maryland	Perennial and intermittent streams, rivers, lakes, ponds, bogs, and marshes	Not specified. Dependent on the slope of the land adjacent to the water body.	100 ft ² /acre evenly distributed trees which are 6 inches or greater in diameter. A buffer management plan must be prepared by a registered professional forester.	Directionally fell trees away from the stream bank.	—
Massachusetts	All water bodies and certified vernal pools	50	50 percent of the overstory basal area that is well-distributed	Operational considerations: No equipment can operate within 50 feet of the water's edge. No slash can remain within 25 feet of any perennial stream or any lake, pond, or domestic water supply.	Additional considerations: Widths should be increased to 100 feet for slopes of 30 percent or greater. For perennial and intermittent streams greater than 25 feet in width, ponds greater than 10 acres in size, designated scenic rivers, and along Outstanding Resource Waters and their tributaries (excluding vernal pools), the management width is based on slope with widths increasing beyond 50 feet where slope exceeds 9 percent. A waiting period of five years or more must elapse between harvests within the management zone.
Michigan	Perennial and intermittent streams, lakes, and ponds	100	Retain a sufficient number of trees to maintain shading and to leave a stable, undisturbed forest floor	Avoid equipment use within the zone. Do not operate equipment when the soils are saturated.	Increase widths for slope, where domestic water supply could be impacted, and adjacent to federal "Natural" and "Wild and Scenic Rivers".

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
Minnesota	Designated trout streams and their tributaries: Even-age management	150	60 ft ² /acre	Relatively even distribution of residual basal area or gaps and clumps	Concentrate leave trees adjacent to the RMZ in clumps, strips, or islands with a minimum size of 1/4-acre and occupying a minimum or 5 percent of the area adjacent to the harvest RMZ
	Designated trout streams and their tributaries: Uneven-age management	200	80 ft ² /acre	Relatively even distribution of residual basal area or gaps and clumps	---
	Non-trout perennial and intermittent streams > 10 feet wide: Even-age management	100	25 - 80 ft ² /acre	Relatively even distribution of residual basal area or gaps and clumps	Concentrate leave trees adjacent to the RMZ in clumps, strips, or islands with a minimum size of 1/4-acre and occupying a minimum or 5 percent of the area adjacent to the harvest RMZ
	Non-trout perennial and intermittent streams 3 - 10 feet wide: Even-age management	50	25 - 80 ft ² /acre	Relatively even distribution of residual basal area or gaps and clumps	Concentrate leave trees adjacent to the RMZ in clumps, strips, or islands with a minimum size of 1/4-acre and occupying a minimum or 5 percent of the area adjacent to the harvest RMZ
	Non-trout perennial streams < 3 feet wide: Even-age management	50	25 - 80 ft ² /acre	Relatively even distribution of residual basal area or gaps and clumps	Concentrate leave trees adjacent to the RMZ in clumps, strips, or islands with a minimum size of 1/4-acre and occupying a minimum or 5 percent of the area adjacent to the harvest RMZ
	Non-trout intermittent streams < 3 feet wide: Even-age management	Not applicable	Not applicable	---	Protect the forest floor through use of a filter strip.

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
	Non-trout lakes and open-water wetlands at least 10 acres in size: Even-age management	100	25 - 80 ft ² /acre	Relatively even distribution of residual basal area or gaps and clumps	Concentrate leave trees adjacent to the RMZ in clumps, strips, or islands with a minimum size of 1/4-acre and occupying a minimum or 5 percent of the area adjacent to the harvest RMZ
	Non-trout lakes and open-water wetlands < 10 acres in size: Even-age management	50	25 - 80 ft ² /acre	Relatively even distribution of residual basal area or gaps and clumps	Concentrate leave trees adjacent to the RMZ in clumps, strips, or islands with a minimum size of 1/4-acre and occupying a minimum or 5 percent of the area adjacent to the harvest RMZ
	Non-trout perennial and intermittent streams > 10 feet wide: Uneven-age management	200	80 ft ² /acre	Relatively even distribution of residual basal area or gaps and clumps	---
	Non-trout perennial and intermittent streams 3 - 10 feet wide: Uneven-age management	100	80 ft ² /acre	Relatively even distribution of residual basal area or gaps and clumps	---
	Non-trout perennial streams < 3 feet wide: Uneven-age management	50	80 ft ² /acre	Relatively even distribution of residual basal area or gaps and clumps	---
	Non-trout intermittent streams < 3 feet wide: Uneven-age management	Not applicable	Not applicable	---	Protect the forest floor through use of a filter strip.

Table 4-1. Summary of timber harvesting riparian guidelines in the United States					
State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
	Non-trout lakes and open-water wetlands: Uneven-age management	200	80 ft ² /acre	Relatively even distribution of residual basal area or gaps and clumps	—
Mississippi	Perennial streams	30	50 ft ² /acre	Harvesting trees on the edge of a stream channel must minimize impact to the stream bank.	Widths should be increased for slopes exceeding 5 percent.
	Intermittent streams	30	Not specified. Must maintain water quality.	Harvesting trees on the edge of a stream channel must minimize impact to the stream bank.	Experience and judgment dictate whether widths should be increased under certain conditions.
Missouri	Perennial and intermittent streams, caves, springs, and lakes	Primary strip: 25 feet Secondary strip: Twice the slope percentage of the surrounding land	60 ft ² /acre	Primary strip: Logs must be removed using a cable skidder. Avoid use of wheeled or tracked equipment. Secondary strip: Careful use of wheeled or tracked equipment	—

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
Montana	Perennial and intermittent streams, lakes, reservoirs, springs, and seeps	50 feet from the ordinary high-water mark	Not specified	Use directional felling. Limb or top trees above the high-water mark. Do not operate equipment on stream banks. Suspend the lead end of a log during skidding whenever possible. Use cable skidders when ground-based equipment is employed.	Width extends beyond 50 feet to include wetlands along the stream bottom and in areas of steep slopes or erosive soils. Leave hardwoods, unmerchantable conifers, snags, and defective and submerchantable trees.
Nebraska	Perennial streams	50	Not specified	Cable logs out of management zone.	Streams 20 feet and wider have a wider management zone. If the width is 20 - 40 feet, width is 75 feet. For streams wider than 40 feet, the width is 200 feet. Trees growing on the stream bank should not be harvested. Use single-tree selection (not clearcutting) when harvesting cottonwood along major streams.
Nevada	Perennial streams, lakes, and reservoirs	200	50 percent of the shade producing canopy	Directionally fell trees away from the water's edge. No skidding equipment allowed within the management zone.	---
New Hampshire ⁴	Intermittent streams: Recommended	Management zone: 100	70 percent crown closure or full stocking	---	Manage using an uneven-aged system

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
	First and second order streams: Legally required	Management zone: 50	70 percent crown closure or full stocking	---	Manage using an uneven-aged system
	First and second order streams: Recommended	Management zone: 100	70 percent crown closure or full stocking	---	Manage using an uneven-aged system
	Third order streams: Legally required	Management zone: 50	70 percent crown closure or full stocking	---	Manage using an uneven-aged system
	Third order streams: Recommended	No-harvest zone: 25 Management zone: 300	70 percent crown closure or full stocking within the management zone	---	Manage using an uneven-aged system
	Fourth order and larger streams: Legally required	Management zone: 150	70 percent crown closure or full stocking	---	Manage using an uneven-aged system
	Fourth order and larger streams: Recommended	No-harvest zone: 25 Management zone: 600	70 percent crown closure or full stocking within the management zone	---	Manage using an uneven-aged system
	Ponds < 10 acres: Legally required	Management zone: 50	70 percent crown closure or full stocking	---	Manage using an uneven-aged system
	Ponds < 10 acres: Recommended	Management zone: 100	70 percent crown closure or full stocking	---	Manage using an uneven-aged system

Table 4-1. Summary of timber harvesting riparian guidelines in the United States					
State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
	Great ponds > 10 acres: Legally required	Management zone: 150	70 percent crown closure or full stocking	---	Manage using an uneven-aged system
	Great ponds > 10 acres: Recommended	No-harvest zone: 25 Management zone: 300	70 percent crown closure or full stocking within the management zone	---	Manage using an uneven-aged system
	Non-forested wetland < 10 acres: Recommended	Management zone: 100	70 percent crown closure or full stocking	---	Manage using an uneven-aged system
	Non-forested wetland > 10 acres: Recommended	No-harvest zone: 25 Management zone: 300	70 percent crown closure or full stocking within the management zone	---	Manage using an uneven-aged system
New Jersey	Perennial and intermittent streams, ponds, lakes, and marshes	25 feet on slightly erodible soils and 50 feet on severely erodible soils	Not specified	Limit equipment use within the management zone.	Widths should be increased for slopes exceeding 10 percent. Protect trees that provide streambank stabilization and shade.
New Mexico	Streams	Not specified	Protect the shading and filtering effects provided by overstory trees and understory stream bank vegetation	Directionally fell trees away from the stream. Skid trees away from streams.	---

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
New York	Perennial streams, ponds, and marshes	50	Not specified.	Directionally fell trees so tops land away from a stream. Keep skidders at least 50 feet from the water. Winch logs out of the management zone. Keep skidders at least 100 feet away from the water when slope exceeds 10 percent.	Avoid cutting trees within 10 feet of the stream bank.
North Carolina	Perennial and intermittent streams and other perennial water bodies	50	75 percent of the pre-harvest shade on the stream channel	Directionally fell trees away from the water body. Timber must be removed by a cable skidder that cannot enter the management zone.	Width increases adjacent to perennial trout streams where for slopes exceeding 5 percent.
North Dakota	Perennial and intermittent streams	Stream width < 20 feet: 60 feet Stream width 20-40 feet: 75 feet Stream width > 40 feet: 150 feet	Not specified. Remove only problem trees within the first 15 feet from the ordinary-high water mark.	Directionally fell trees away from water. Suspend the lead end of logs during skidding whenever possible. Do not operate equipment on streambanks.	Widths should be increased for slopes exceeding 10 percent. Retain trees necessary for bank stabilization.

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting¹	Minimum residual basal area	Operational considerations	Additional considerations
	Lakes	60	Not specified. Remove only problem trees within the first 15 feet from the ordinary-high water mark.	Directionally fell trees away from water. Suspend the lead end of logs during skidding whenever possible. Do not operate equipment on streambanks	Widths should be increased for slopes exceeding 10 percent. Retain trees necessary for bank stabilization.
Ohio	Perennial and intermittent streams	25	Not specified. A light cut can be performed	No skidding allowed in management zone	Retain all trees casting shade on the stream
Oklahoma	Streams	50	Landowner's objectives	Keep skidders away from streambanks. Keep heavy equipment out during wet conditions. Use a cable skidder if it is available.	Widths should be increased for slope and other site conditions.
Oregon	Perennial and intermittent streams, lakes, and wetlands (including seeps and springs)	See Attach. 1	See Attach. 1	See Attach. 1	See Attach. 1

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
Pennsylvania	Temporary ponds and spring seeps	50	50 percent crown cover	Directionally fell trees away from ponds and seeps. Do not remove trees within 10 feet of seep or pond banks. Winch logs out of the zone rather than enter it with equipment. Avoid making ruts deeper than 6 inches within 200 feet of a vernal pond.	---
	Perennial streams	50	50 percent crown cover	Directionally fell trees away from streams. Use cable skidders when possible. Minimize skid trails by maximizing cable length.	---
Rhode Island	Streams	15	Not specified	No soil disturbance from harvesting equipment within management zone.	---
	Wetlands	Not specified	60 percent stocking	---	Width is related to slope, depth to water table, soil type, type of vegetation, and intensity of management in surrounding areas
	Vernal pools	Primary zone: 25 feet Secondary zone: 25 feet	Primary zone: No harvesting allowed Secondary zone: 60 percent stocking	Avoid making ruts greater 6 inches deep within 200 feet of the vernal pool.	---

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
South Carolina	Perennial streams	40 feet in primary zone.	50 ft ² /acre evenly spaced	Directionally fell trees away from the stream.	Where slope is at least 5 percent, the width increases in a secondary zone by 40 feet (5 - 20 percent slope), 80 feet (21 - 40 percent slope), and 120 feet (> 40 percent slope). All silvicultural systems are suitable and more mineral soil exposure is allowed within the secondary zone.
	Intermittent streams	40 feet in primary zone.	No minimum as long as filter strip is maintained.	Directionally fell trees away from the stream.	Where slope is at least 5 percent, the width increases in a secondary zone by 40 feet (5 - 20 percent slope), 80 feet (21 - 40 percent slope), and 120 feet (> 40 percent slope). All silvicultural systems are suitable and more mineral soil exposure is allowed within the secondary zone.
	Trout streams	40 feet where the slope is less than 5 percent and 80 feet elsewhere	No minimum. Maintain a shade cover.	Directionally fell trees away from the stream.	Where slope is at least 5 percent, the width increases in a secondary zone by 40 feet (5 - 20 percent slope), 80 feet (21 - 40 percent slope), and 120 feet (> 40 percent slope). All silvicultural systems are suitable and more mineral soil exposure is allowed within the secondary zone.
	Ephemeral streams	Not specified	Not specified	---	Protect the forest floor through use of a filter strip.
South Dakota	All water bodies	50	Hardwoods, unmerchantable timber	Directionally fell trees away from the water body	---

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
Tennessee	Perennial, intermittent, and ephemeral streams	25	50 percent of the tree crown canopy that cast shade on streams	Avoid using equipment within the zone. When possible, remove logs by winching them out. Harvesting should be stopped or delayed when wheel ruts greater than 10 inches deep develop.	Widths should be increased for slope. From the base width of 25 feet at 0 percent slope, width increases by 20 feet for every 10 percent increase in slope. Do not harvest trees on the banks or channels if removal would destabilize the soil.
Texas	Perennial and intermittent streams, lakes, ponds, naturally flowing springs, and reservoirs	50	50 percent of the original canopy	---	---
Utah	Perennial and intermittent streams or other bodies of water used for domestic water supply and/or spawning, rearing, or migration of fish. Perennial streams that contribute significant flow to downstream fisheries	75 feet from the ordinary high-water mark	Avoid clearcutting	Avoid driving heavy equipment within the zone. Use directional felling or a boom feller-buncher. Use cable skidders.	Increase width 100 feet when slope exceeds 35 percent. Establish undisturbed strip 15 feet wide from ordinary high water mark. Leave a diversity of tree species and age classes. Promote the retention of long-lived species along perennial streams. Leave an adequate number of mature trees to avoid potential regeneration problems.

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
	All other intermittent or perennial streams and lakes or ponds > 0.10 acres that do not support fish or provide domestic water supply	35 feet from the ordinary high-water mark	Avoid clearcutting	Avoid driving heavy equipment within the zone. Use directional felling or a boom feller-buncher. Use cable skidders.	Increase width 50 feet when slope exceeds 35 percent. Establish undisturbed strip 15 feet wide from ordinary high water mark. Leave a diversity of tree species and age classes. Promote the retention of long-lived species along perennial streams. Leave an adequate number of mature trees to avoid potential regeneration problems.
Vermont	Streams and lakes	50	Not specified. Only light thinning or selection harvesting can occur so that breaks made in the canopy are minimal and a continuous cover is maintained.	—	Add 20 feet of width for each additional 10 percent of side slope
Virginia	Warm water perennial streams and wetlands	50	50 percent of the crown cover	Limited to cable or winch systems.	Widths should be increased for slopes exceeding 10 percent. Partial clearcutting is not acceptable.
	Cold water (trout) perennial streams	60	50 percent of the crown cover	Limited to cable or winch systems.	Widths should be increased for slopes exceeding 10 percent. Partial clearcutting is not acceptable.
	Municipal water supplies (streams or lakes)	100	50 percent of the crown cover	Limited to cable or winch systems.	Widths should be increased for slopes exceeding 10 percent. Partial clearcutting is not acceptable.
	Intermittent stream	25	50 percent of the crown cover	Limited to cable or winch systems.	Widths should be increased for slopes exceeding 10 percent. Partial clearcutting is not acceptable.

Table 4-1. Summary of timber harvesting riparian guidelines in the United States

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
Washington	Streams, lakes, and wetlands (including bogs)	See Attach. 2	See Attach. 2	See Attach. 2	See Attach. 2
West Virginia	Perennial and intermittent streams; all lakes, ponds, perennial flowing natural springs, and all springs and reservoirs serving as a domestic water supply	100	No-harvest or light-harvest as long as adequate shading of the water body is retained.	Limit equipment operation.	---
	Ephemeral streams	25	No-harvest or light-harvest as long as adequate shading of the water body is retained.	Limit equipment operation.	---
Wisconsin	Lakes and navigable perennial streams	100 feet from ordinary high-water mark	60 ft ² /acre of basal area evenly distributed	Do not operate ground-based equipment within 50 feet of the ordinary high-water mark.	Selective harvesting at intervals of 10 years or longer. Promote long-lived tree species appropriate to the site
	Navigable intermittent streams	35 feet from ordinary high-water mark	60 ft ² /acre of basal area evenly distributed	Operate ground-based equipment within 15 feet of the ordinary high-water mark only when the ground is frozen or dry.	Selective harvesting at intervals of 10 years or longer. Promote long-lived tree species appropriate to the site.

State	Water bodies addressed	Minimum width (ft) for timber harvesting ¹	Minimum residual basal area	Operational considerations	Additional considerations
	Non-navigable perennial and intermittent streams	35 feet from ordinary high-water mark	—	Operate ground-based equipment within 15 feet of the ordinary high-water mark only when the ground is frozen or dry.	—
Wyoming	Perennial and intermittent streams, lakes, reservoirs, springs, and seeps	100	Not specified	Directionally fell trees away from the stream. Limb or top trees above the high-water mark. Do not operate equipment on stream banks. Suspend the lead end of a log during skidding whenever possible. Use cable skidders when ground-based equipment is employed.	Widths should be increased for slopes exceeding 20 percent. Operations on slopes greater than 40 percent need special consideration. Leave hardwoods, unmerchantable conifers, snags, and defective and submerchantable trees.

¹Unless specified otherwise, the width represents the minimum width in feet from the water's edge landward. The width is applied on both sides of streams.

²Alaska has identified Type A, Type B, and Type C water bodies. A Type water body is Anadromous stream or river with average gradient of 8 percent or less, banks held in place by vegetation, channels that are not incised, and a substrate composed of rubble, gravel, sand, or silt; anadromous wetlands and lakes. A Type B water body is an anadromous fish stream or river having an average gradient of 8 percent or less, a channel that is incised and contained by the geomorphology and not be vegetation, and a substrate that ranges from rubble to bedrock. A Type C water body is a stream that is tributary to anadromous waters and that is incised greater than 28 degrees, has an average gradient of greater than 8 percent, is narrower than 20 feet between ordinary high water marks, has a substrate of rubble and bedrock, and is a mountain slope stream at the upper end of the watershed. A Type D water body is one that is not anadromous, that is tributary to a Type A or Type B water body, and that has a gradient greater than 12 percent.

³Georgia guidelines for lakes, ponds, and other bodies of flowing water are the same as for perennial streams if those other water bodies could potentially move sediments or other pollutants off-site. Seeps and springs are treated as perennial streams if they flow all year long or intermittent otherwise. Sloughs are treated as perennial or intermittent streams if they could potentially move sediment or other pollutants off-site. For governmentally owned impoundments or intakes occurring within a watershed that is 100 square miles or larger, the management width becomes 150 feet adjacent to all reservoirs and 100 feet adjacent to all perennial streams

within a seven-mile radius above intakes. For governmentally owned impoundments or intakes occurring within a watershed that is smaller than 100 square miles, the management width is 100 feet adjacent to perennial streams within a seven-mile radius and 50 feet adjacent to perennial streams above the seven-mile radius.

⁴New Hampshire has both Legally Required and Recommended guidelines. While their Legally Required guidelines are designed to address water quality protection, the Recommended guidelines also address wildlife habitat protection and scenic objectives. The No-harvest zone, which is only noted for the Recommended guidelines, is the area directly adjacent to the water body where no cutting should take place. Where a No-harvest Zone is identified, the associated Management Zone begins directly adjacent to the No-harvest Zone. Where a No-harvest Zone is not identified, the Management Zone is the area directly adjacent to the water body. This summary only reports values where there are Legally Required and/or Recommended guidelines for a water body.

Table 4-2. Summary of timber harvesting riparian guidelines in California.

Water class characteristics or key indicator of beneficial use	1) Domestic supplies, including springs, on- site and/or within 100 feet downstream of the operations area and/or 2) Fish always or seasonally present on-site, includes habitat to sustain fish migration and spawning		1) Fish always or seasonally present off-site within 1000 feet downstream and/or 2) Aquatic habitat for moonfish aquatic species 3) Excludes Class III waters that are tributary to Class I waters.		No aquatic life present, watercourse showing evidence of being capable of sediment transport to Class I and II waters under normal high water flow conditions after completion of timber operations.		Man-made watercourses, usually downstream, established domestic, agricultural. Hydroelectric supply or other beneficial use.	
Water class	Class I		Class II		Class III		Class IV	
Slope class (percent)	Width (feet)	Protection measures ¹	Width (feet)	Protection measures ¹	Width (feet)	Protection measures ^{1,2}	Width (feet)	Protection measures ^{1,2}
< 30	75	BDG	50	BEI	CFH		CFI	
30 - 50	100	BDG	75	BEI	CFH		CFI	
> 50	150 ³	ADG	100 ⁴	BEI	CFH		CFI	

¹Protection measures:

“A” — Watercourse and lake protection zone shall be clearly identified on-the-ground by the Registered Professional Forester who prepared the plan, or his designee, with paint, flagging, or other suitable means, prior to the preharvest inspection.

“B” — Watercourse and lake protection zone shall be clearly identified on-the-ground by the Registered Professional Forester who prepared the plan, or his designee, with paint, flagging, or other suitable means, prior to the start of timber operations.

“C” — In site-specific cases, the Registered Professional Forester may provide in the plan, or the Director of Forestry and Fire Protection may require, that the watercourse and lake protection zone be clearly identified on-the-ground with flagging or by other suitable means prior to the start of timber operations.

“D” — To ensure retention of shade canopy filter strip properties of the watercourse and lake protection zone and the maintenance of a multi-storied stand for protection of specific values (i.e., water temperature control, streambed and flow modification by large woody debris, filtration of organic and inorganic material, upslope stability, bank and channel stabilization, vegetation structure diversity for fish and wildlife habitat), a base mark below the outline of residual or harvest trees within the zone shall be done in advance of preharvest inspection by the registered professional forester who prepared the plan, or his designee. Sample marking is satisfactory in those cases where the Director of Forestry and Fire Protection determines it is adequate for plan evaluation. When sample marking has been used, all marking shall be done in advance of falling operations within the watercourse and lake protection zone.

“E” — To ensure retention of shade canopy filter strip properties and the maintenance of wildlife values (i.e., vertical diversity; migration corridor; nesting, roosting, and escape; food abundance; microclimate modification; snags; surface cover), a base mark shall be placed below the cutline of the residual or harvest trees within the zone and shall be done in advance of timber falling operations by the registered professional forester who prepared the plan, or his designee.

“F” — Residual or harvest tree marking within the watercourse and lake protection zone may be stipulated in the timber harvest plan by the registered professional forester or required by the Director of Forestry and Fire Protection in site-specific cases to ensure retention of filter strip properties or to maintain soil stability of the zone. The registered professional forester shall state in the timber harvesting plan if marking was used in these zones.

“G” — To protect water temperature, filter strip properties, upslope stability, and fish and wildlife values, at least 50 percent of the overstory and 50 percent of the understory canopy covering the ground and adjacent waters shall be left in a well distributed multi-storied stand composed of a diversity of species similar to that found before the start of operations. The residual overstory canopy shall be composed of at least 25 percent of the existing overstory conifers. Species composition may be adjusted consistent with the above standard to meet on-site conditions when agreed to in the timber harvesting plan by the registered professional forester and the Director of Forestry and Fire Protection.

“H” — At least 50 percent of the understory vegetation present before timber operations shall be left living and well distributed within the watercourse and lake protection zone to maintain soil stability. This percentage may be adjusted to meet on-site conditions when agreed to in the timber harvesting plan by the registered professional forester and the Director of Forestry and Fire Protection. Unless required by the Director of Forestry and Fire Protection, this shall not be construed to prohibit broadcast burning with a project type burning permit for site preparation.

“I” — To protect water temperature, filter strip properties, upslope properties, and fish and wildlife values, at least 50 percent of the total canopy covering the ground shall be left in a well-distributed multi-storied stand configuration composed of a diversity of species similar to that found before the start of operations. The residual overstory canopy shall be composed of at least 25 percent of the existing overstory conifers. Due to variability in Class II watercourses these percentages and species composition may be adjusted to meet on-site conditions when agreed to by the Registered Professional Forester and the Director of Forestry and Fire Protection in the timber harvesting plan.

²The protection and watercourse and lake protection zones for Class III and IV waters shall prevent the degradation of the downstream beneficial use of water and shall be determined on a site-specific basis. (1) When necessary to protect the beneficial use of water, the registered professional forester shall designate and the Director of Forestry and Fire Protection may require a watercourse and lake protection zone or equipment limitation zone for Class III and Class IV waters. Required protection measures may include surface cover retention, equipment limitations, and timber falling limitations. (2) The width of the watercourse and lake protection zone for Class III and IV waters shall be determined from on-site inspection. Minimum protection measures required when Class III and IV protection zones are necessary are contained in Table 2. (3) Soil deposited during timber operations in a Class III watercourse other than that at a temporary crossing shall be removed and debris deposited during timber operations shall be removed or stabilized before the conclusion of timber operations, or before October 15. Temporary crossings shall be removed before the winter period, or as approved by the Director of Forestry and Fire Protection. (4) When approved by the Director of Forestry and Fire Protection on an individual plan basis, Class IV waters shall be exempted from the required protection when such protection is inconsistent with the management objectives of the owner of the manmade watercourse.

³Subtract 50 feet width for cable yarding operations.

⁴Subtract 25 feet width for cable yarding operations.

Objective 5: Recommendations for Further Study and Next Steps

While compiling information about how a timber harvester's operational efficiency, labor and capital requirements, cost structure, and profitability are impacted by applying forest management guidelines (Objective 1), who pays for guideline implementation and the extent to which those costs are passed on to landowners and wood consuming mills (Objective 2), and how states and Canadian provinces encourage the use of timber harvesting and forest management practices (Objective 3), gaps in the knowledge and areas deserving more study were identified. Follow-up studies and next steps are described below.

Impact of Forest Management Guidelines on Timber Harvesters (Objective 1)

Because of the variability in logging businesses (e.g., differences in types of equipment, level of mechanization, labor requirements and associated benefits, equipment age, productivity) and site and stand conditions (e.g., terrain, soils, timber) across Minnesota, it is not possible to define one value which represents the total additional cost of guideline application under all situations. To get a true picture of the costs to logging contractors in Minnesota, very detailed on-the-ground study of individual sites and practices is necessary.

While there are a number of ways to approach a more detailed study, one is to use the results from the state's implementation monitoring program to first identify the guidelines which occur most frequently. Detailed time and motion studies could then be conducted to identify the marginal cost of applying each guideline. Given the variability in logging businesses and site and stand conditions, a relatively large amount of data would need to be collected across a range of logging businesses and site, stand, and seasonal conditions. Results could then be used to develop spreadsheet tools or regression models that would predict guideline application costs across a range of equipment and operating conditions.

To properly estimate real Minnesota harvest cost differences attributable to the employment of particular harvest practices, a study would have to examine costs incurred by each of several categories of loggers on each of several categories of land (terrain, species) under both frozen and non-frozen soil conditions for each of the practices in question. At the same time, analysts would have to estimate how many acres of land would be subject to each of the practices and which category of logger would be expected to harvest each category of land. From these two complex—and probably expensive—studies, the analyst could then calculate a land/logger/practice weighted average cost of the voluntary guidelines compliance.

Who Pays for Implementation and How are Those Costs Passed Along (Objective 2)

Were budget and time no obstacles, here are some elements of a strong structural study of Minnesota's forest industry. One would first create a sample of markets across the region stratified by mill, wood type, major landscape, etc. The proper stratification would depend upon

the results of yet another study, one that thoroughly monitored both the industry and the landscape, especially with respect to the need for practices and to actual current practices.

For each sampled firm/site, we would collect complete descriptions of both their physical and economic characteristics. For a selected set of loggers, we would collect complete harvest and transport cost data, as well as volume and price data for all sales. For one or more markets we would try to assemble a complete-as-possible description of all timber market activity over time—all sales, volumes, prices, practices, costs, destinations, etc.

Even all this, however, would not get us to a point where we could easily generalize about cost incidence. In order to scale up the results of one or a few markets to all markets, we would need considerable assurance that the activities we observed in detail are representative of the entire set of Minnesota timber markets. A careful sampling strategy can help here, but there are so many factors that influence the behaviors of market participants that one can never be sure.

Even if the State were to invest substantially in a forest industry performance monitoring system such as that described below, it is unlikely that we would ever be able to see cost-sticking to any extent, even if it exists. There is simply too much "noise" for our statistics-based market evaluation tools to penetrate. And, of course, even if we could observe instances of sticking, we may not be able to determine if these were avoidable and, hence, perhaps less deserving of policy attention.

Next steps

The Council might proceed along three major lines explored in this report. First, it could commission further studies, elaborating on those highlighted and sketched above. In particular, there is a need for consistent field-based engineering studies of a range of practices on a range of typical Minnesota timber landscapes and stands. There presently exists too little Minnesota-specific information on which to base targeted policies.

The second phase is monitoring what is going on now. The need for this is highlighted throughout the report. We know surprisingly little about Minnesota's forest industry as practiced, especially on private lands. We also are unprepared to answer even basic questions such as how much timber is being cut on environmentally sensitive lands.

The third phase, policy development, depends in part on the Council's posture toward the first two. If it elects to pursue them extensively, it will find itself—at some future time—with information suitable to administer a reasonably fine tuned program. If it instead decides the cost of this additional information is too expensive—and it will be expensive—then it can design policies that do not require so much information, such as those discussed in objective 2.

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Attachment 1: Timber Harvesting Riparian Guidelines in Oregon

*Oregon Department of Forestry
Forest Practice Administrative Rules*

DIVISION 630 -- HARVESTING

629-630-000	Purpose
629-630-100	Skidding and yarding Practices
629-630-200	Landings
629-630-300	Drainage Systems
629-630-400	Treatment of Waste Materials
629-630-500	Harvesting on High Risk Sites in Western Oregon
629-630-600	Felling; Removal of Slash
629-630-700	Yarding' Cable Equipment Near Waters of the State
629-630-800	Yarding; Ground-based Equipment Near Waters of the State

629-630-000 - Purpose

- (1) Harvesting of forest tree species is an integral part of forest management by which wood for human use is obtained and by which forests are established and tended.
- (2) Harvesting operations result in a temporary disturbance to the forest environment.
- (3) The purpose of the harvesting rules is to establish standards for forest practices that will maintain the productivity of forestland, minimize soil and debris entering waters of the state, and protect wildlife and fish habitat.
- (4) OARs (Oregon Administrative Rules) 629-630-000 through 629-630-800 shall be known as the harvesting rules.
- (5) The harvesting rules shall apply to all forest practices regions unless otherwise indicated.

629-630-100 - Skidding and Yarding Practices

- (1) For each harvesting operation, operators shall select a logging method and type of equipment appropriate to the given slope, landscape, and soil properties in order to minimize soil deterioration and to protect water quality.
- (2) Operators shall avoid ground based yarding on unstable, wet, or easily compacted soils and on slopes which exceed 35 percent unless operations can be conducted without damaging soil productivity through soil disturbance, compaction or erosion.
- (3) Operators shall locate skid trails where sidecasting is kept to a minimum.

(4) Operators shall locate skid trails on stable areas so as to minimize the risk of material entering waters of the state.

(5) Operators shall avoid excavating skid trails on slumps or slides.

(6) Operators shall limit cable logging to uphill yarding whenever practical. When yarding across high risk sites in the Northwest Oregon Region or Southwest Oregon Region, or when downhill cable yarding in any region is necessary, operators shall use a layout and system which minimizes soil displacement.

629-630-200 - Landings

(1) Operators shall minimize the size of landings to that necessary for safe operation.

(2) Operators shall locate landings on stable areas so as to minimize the risk of material entering waters of the state.

(3) Operators shall avoid locating landings in riparian management areas. When no feasible alternative landing locations exist, operators shall obtain prior approval of the State Forester before locating landings in riparian management areas.

(4) Operators shall not incorporate slash, logs, or other large quantities of organic material into landing fills.

(5) Operators shall deposit excess material from landing construction in stable locations well above the high water level.

629-630-300 - Drainage Systems

(1) The purpose of this rule is to provide and maintain a drainage system for each landing, skid trail, and fire trail that will control and disperse surface runoff to minimize sediment entering waters of the state.

(2) Operators shall construct dips, grade reversals or other effective water diversions in skid trails and fire trails as necessary to minimize soil displacement and to ensure runoff water is filtered before entering waters of the state.

(3) Operators shall drain skid trails by water barring or other effective means immediately following completion of the operation and at all times during the operation when runoff is likely.

(4) Operators shall establish effective drainage on landings during and after use.

629-630-400 - Treatment of Waste Materials

(1) Operators shall leave or place all debris, slash, sidecast and other waste material associated with harvesting in such a manner to prevent their entry into waters of the state.

(2) Where sidecast material or exposed soils are potentially unstable or erodible, the operator shall stabilize it by pullback, spreading out, seeding or other effective means.

(3) Operators shall remove from the forest all petroleum product related waste material associated with the operation including, but not limited to, crankcase oil, filters, grease and oil containers.

(4) Operators shall dispose of all other debris such as machine parts, old wire rope, and used tractor tracks so that such materials do not enter waters of the state.

629-630-500 - Harvesting on High Risk Sites in Western Oregon

(1) In the Northwest Oregon and Southwest Oregon regions, operators shall obtain prior approval from the State Forester before conducting harvesting operations on high risk sites.

(2) Written plans, where required for harvesting on high risk sites, will describe how harvesting operations will be conducted to minimize impact upon soil and water resources.

629-630-600 - Felling; Removal of Slash

(1) Operators shall fell, buck, and limb trees in ways that minimize disturbance to channels, soils and retained vegetation in riparian management areas, streams, lakes and all wetlands greater than one-quarter acre, and that minimize slash accumulations in channels, significant wetlands and lakes.

(2) During felling operations operators shall:

(a) Whenever possible, fell all conifer trees away from riparian management areas, streams, lakes and significant wetlands, except for trees felled for approved stream improvement projects.

(b) On steep slopes, use felling practices such as jacking, line pulling, high stumps, whole tree yarding, or stage-cutting as necessary and feasible to prevent damage to vegetation retained in riparian management areas, soils, streams, lakes and significant wetlands.

(c) When hardwoods must be felled into or across streams, lakes or significant wetlands, operators shall:

(A) Buck and yard the trees to minimize damage to beds, banks and retained vegetation.

(B) When it can be done consistently with protecting beds and banks, yard hardwood trees or logs away from the water before limbing.

(3) Operators shall minimize the effects of slash that may enter waters of the state during felling, bucking, limbing or yarding by:

(a) Removing slash from Type F and Type D streams, lakes and significant wetlands as an ongoing process (removal within 24 hours of the material entering the stream) during the harvest operation.

(b) Not allowing slash to accumulate in Type N streams, lakes or wetlands in quantities that threaten water quality or increase the potential for mass debris movement.

(c) Placing any slash that is removed from streams, lakes, or wetlands above high water levels where it will not enter waters of the state.

629-630-700 - Yarding; Cable Equipment Near Waters of the State

(1) Operators shall maintain the purposes and functions of vegetation required to be retained in riparian management areas and minimize disturbance to beds and banks of streams, lakes, all wetlands larger than one-quarter acre, and retained vegetation during cable yarding operations.

(2) Operators shall minimize the yarding of logs across streams, lakes, significant wetlands, and other wetlands greater than one-quarter acre whenever harvesting can be accomplished using existing roads or other practical alternatives.

(3) Operators may use yarding corridors through retained streamside trees as long as the numbers and widths of yarding corridors are minimized. Operators shall obtain prior approval of the State Forester when yarding across streams classified as Type F or Type D, any large or medium Type N streams, lakes, or significant wetlands.

(4) When yarding across Type F or Type D streams, any large or medium Type N streams, lakes, or significant wetlands is necessary, it shall be done by swinging the yarded material free of the ground in the aquatic areas and riparian areas.

(5) Cable yarding across streams classified as small Type N or other wetlands greater than one-quarter acre shall be done in ways that minimize disturbances to the stream channel or wetland and minimize disturbances of retained streamside vegetation.

629-630-800 - Yarding; Ground-based Equipment Near Waters of the State

(1) Operators shall maintain the purposes and functions of vegetation required to be retained in riparian management areas, and minimize disturbances to beds and banks of streams, lakes, all wetlands larger than one-quarter acre, and retained vegetation during ground-based yarding operations.

(2) Operators shall not operate ground-based equipment within any stream channel except as allowed in the rules for temporary stream crossings.

(3) Operators shall minimize the number of stream crossings.

(4) For crossing streams that have water during the periods of the operations, operators shall:

(a) Construct temporary stream crossing structures such as log crossings, culvert installations, or fords that are adequate to pass stream flows that are likely to occur during the periods of use. Structures shall be designed to withstand erosion by the streams and minimize sedimentation.

- (b) Choose locations for temporary stream crossing structures which minimize cuts and fills or other disturbances to the stream banks.
 - (c) Minimize the volume of material in any fills constructed at a stream crossing. Fills over eight feet deep contain such a large volume of material that they can be a considerable risk to downstream beneficial uses should the material move downstream by water. For any fill for a temporary crossing that is over eight feet deep, operators shall obtain approval by the State Forester of a written plan that includes a description of how the fills would be constructed, passage of water, and the length of time the fills would be in the stream.
 - (d) Design temporary structures so that fish movement is not impaired on Type F streams.
 - (e) Remove all temporary stream crossing structures immediately after completion of operations or prior to seasonal runoff that exceeds the water carrying capacity of the structures, whichever comes first. When removing temporary structures, operators shall place fill material where it will not enter waters of the state.
- (5) For stream crossings where the channels do not contain water during the periods of the operations, operators are not required to construct temporary crossings as long as disturbances are no greater than what would occur if structures were constructed. Soil that enters the channels during the yarding operations must be removed after completion of the operation or prior to stream flow, whichever comes first. When removing such materials from the channels, operators shall place the materials in locations where they will not enter waters of the state.
- (6) Operators shall construct effective sediment barriers such as water bars, dips, or other water diversion on stream crossing approaches after completion of operations, or prior to rainy season runoff, whichever comes first.
- (7) Machine activity near (generally within 100 feet) streams, lakes, and other wetlands greater than one-quarter acre shall be conducted to minimize the risk of sediment entering waters of the state and preventing changes to stream channels. Operators shall only locate, construct, and maintain skid trails in riparian management areas consistent with the harvesting rules.
- (8) Operators shall minimize the amount of exposed soils due to skid trails within riparian management area. Except at stream crossings, operators shall not locate skid trails within 35 feet of Type F or Type D streams. Operators shall provide adequate distances between all skid trails and waters of the state to filter sediment from runoff water.
- (9) Operators shall locate and construct skid trails so that when high stream flow occurs water from the stream will not flow onto the skid trail.

**DIVISION 635 - WATER PROTECTION RULES: PURPOSE, GOALS,
CLASSIFICATION AND RIPARIAN MANAGEMENT AREAS**

629-635-000	Riparian Management Goals
629-635-100	Water Protection Rules; Purpose and Goals
629-635-110	Water Protection Rules; Applicability and Monitoring
629-635-120	Watershed Specific Practices for Water Quality Limited Watersheds and Threatened or Endangered Aquatic Species
629-635-130	Written Plans For Streams, Lakes, Wetlands and Riparian Management Areas
629-635-200	Water Classification
629-635-210	Designation of Waters; Notice to Landowners; Reconsideration
629-635-220	Geographic Regions
629-635-300	Riparian Management Areas and Water Quality Protection Measures
629-635-310	Riparian Management Area Widths for Streams
<u>Table 1</u>	Riparian Management Area Widths for Streams of Various Sizes and Beneficial Uses

629-635-000 - Riparian Management Goals

The definitions in OAR 629-600-100 apply to the Water Protection Rules, unless otherwise defined in the specific rules.

629-635-100 - Water Protection Rules; Purpose and Goals

(1) The leading use on private forestland is the growing and harvesting of trees, consistent with sound management of soil, air, water, fish and wildlife resources. There is a unique concentration of public resource values in and near waters of the state because these areas are critical for the overall maintenance of fish and wildlife and for maintaining water quality. Consequently, the policies of the Forest Practices Act, including encouraging economically efficient forest practices, are best achieved by focusing protection measures in riparian management areas.

(2) OAR 629-635-000 through 629-660-060 shall be known as the "water protection rules."

(3) The purpose of the water protection rules is to protect, maintain and, where appropriate, improve the functions and values of streams, lakes, wetlands, and riparian management areas. These functions and values include water quality, hydrologic functions, the growing and harvesting of trees, and fish and wildlife resources.

(4) The water protection rules include general vegetation retention prescriptions for streams, lakes and wetlands that apply where current vegetation conditions within the riparian management area have or are likely to develop characteristics of mature forest stands in a "timely manner." Landowners are encouraged to manage stands within riparian management areas in order to grow trees in excess of what must be retained so that the excess may be harvested.

(5) The water protection rules also include alternative vegetation retention prescriptions for streams to allow incentives for operators to actively manage vegetation where existing vegetation conditions are not likely to develop characteristics of mature conifer forest stands in a "timely manner."

(6) OARs 629-640-400 and 629-645-020 allow an operator to propose site-specific prescriptions for sites where specific evaluation of vegetation within a riparian management area and/or the condition of the water of the state is used to identify the appropriate practices for achieving the vegetation and protection goals.

(7) The overall goal of the water protection rules is to provide resource protection during operations adjacent to and within streams, lakes, wetlands and riparian management areas so that, while continuing to grow and harvest trees, the protection goals for fish, wildlife, and water quality are met.

(a) The protection goal for water quality (as prescribed in ORS 527.765) is to ensure through the described forest practices that, to the maximum extent practicable, non-point source discharges of pollutants resulting from forest operations do not impair the achievement and maintenance of the water quality standards.

(b) The protection goal for fish is to establish and retain vegetation consistent with the vegetation retention objectives described in OAR 629-640-000 (streams), OAR 629-645-000 (significant wetlands), and OAR 629-650-000 (lakes) that will maintain water quality and provide aquatic habitat components and functions such as shade, large woody debris, and nutrients.

(c) The protection goal for wildlife is to establish and retain vegetation consistent with the vegetation retention objectives described in OAR 629-640-000 (streams), OAR 629-645-000 (significant wetlands), and OAR 629-650-000 (lakes) that will maintain water quality and habitat components such as live trees of various species and size classes, shade, snags, downed wood, and food within riparian management areas. For wildlife species not necessarily reliant upon riparian areas, habitat in riparian management areas is also emphasized in order to capitalize on the multiple benefits of vegetation retained along waters for a variety of purposes.

629-635-110 - Water protection Rules; Applicability and Monitoring

(1) Except as described below, the water protection rules shall become effective on September 1, 1994 and shall be applied as follows:

(a) Operations for which a notification has been received after April 22, 1994, must comply with the water protection rules in all portions of the operation that have not been felled prior to September 1, 1994.

(b) Operations for which a notification has been received and a written plan has been approved by the State Forester on or before April 22, 1994, shall continue to comply with the written plan and the rules that were in effective April 21, 1994, through December 31, 1994, unless the operator has requested and the State Forester has approved a change to the water protection rules as allowed in subsection (1)(d).

(c) After December 31, 1994 the water protection rules shall apply fully to all operations.

(d) Operators may request to have the water protection rules apply to an operation at any time following April 22, 1994. The State Forester shall approve such requests so long as the operator will fully apply the water protection rules on the operation.

(2)

(a) For the purposes of the Oregon Forest Practices Act (ORS 527.610 to ORS 527.770, and related sections, Chapter 919, Oregon Laws 1991), Type F and Type D streams classified under OAR 629-635-200 are equivalent to "Class I streams."

(b) For the purposes of ORS 215.730(1)(b)(c), Type N Streams classified under OAR 629-635-200 are equivalent to "Class II streams."

(3)

(a) Monitoring and evaluation of the water protection rules are necessary because of the innovative approach taken in the rules. Monitoring and evaluation are needed to increase the level of confidence of all concerned that the rules will maintain and improve the condition of the riparian vegetation and waters of the state over time.

(b) In cooperation with state and federal agencies, landowners and other interested parties, the department shall conduct monitoring on a continuing basis to evaluate the effectiveness of the water protection rules. The monitoring shall determine the effectiveness of the rules to meet the goals of the Forest Practices Act and the purposes stated in the rules, as well as their workability and operability.

(c) It is the Board of Forestry's intent that the department and its cooperators place a high priority on assessing the monitoring needs and securing adequate resources to conduct the necessary monitoring. The department shall work with its cooperators and the Legislature to secure the necessary resources, funding and coordination for effective monitoring.

(d) The department shall report to the Board of Forestry annually about current monitoring efforts and, in a timely manner, present findings and recommendations

for changes to practices. The Board of Forestry shall consider the findings and recommendations and take appropriate action.

629-635-120 - Watershed Specific Practices for Water Quality Limited Watersheds and Threatened or Endangered Aquatic Species

(1) The objective of this rule is to describe a process for determining whether additional watershed specific protection rules are needed for watersheds that have been designated as water quality limited or for watersheds containing threatened or endangered aquatic species.

(2) The Board of Forestry shall appoint an interdisciplinary task force, including representatives of forest landowners within the watershed and appropriate state agencies, to evaluate a watershed, if the board has determined based on evidence presented to it that forest practices in a watershed are measurably limiting to water quality achievement or species maintenance, and either:

(a) The watershed is designated by the Environmental Quality Commission as water quality limited; or

(b) The watershed contains threatened or endangered aquatic species identified on lists that are adopted by rule by the State Fish and Wildlife Commission, or are federally listed under the Endangered Species Act of 1973 as amended.

(3) The board shall direct the task force to analyze conditions within the watershed and recommend watershed-specific practices to ensure water quality achievement or species maintenance.

629-635-130 - Written Plans For Streams, Lakes, Wetlands And Riparian Management Areas

(1) Operators shall obtain written approval from the State Forester of a written plan before conducting any operation requiring notification under OAR 629-605-140(1) within:

(a) 100 feet of fish use or domestic water use streams (classified as Type F or Type D under OAR 629-635-200), except as described in section (3) of this rule;

(b) 300 feet of significant wetlands; or

(c) 100 feet of large lakes.

(2) In addition to the written plan requirements in OAR 629-605-170(6), operators shall specifically describe in the written plan for operations within 100 feet of domestic water use portions of Type F or D streams the practices and methods that will be used to prevent sediment from entering waters of the state.

(3) The State Forester may waive, in writing, the requirement for a written plan within 100 feet of a Type F or Type D stream, if the State Forester determines the intended forest practice will not

directly affect the physical components of the riparian management area. "Physical components" means materials such as, but not limited to, vegetation, snags, rocks, and soil. "Directly affect" means that physical components will be moved, disturbed, or otherwise altered by the operation activity, even if only temporarily.

(4) Written plans required under section (1) of this rule are subject to the process required for a written plan pursuant to ORS 527.670(8) through (12), and appeal pursuant to ORS 527.700.

(5) The operator shall comply with all provisions of an approved written plan.

629-635-200 - Water Classification

(1) The purpose of this water classification system is to match the physical characteristics and beneficial uses of a water body to a set of appropriate protection measures.

(2) For the purposes of applying appropriate protection measures, waters of the state shall be classified as either streams, wetlands, or lakes.

(3) Streams shall be classified further according to their beneficial uses and size.

(4) Streams shall be classified into one of the following three beneficial use categories:

(a) Streams that have fish use, including fish use streams that have domestic water use, shall be classified as Type F.

(b) Streams that have domestic water use, but not fish use, shall be classified as Type D.

(c) All other streams shall be classified as Type N.

(5) For purposes of classification, a stream is considered to have domestic water use only if a domestic water use permit has been issued by the Oregon Water Resources Department.

(6) A channel is considered to have domestic water use upstream of an intake for the distances indicated below:

(a) For domestic water use that is a community water system (as defined under OAR 333-61-020), Type D classification shall initially apply to the length of stream that was designated as Class I under the classification system that was in effect on April 22, 1994, which is that shown on district water classification maps at the time of adoption of this rule.

(b) For domestic water use that is not a community water system, Type D classification shall be initially applied for the shortest of the following distances:

(A) The distance upstream of the intake to the farthest upstream point of summer surface flow;

(B) Half the distance from the intake to the drainage boundary; or

(C) 3000 feet upstream of the intake.

(c) Type D classification shall apply to tributaries off the main channel as long as the conditions of subsections (6)(a) and (b) of this rule apply.

(7)

(a) A representative of a community water system or other domestic use water permit holder may request that the department designate additional lengths of channels upstream of a domestic water intake or reservoir as Type D. The representative or permit holder must present evidence that the additional stream protection is needed. The department will decide whether or not to extend Type D classification to these other channels based on evidence presented by the requesting party showing that protection measures associated with Type N classification would be insufficient to prevent adverse detrimental temperature increases, turbidity increases, or other adverse water quality changes at the domestic water use intake or reservoir.

(b) The process and criteria described in subsection (7)(a), and the criteria under section (6) of this rule will be used to evaluate the extent of Type D classification for new community water systems.

(c) The department will decide whether or not to extend the length of Type D classification within 30 days of the presentation of evidence.

(8) The domestic water use classification may be waived by the department at the request of a landowner who is the sole domestic water use permit holder for an intake and who owns all the land along upstream channels that would be affected by the classification related to that intake. This waiver shall not affect the classification related to downstream domestic water use intakes.

(9) A stream or lake will be considered to have fish use if inhabited at any time of the year by anadromous or game fish species or fish that are listed as threatened or endangered species under the federal or state endangered species acts.

(10) The fish use classification does not apply to waters where fish were introduced through a fish stocking permit that includes documentation that the stream had no fish prior to stocking.

(11) The department, with assistance from the Oregon Department of Fish and Wildlife, will conduct a comprehensive field survey to identify fish use on non-federal forestland in Oregon. However, this survey will take a number of years to complete. In the interim, the following procedures apply to determining which unsurveyed waters are designated Type F:

(a) The department will assume that waters have fish use if they were Class I under the previous classification system. Waters that were Class I solely because of domestic water use are excluded.

(b) If waters within the boundaries of a proposed operation were not Class I (under the previous classification system) and fish use is unknown, then:

(A) The department will conduct a field survey for fish after a notification of operation is received; or

(B) The department will approximate the upstream extent of fish use in a watershed by considering the connection of the water with downstream waters where fish use is known. Fish use will be assumed to occur upstream of the known fish use until the first natural barrier to fish use is encountered.

(c) Where fish use is unknown, an operator may request that the department conduct a field survey for fish use for reaches of a stream that will be included within an operation that is scheduled to start at least 12 months following the request. The operator shall limit such requests to operations that are part of a landowner's planned harvest schedule and will be conducted during the following year. The department, with assistance from the Oregon Department of Fish and Wildlife when needed, shall attempt to complete such surveys within 12 months following the request. If the survey cannot be conducted in the time indicated, the stream will be considered to have no fish use. However, if the operation has not commenced within six months of the time the operation was scheduled to begin, the stream will again be considered to have unknown fish use.

(d) The department may use other reliable fish survey information when determining whether or not a stream has fish use. This information could include surveys done by landowners, federal or state agencies, universities, or other persons or entities. The department will determine whether such information is reliable.

(12) For each of the three beneficial use categories (Type F, Type D, and Type N), streams shall be categorized further according to three size categories: large, medium, and small. The size categories are based on average annual flow.

(a) Small streams have an average annual flow of two cubic feet per second or less.

(b) Medium streams have an average annual flow greater than two and less than ten cubic feet per second.

(c) Large streams have an average annual flow of ten cubic feet per second or greater.

(13) The assignment of size categories to streams on forestland will be done by the department as follows:

(a) The department will index average annual flow to the upstream drainage area and average annual precipitation. The methodology is described in Technical Note FP1 dated April 21, 1994.

(b) Actual measurements of average annual flow may substitute for the calculated flows described in the technical note.

(c) Any stream with a drainage area less than 200 acres shall be assigned to the small stream category regardless of the flow index calculated in subsection (13)(a).

(14) Wetlands shall be classified further as indicated below.

(a) The following types of wetlands are classified as "significant wetlands":

(A) Wetlands that are larger than eight acres;

(B) Estuaries;

(C) Bogs; and

(D) Important springs in eastern Oregon.

(b) Stream-associated wetlands that are less than eight acres are classified according to the stream with which they are connected.

(c) All other wetlands, including seeps and springs are classified according to their size as either "other wetlands greater than one-quarter acre" or "other wetlands less than one-quarter acre."

(15) Lakes shall be classified further as indicated below:

(a) Lakes greater than eight acres are classified as "large lakes."

(b) All other lakes are classified as "other lakes."

629-635-210 - Designation of Waters; Notice to Landowners; Reconsideration

(1) The State Forester shall maintain a map showing the classification of waters of the state in each Department of Forestry unit office where notice of operations required by ORS 527.670(6) may be submitted. The map shall show streams, lakes, and significant wetlands of known classification within the geographic area of responsibility for that unit office. For streams, the maps shall indicate the size class and, when known, extent of fish use and domestic water use classification.

(2) Once a water of the state has been classified according to OAR 629-635-200, the State Forester shall not change the classification without written notice to the landowners immediately

adjoining the portion(s) of water to be reclassified. Notice to landowners shall include the reason for the change of classification and applicable rules.

(3) Any landowner whose land immediately adjoins the water to be reclassified, any landowner who has received a water right or was granted an easement affecting the water classification, or any state resource agency may request reconsideration of classifications of waters of the state by the department. Such a request shall be in writing and shall identify on a map the portion of the stream or water of the state which should be reconsidered. The request shall present evidence that the current classification is not consistent with OAR 629-635-200 "Water Classification."

(4) The department shall have up to 14 days to provide a final decision on a request for reconsideration of water classification. Until such a decision is provided, operators shall conduct any operation based upon the most protective potential water classification.

629-635-220 - Geographic Regions

For the purposes of assigning protection measures to waters of the state, seven geographic regions have been delineated for forested areas within the state. The boundaries and names of the geographic regions are displayed in [Figure 1](#). Precise boundaries are found on maps at department field offices. Geographic regions are not "forest regions" established pursuant to ORS 527.640(1).

629-635-300 - Riparian Management Areas and Water Quality Protection Measures

(1) Riparian management area widths are designated to provide adequate areas along streams, lakes, and significant wetlands to retain the physical components and maintain the functions necessary to accomplish the purposes and to meet the protection objectives and goals for water quality, fish, and wildlife set forth in OAR 629-635-100.

(2) Specified protection measures, such as for site preparation, yarding and stream channel changes, are required for operations near waters of the state and within riparian management areas to maintain water quality.

(3)

(a) Operators shall apply the specified water quality protection measures and protect riparian management areas along each side of streams and around other waters of the state as described in OAR 629-635-310 through 629-660-060.

(b) Operators may vary the width of the riparian management area above or below the average specified width depending upon topography, operational requirements, vegetation, fish and wildlife resources and water quality protection as long as vegetation retention and protection standards are met. However, the average width of the entire riparian management area within an operation must equal or exceed the required width.

629-635-310 - Riparian Management Area Widths for Streams

(1)

(a) The riparian management area widths for streams are designated for each stream type as shown in [Table 1](#).

(b) Except as indicated in section (2), operators shall measure the riparian management area width as a slope distance from the high water level of main channels.

(c) Notwithstanding the distances designated in subsection (1)(a), where wetlands or side channels extend beyond the designated riparian management area widths, operators shall expand the riparian management area as necessary to entirely include any stream-associated wetland or side channel plus at least 25 additional feet. This provision does not apply to small Type N streams.

(2) In situations where the slope immediately adjacent to the stream channel is steep exposed soil, a rock bluff or talus slope, operators shall measure the riparian management area as a horizontal distance until the top of the exposed bank, bluff or talus slope is reached. From that point, the remaining portion of the riparian management area shall be measured as a slope distance.

Table 1. Riparian Management Area Widths for Streams of Various Sizes and Beneficial Uses (OAR 629-635-310.)

	Type F	Type D	Type N
Large	100 feet	70 feet	70 feet
Medium	70 feet	50 feet	50 feet
Small	50 feet	20 feet	Apply specified water quality protection measures, and see 629-640-200.

DIVISION 640 -- WETLANDS AND RIPARIAN MANAGEMENT AREAS

629-640-000	Vegetation Retention Goals for Streams; Desired Future Conditions
629-640-100	General Vegetation Retention Prescription for Type F Streams
629-640-110	Live Tree Retention Credit for Improvement of Type F Streams
629-640-200	General Vegetation Retention Prescription for Type D and Type N Streams
629-640-300	Alternative Vegetation Retention Prescriptions
629-640-400	Site Specific Vegetation Retention Prescriptions for Streams and Riparian Management Areas
629-640-500	Reforestation Within Stream Riparian Management Areas
Table 2	General Prescription for Type F Streams: Streamside Tree Retention for Harvest Type 2 or 3 Units (OAR 629-640-100)
Table 3	General Prescription for Type F Streams: Streamside Tree Retention for Harvest Type 1, Partial Harvest, or Thinning Units (OAR 629-640-100)
Table 4	Basal Area for Various Diameter Classes (OAR 629-640-100)
Table 5	Vegetation Retention for Specified Small Type N Streams (OAR 629-640-200)
Table 6	General Prescription for Type D, and Large and Medium Type N Streams: Streamside Tree Retention for Harvest Type 2, or Type 3 Units (OAR 629-640-200)
Table 7	General Prescription for Type D, and Large and Medium Type N Streams: Streamside Tree Retention for Harvest Type 1, Partial Harvest, or Thinning (OAR 629-640-200)

629-640-000 - Vegetation Retention Goals for Streams; Desired Future Conditions

(1) The purpose of this rule is to describe how the vegetation retention measures for streams were determined, their purpose and how the measures are implemented. The vegetation retention requirements for streams described in OAR 629-640-100 through OAR 629-640-400 are designed to produce desired future conditions for the wide range of stand types, channel conditions, and disturbance regimes that exist throughout forestlands in Oregon.

(2) The desired future condition for streamside areas along fish use streams is to grow and retain vegetation so that, over time, average conditions across the landscape become similar to those of mature streamside stands. Oregon has a tremendous diversity of forest tree species growing along waters of the state and the age of mature streamside stands varies by species. Mature streamside stands are often dominated by conifer trees. For many conifer stands, mature stands occur between 80 and 200 years of stand age. Hardwood stands and some conifer stands may become mature at an earlier age. Mature stands provide ample shade over the channel, an abundance of large woody debris in the channel, channel-influencing root masses along the edge of the high water level, snags, and regular inputs of nutrients through litter fall.

(3) The rule standards for desired future conditions for fish use streams were developed by estimating the conifer basal area for average unmanaged mature streamside stands (at age 120) for each geographic region. This was done by using normal conifer yield tables for the average

upland stand in the geographic region, and then adjusting the basal area for the effects of riparian influences on stocking, growth and mortality or by using available streamside stand data for mature stands.

(4) The desired future condition for streamside areas that do not have fish use is to have sufficient streamside vegetation to support the functions and processes that are important to downstream fish use waters and domestic water use and to supplement wildlife habitat across the landscape. Such functions and processes include: maintenance of cool water temperature and other water quality parameters; influences on sediment production and bank stability; additions of nutrients and large conifer organic debris; and provision of snags, cover, and trees for wildlife.

(5) The rule standards for desired future conditions for streams that do not have fish use were developed in a manner similar to fish use streams. In calculating the rule standards, other factors used in developing the desired future condition for large streams without fish use and all medium and small streams included the effects of trees regenerated in the riparian management area during the next rotation and desired levels of instream large woody debris.

(6) For streamside areas where the native tree community would be conifer dominated stands, mature streamside conditions are achieved by retaining a sufficient amount of conifers next to large and medium sized fish use streams at the time of harvest, so that halfway through the next rotation or period between harvest entries, the conifer basal area and density is similar to mature unmanaged conifer stands. In calculating the rule standards, a rotation age of 50 years was assumed for even-aged management and a period between entries of 25 years was assumed for uneven-aged management. The long-term maintenance of streamside conifer stands is likely to require incentives to landowners to manage streamside areas so that conifer reforestation occurs to replace older conifers over time.

(7) Conifer basal area and density targets to produce mature stand conditions over time are outlined in the general vegetation retention prescriptions. In order to ensure compliance with state water quality standards, these rules include requirements to retain all trees within 20 feet and understory vegetation within 10 feet of the high water level of specified channels to provide shade.

(8) For streamside areas where the native tree community would be hardwood dominated stands, mature streamside conditions are achieved by retaining sufficient hardwood trees. As early successional species, the long-term maintenance of hardwood streamside stands will in some cases require managed harvest using site specific vegetation retention prescriptions so that reforestation occurs to replace older trees. In order to ensure compliance with state water quality standards, these rules include requirements in the general vegetation retention prescription to retain all trees within 20 feet and understory vegetation within 10 feet of the high water level of specified channels to provide shade.

(9) In many cases the desired future condition for streams can be achieved by applying the general vegetation retention prescriptions, as described in OAR 629-640-100 and OAR 629-640-200. In other cases, the existing streamside vegetation may be incapable of developing into the future desired conditions in a "timely manner." In this case, the operator can apply an alternative

vegetation retention prescription described in OAR 629-640-300 or develop a site specific vegetation retention prescription described in OAR 629-640-400. For the purposes of the water protection rules, "in a timely manner" means that the trees within the riparian management area will meet or exceed the applicable basal area target or vegetation retention goal during the period of the next harvest entry that would be normal for the site. This will be 50 years for many sites.

(10) Where the native tree community would be conifer dominant stands, but due to historical events the stand has become dominated by hardwoods, in particular, red alder, disturbance is allowed to produce conditions suitable for the re-establishment of conifer. In this and other situations where the existing streamside vegetation is incapable of developing characteristics of a mature streamside stand in a "timely manner," the desired action is to manipulate the streamside area and woody debris levels at the time of harvest (through an alternative vegetation retention prescription or site specific vegetation retention prescription) to attain such characteristics more quickly.

629-640-100 - General Vegetation Retention Prescription For Type F Streams

(1)

(a) Operators shall apply the vegetation retention requirements described in this rule to the riparian management areas of Type F streams.

(b) Segments of Type F streams that are different sizes within an operation shall not be combined or averaged together when applying the vegetation retention requirements.

(c) Trees left to meet the vegetation retention requirements for one stream type shall not count towards the requirements of another stream type.

(2) Operators shall retain:

(a) All understory vegetation within 10 feet of the high water level;

(b) All trees within 20 feet of the high water level; and

(c) All trees leaning over the channel.

(3) Operators shall retain within riparian management areas and streams all downed wood and snags that are not safety or fire hazards. Snags felled for safety or fire hazard reasons shall be retained where they are felled unless used for stream improvement projects approved by the State Forester.

(4) Notwithstanding the requirements of section (2) of this rule, vegetation, snags and trees within 20 feet of the high water level of the stream may be felled, moved or harvested as allowed in other rules for road construction, yarding corridors, temporary stream crossings, or for stream improvement.

(5) Operators shall retain at least 40 live conifer trees per 1000 feet along large streams and 30

live conifer trees per 1000 feet along medium streams. This includes trees left to meet the requirements described in section (2) of this rule. Conifers must be at least 11 inches DBH for large streams and 8 inches DBH for medium streams to count toward these requirements.

(6) Operators shall retain trees or snags six inches or greater DBH to meet the following requirements (this includes trees left to meet the requirements of sections (2) and (5) of this rule):

(a) If live conifer tree basal area in the riparian management area is greater than the standard target shown in [Table 2](#) where the harvest unit will be a harvest type 2 or type 3 unit (as defined by ORS 527.620(2)), or [Table 3](#) where the harvest unit will be a harvest type 1, partial harvest, or thinning, operators shall retain live conifer trees of sufficient basal area to meet the standard target.

(b) If live conifer tree basal area in the riparian management area is less than the standard target (as shown in [Table 2](#) where the harvest unit will be a harvest type 2 or type 3 unit, or [Table 3](#) where the harvest unit will be a harvest type 1, partial harvest, or thinning) but greater than one-half the standard target shown in [Table 2](#), operators shall retain all live conifer trees six inches DBH or larger in the riparian management area (up to a maximum of 150 conifers per 1000 feet along large streams, 100 conifers per 1000 feet along medium streams, and 70 conifers per 1000 feet along small streams).

(c) If live conifer tree basal area in the riparian management area is less than one-half the standard target shown in [Table 2](#):

(A) Operators may apply an alternative vegetation retention prescription as described in OAR 629-640-300 where applicable, or develop a site specific vegetation retention prescription as described in OAR 629-640-400; or

(B) Operators shall retain all conifers in the riparian management area and all hardwoods within 50 feet of the high water level for large streams, within 30 feet of the high water level for medium streams, and within 20 feet of the high water level for small streams.

(7) In the Coast Range, South Coast, Interior, Western Cascade, and Siskiyou geographic regions, hardwood trees and snags six inches or greater DBH may count toward the basal area requirements in subsection (6)(a) of this rule as follows:

(a) All cottonwood and Oregon ash trees within riparian management areas that are beyond 20 feet of the high water level of large Type F streams, may count toward the basal area requirements.

(b) Up to 10 percent of the basal area requirement may be comprised of sound conifer snags at least 30 feet tall and other large live hardwood trees, except red

alder, growing in the riparian management area more than 20 feet from the high water level and at least 24 inches DBH.

(8) In the Eastern Cascade and Blue Mountain geographic regions, hardwood trees, dying or recently dead or dying trees and snags six inches or greater DBH may count toward the basal area requirements in subsection (6)(a) of this rule as follows:

(a) The basal area of retained live hardwood trees may count toward meeting the basal area requirements.

(b) Up to 10 percent of the basal area retained to meet the basal area requirement may be comprised of sound conifer snags at least 30 feet tall.

(c) For small Type F streams, the maximum required live conifer tree basal area that must be retained to meet the standard target is 40 square feet. The remaining basal area required may come from retained snags, dying or recently dead trees, or hardwoods if available within the riparian management area.

(9) Notwithstanding the requirements indicated in this rule, operators may conduct precommercial thinning and other release activities to maintain the growth and survival of conifer reforestation within riparian management areas. Such activities shall contribute to and be consistent with enhancing the stand's ability to meet the desired future condition.

(10) When determining the basal area of trees, the operator may use the average basal area for a tree's diameter class, as shown in [Table 4](#), or determine an actual basal area for each tree. The method for determining basal area must be consistent throughout the riparian management area.

(11)

(a) For large and medium Type F streams, live conifer trees retained in excess of the active management target and hardwoods retained beyond 20 feet of the high water level of the stream that otherwise meet the requirements for leave trees may be counted toward requirements for leave trees within clearcuts (pursuant to Section 9, Chapter 9, Oregon Laws 1996 Special Session).

(b) For small Type F streams, all retained live trees that otherwise meet the requirements for leave trees may count toward requirements for leave trees within harvest type 2 or harvest type 3 units (pursuant to Section 9, Chapter 9, Oregon Laws 1996 Special Session).

(12) Trees on islands with ground higher than the high water level may be harvested as follows:

(a) If the harvest unit is solely on an island, operators shall apply all the vegetation retention requirements for a large Type F stream described in this rule to a riparian management area along the high water level of the channels forming the island.

(b) Otherwise, operators shall retain all trees on islands within 20 feet of the high water level of the channels forming the island and all trees leaning over the channels. In 124

this case, conifer trees retained on islands may count toward the basal area requirement for adjacent riparian management areas so long as the trees are at least 11 inches DBH for large streams and eight inches DBH for medium streams.

(13) When applying the vegetation retention requirements described in this rule to the riparian management areas, if an operator cannot achieve the required retention without leaving live trees on the upland side of a road that may be within the riparian management area and those trees pose a safety hazard to the road and will provide limited functional benefit to the stream, the State Forester may modify the retention requirements on a site specific basis.

Table 2. General Prescription for Type F streams: Streamside Tree Retention for Harvest Type 2 or 3 Units (OAR 629-640-100)

Geographic Region	Square Feet of Basal Area per 1000 Feet of Stream, Each Side					
	Large Type F RMA = 100 feet		Medium Type F RMA = 70 feet		Small Type F RMA = 50 feet	
	Standard Target	Active Management Target	Standard Target	Active Management Target	Standard Target	Active Management Target
Coast Range and South Coast	230	170	120	90	40	20
Interior and Western Cascade	270	200	140	110	40	20
Siskiyou	220	170	110	90	40	20
Eastern Cascade and Blue Mountain	170	130	90	70	<u>50(1)</u>	<u>50(2)</u>

Table 3. General Prescription for Type F Streams: Streamside Tree Retention for Harvest Type 1, Partial Harvest, or Thinning Units (OAR 629-640-100)

Geographic Region	Square Feet of Basal Area per 1000 Feet of Stream, Each Side					
	Large Type F RMA = 100 feet		Medium Type F RMA = 70 feet		Small Type F RMA = 50 feet	
	Standard Target	Active Management Target	Standard Target	Active Management Target	Standard Target	Active Management Target
Coast Range and South Coast	300	270	160	140	50	30
Interior and Western Cascade	350	310	180	160	50	30
Siskiyou	290	260	140	120	50	30
Eastern Cascade and Blue Mountain	220	200	120	100	50(1)	50(2)

Table 4. Basal Area for Various Diameter Classes (OAR 629-640-100)

Diameter Breast Height (inches)	Basal Area (square feet)		Diameter Breast Height (inches)	Basal Area (square feet)
6 to 10	0.3		41 to 45	10.1
11 to 15	0.9		46 to 50	12.6
16 to 20	1.8		51 to 55	15.3
21 to 25	2.9		56 to 60	18.3
26 to 30	4.3		61 to 65	21.6
31 to 35	5.9		66 to 70	25.2
36 to 40	7.9		71 to 75	29.0

629-640-110 - Live Tree Retention Credit For Improvement of Type F Streams

(1) Many Type F streams currently need improvement of fish habitat because they lack adequate amounts of large woody debris in channels, or they lack other important habitat elements.

(2) This rule allows operator incentives to place conifer logs in channels or to take other enhancement actions to create immediate improvements in fish habitat.

(3) Subject to prior approval of the State Forester, operators may place conifer logs or downed trees in Type F streams and receive basal area credit toward meeting the live tree retention requirements in a stream's riparian management area.

(4) For each conifer log or tree the operator places in a large or medium Type F stream, the basal area credit is twice the basal area of the placed log or tree.

- (5) For each conifer log or tree the operator places in a small Type F stream, the basal area credit is equal to the basal area of the placed log or tree.
- (6) Basal area credit will be determined by measuring the cross-sectional area of the large end of a log or by measuring the point on a downed tree that would be equivalent to breast height.
- (7) To receive basal area credit for downed trees or conifer logs placed in a stream, the operator shall comply with the guidance and restrictions for placing logs or trees prescribed by the State Forester.
- (8) Operators may propose other stream enhancement projects for basal area credit such as creation of backwater alcoves, riparian grazing exclosures (such as fencing), and placement of other instream structure such as boulders and rootwads. When a project is approved by the department through consultation with the Oregon Department of Fish and Wildlife, basal area credit shall be given toward meeting the live tree requirements within riparian management areas. The basal area credit shall be negotiated between the department, operator and Oregon Department of Fish and Wildlife.
- (9) Basal area credit may be given to an operation for enhancement projects conducted at locations other than at the operation site so long as the project is in the same immediate vicinity as the operation site (for instance, within one or two miles of the operation).
- (10) Basal area credit may be given to an operation for improvement projects conducted at a later date (this may be necessary to avoid operating under high water conditions or to protect spawning areas), but the project must be completed within six months of the completion of the operation.
- (11) In granting basal area credit, the standing tree basal area retained within riparian management areas of Type F streams shall not be reduced to less than the active management targets shown in [Table 2](#) or [Table 3](#), as applicable.
- (12) For small Type F streams in the Eastern Cascade and Blue Mountain geographic regions, the live conifer tree basal area may be reduced to 30 square feet for the active management target. The remaining portion of the basal area requirement must come from snags, dying or recently dead trees, or hardwood trees if available in the riparian management area.
- (13) Operators shall notify the State Forester of the completion of live tree retention credit stream improvement projects that were planned for locations other than on the operation site under section (9) of this rule or that were planned to be completed at another date under section (10) of this rule.

629-640-200 - General Vegetation Retention Prescription For Type D and Type N Streams

(1)

(a) Operators shall apply the vegetation retention requirements described in this rule to the riparian management areas of Type D and Type N streams.

(b) Segments of Type D or Type N streams that may be of a different size within an operation shall not be combined or averaged together when applying the vegetation retention requirements.

(c) Trees left to meet the vegetation retention requirements for one stream type shall not count toward the requirements of another stream type.

(2) Operators shall retain along all Type D, and large and medium Type N streams:

(a) All understory vegetation within 10 feet of the high water level;

(b) All trees within 20 feet of the high water level; and

(c) All trees leaning over the channel.

(3) Operators shall retain all downed wood and snags that are not safety or fire hazards within riparian management areas and streams. Snags felled for safety or fire hazard reasons shall be retained where they are felled unless used for stream improvement projects approved by the State Forester.

(4) Notwithstanding the requirements of section (2), vegetation, snags and trees within 20 feet of the high water level of the stream may be felled, moved or harvested as allowed in the rules for road construction, yarding corridors, temporary stream crossings, or for stream improvement.

(5) Operators shall retain at least 30 live conifer trees per 1000 feet along large Type D and Type N streams and 10 live conifer trees per 1000 feet along medium Type D and Type N streams. This includes any trees left to meet the requirements described in section (2) of this rule. Conifers must be at least 11 inches DBH for large streams and eight inches DBH for medium streams to count toward these requirements.

(6) Operators shall retain all understory vegetation and non-merchantable conifer trees (conifer trees less than six inches DBH) within 10 feet of the high water level on each side of small perennial Type N streams indicated in [Table 5](#).

(a) The determination that a stream is perennial shall be made by the State Forester based on a reasonable expectation that the stream will have summer surface flow after July 15.

(b) The determination in subsection (6)(a) of this rule can be made based on a site inspection, data from other sources such as landowner information, or by applying judgment based upon stream flow patterns experienced in the general area.

(c) Operators are encouraged whenever possible to retain understory vegetation, non-merchantable trees, and leave trees required within harvest type 2 or harvest type 3 units (pursuant to Section 9, Chapter 9, Oregon Laws 1996 Special Session) along all other small Type N streams within harvest units.

(7) Operators shall retain trees six inches or greater DBH to meet the following requirements (this includes trees left to meet the requirements of sections (2) and (5) of this rule):

(a) If the live conifer tree basal area in the riparian management area is greater than the standard target shown in [Table 6](#) where the harvest will be a harvest type 2 or type 3 unit (as defined by ORS 527.620), or in [Table 7](#) where the harvest unit is a harvest type 1, partial harvest, or thinning, operators shall retain along all Type D, and medium and large Type N streams live conifer trees of sufficient basal area to meet the standard target.

(b) If the live conifer tree basal area in the riparian management area is less than the standard target (as shown in [Table 6](#) where the harvest will be a harvest type 2 or type 3 unit or [Table 7](#) where the harvest unit is a harvest type 1, partial harvest, or thinning), but greater than one-half the standard target shown in [Table 6](#), operators shall retain along all Type D, and medium and large Type N streams all conifers 6 inches DBH or larger in the riparian management area (up to a maximum of 100 conifers per 1000 feet along large streams, and 70 conifers per 1000 feet along medium streams).

(c) If the live conifer tree basal area in the riparian management area is less than one-half the standard target shown in [Table 6](#):

(A) Operators may apply an alternative vegetation retention prescription as described in OAR 629-640-300, where applicable, or develop a site specific vegetation retention prescription as described in OAR 629-640-400; or

(B) Operators shall retain along all Type D, and medium and large Type N streams all conifers in the riparian management area and all hardwoods within 30 feet of the high water level for large streams and within 20 feet of the high water level for medium streams.

(8) In the Coast Range, South Coast, Interior, Western Cascade, and Siskiyou geographic regions, hardwood trees and snags six inches or greater DBH may count toward the basal area requirements in subsection (7)(a) of this rule as follows:

(a) All cottonwood and Oregon ash trees within riparian management areas that are beyond 20 feet of the high water level of large Type D and N streams, may count toward the basal area requirements.

(b) For large Type D and N streams, up to 10 percent of the basal area requirement may be comprised of sound conifer snags at least 30 feet tall and other

large live hardwood trees, except red alder, growing in the riparian management area more than 20 feet from the high water level and at least 24 inches DBH.

(c) For medium Type D and N streams:

(A) Up to 30 square feet of basal area per 1000 feet of stream may be comprised of hardwood trees.

(B) Up to five percent of the basal area retained may be comprised of sound conifer snags that are at least 30 feet tall.

(9) In the eastern Oregon and Blue Mountain geographic regions:

(a) The basal area of all retained live hardwood trees may count toward meeting the basal area requirements.

(b) For large Type D and N streams, up to 10 percent of the basal area requirement may be comprised of sound conifer snags at least 30 feet tall.

(c) For medium Type D and N streams, up to five percent of the basal area retained may be comprised of sound conifer snags that are at least 30 feet tall.

(10) Notwithstanding the requirements indicated in this rule, operators may conduct precommercial thinning and other release activities to maintain the growth and survival of conifer reforestation within riparian management areas. Such activities shall contribute to and be consistent with enhancing the stand's ability to meet the desired future condition.

(11) When determining the basal area of trees along streams in a harvest unit, operators may use the average basal area for a tree's diameter class, as shown in [Table 4](#) in OAR 629-640-100, or determine an actual basal area for each tree. The method for determining basal area must be consistent throughout the riparian management area.

(12) All live trees retained along Type D and N streams that otherwise meet the requirements for leave trees may count toward requirements for leave trees within harvest type 2 or harvest type 3 units (pursuant to Section 9, Chapter 9, Oregon Laws 1996 Special Session).

(13) Trees on islands with ground higher than the high water level may be harvested as follows:

(a) If the harvest unit is solely on an island, operators shall apply all the vegetation retention requirements for a large Type F stream described in this rule to a riparian management area along the high water level of the channels forming the island.

(b) Otherwise, operators shall retain all trees on islands within 20 feet of the high water level of the channels forming the island and all trees leaning over the channels. In this case, conifer trees retained on islands may count toward the basal area requirement for adjacent riparian management areas so long as the trees are at least 11 inches DBH for large streams and 8 inches DBH for medium streams.

(c) All merchantable trees may be harvested from islands within small Type N streams.

(14) When applying the vegetation retention requirements described in this rule to the riparian management areas, if an operator cannot achieve the required retention without leaving live trees on the upland side of a road that may be within the riparian management area and those trees pose a safety hazard to the road and will provide limited functional benefit to the stream, the State Forester may modify the retention requirements on a site specific basis.

Table 5. Vegetation Retention for Specified Small Type N Streams (OAR 629-640-200)

Geographic Region	Retain Understory Vegetation and Unmerchantable Conifers 10 Feet Each Side of Stream for:
Eastern Cascades and Blue Mountains	All perennial streams.
South Coast	Portions of perennial streams where the upstream drainage area is greater than 160 acres.
Interior	Portions of perennial streams where the upstream drainage area is greater than 330 acres.
Siskiyou	Portions of perennial streams where the upstream drainage area is greater than 580 acres.
Coast Range and Western Cascades	No retention required.

Table 6. General Prescription for Type D, and Large and Medium Type N Streams: **Streamside Tree Retention for Harvest Type 2, or Type 3 Units** (OAR 629-640-200)

Geographic Region	Square Feet of Basal Area Per 1000 Feet of Stream, Each Side		
	Large Type D and N RMA = 70 feet	Medium Type D and N RMA = 50 feet	Small Type D and N RMA = 20 feet
	Standard Target	Standard Target	Standard Target
Coast Range and South Coast	90	50 (1)	0
Interior and Western Cascade	110	50 (1)	0
Siskiyou	90	50 (1)	0
Eastern Cascade and Blue Mountain	70	50 (1)	0

Table 7. General Prescription for Type D, and Large and Medium Type N Streams: Streamside Tree Retention for Harvest Type 1, Partial Harvest, or Thinning (OAR 629-640-200)

Geographic Region	Square Feet of Basal Area Per 1000 Feet of Stream, Each Side		
	Large Type D and N RMA = 70 feet	Medium Type D and N RMA = 50 feet	Small Type D and N RMA = 20 feet
	Standard Target	Standard Target	Standard Target
Coast Range and South Coast	140	60 (1)	0
Interior and Western Cascade	160	60 (1)	0
Siskiyou	120	60 (1)	0
Eastern Cascade and Blue Mountain	100	60 (1)	0

629-640-300 - Alternative Vegetation Retention Prescriptions

(1) Alternative prescriptions are intended to apply to situations where the existing streamside stand is too sparse or contains too few live conifers to maintain fish, wildlife, and water quality resources over time. Future desired streamside stand conditions are achieved through immediate manipulation of vegetation, including reforesting the riparian management area with conifers.

(2) Sections (3) and (4) of this rule are alternative vegetation retention prescriptions that operators may apply if the conifer basal area in the riparian management area is no more than one-half of the standard target indicated in either [Table 2](#) of OAR 629-640-100 or [Table 6](#) of OAR 629-640-200, as may be applicable, and conditions described in the alternative prescription are applicable.

(3) Alternative Vegetation Retention Prescription 1 (Catastrophic Events). This alternative prescription applies to streamside stands that have been damaged by wildfire or by catastrophic windthrow, insect or disease mortality. Such mortality must occur at the stand level and shall not include normal endemic mortality. The prescription is intended to provide adequate stream shade, woody debris, and bank stability for the future while creating conditions in the streamside area that will result in quick establishment of a new and healthy stand. Operators shall:

(a) Retain trees that have fallen in the stream. Only portions of these trees that are outside the high water levels and do not contribute to the ability of the downed tree to withstand movement during high flows may be harvested.

(b) Retain all live and dead trees within 20 feet of the high water level of large and medium streams and 10 feet of the high water level of small streams.

(c) For Type F streams, retain live trees, dying or recently dead trees, and downed logs sufficient to satisfy the active management target shown in [Table 2](#).

(d) For Type D and N streams, retain live trees, dying or recently dead trees, or downed logs sufficient to satisfy the standard target shown in [Table 6](#).

(e) Live conifers shall be retained first to meet the target. If live conifers are too few to satisfy the target, then the target shall be met as much as possible by including windthrown trees within the channel and dying or recently dead trees.

(f) For purposes of this prescription the basal area of a windthrown tree in the channel or a retained dying or recently dead tree contributes two times its basal area toward meeting the target.

(4) Alternative Vegetation Retention Prescription 2 (Hardwood Dominated Sites). This alternative prescription applies to streamside sites that are capable of growing conifers, and where conifer stocking is currently low and unlikely to improve in a "timely manner" because of competition from hardwoods and brush. If portions of such riparian management areas currently contain abundant conifer basal area, it is intended that these areas of good conifer basal area be segregated and managed using the general vegetation retention prescription while the remainder is managed according to this alternative prescription. The alternative prescription is intended to provide adequate stream shade, some woody debris, and bank stability for the future while creating conditions in the streamside area that will result in quick establishment of a conifer stand. The operator shall:

(a) Evaluate the stand within the riparian management area and, where they exist, segregate segments (200 feet or more in length) that are well-stocked with conifer, as identified from an aerial photograph, from the ground or through other appropriate means. The general vegetation retention prescription for vegetation retention shall be applied to these segments.

(b) For the remaining portion of the riparian management area that has lower conifer basal area, the riparian management area shall be divided into conversion blocks and retention blocks.

(c) No more than half of the total stream length in the harvest unit can be included within conversion blocks. Conversion blocks can be no more than 500 feet long and must be separated from each other by at least 200 feet of retention block or by at least a 200 foot segment where the general vegetation retention prescription is applied.

(d) Within conversion blocks the operator shall retain:

(A) All trees growing in the stream or within 10 feet of the high water level of the stream.

(B) All trees leaning over the channel within 20 feet of the high water level of large streams.

(e) Within retention blocks the operator shall retain:

(A) For large streams, all conifer trees within 50 feet of the high water level of the stream and all hardwood trees within 30 feet of the high water level of the stream.

(B) For medium streams, all conifer trees within 30 feet of the high water level of the stream and all hardwood trees within 20 feet of the high water level of the stream.

(C) For small streams, all trees within 20 feet of the high water level of the stream.

629-640-400 - Site Specific Vegetation Retention Prescriptions For Streams and Riparian Management Areas

(1)

(a) Operators are encouraged to develop site specific vegetation retention prescriptions in an alternate plan.

(b) A primary aim of these prescriptions is to identify opportunities and allow incentives for restoring or enhancing riparian management areas or streams.

(c) Another purpose of site specific vegetation retention prescriptions is to allow for changes to the vegetation retention requirements in OARs 629-640-100 and 629-640-200. The changes must provide for the functions and values of streams and their riparian management areas as described in the vegetation retention goals for streams while affording a better opportunity to meet other objectives.

(2) Operators may develop site specific vegetation retention prescriptions for streams and their riparian management areas to achieve the vegetation retention goals described in OAR 629-640-000 if:

(a) The potential of the streamside stand to achieve basal area and stand density similar to mature conifer forest stands in a "timely manner" is questionable; or

(b) In-stream conditions are impaired due to inadequate large woody debris or other factors; or

(c) The modification of a standard or practice would result in less environmental damage than if the standard or practice were applied.

(3) A site specific vegetation retention prescription shall be approved if the State Forester determines that when properly executed the alternate plan will have no significant or permanent adverse effects: and

(a) It will meet or exceed the vegetation retention goals in a more "timely manner" than if the plan were not implemented; or

(b) The long-term benefits of the proposed restoration practice are greater than short-term detrimental effects; or

(c) The proposed practice will result in less environmental damage than if the regular rules were followed.

(4) Factors that may need to be considered in the plan include, but are not limited to, the potential of the existing streamside stand to achieve mature conifer forest characteristics, the long-term supply of woody debris, survival of planted conifers, sensitivity to changes in water temperature and water quality, the potential for sedimentation, the stability of woody debris placed in aquatic areas, and monitoring the direct effects of the proposed practices.

629-640-500 - Reforestation Within Stream Riparian Management Areas

Harvested portions of riparian management areas along streams are subject to the same reforestation requirements that apply to adjacent areas outside of the riparian management areas. Reforestation is more difficult in riparian management areas due to a number of factors. To succeed with the required reforestation, landowners should anticipate and plan for such factors as brush control measures, animal damage problems, and tree species that are suitable for wetter sites.

DIVISION 645 -- WATER PROTECTION RULES: RIPARIAN MANAGEMENT AREAS AND PROTECTION MEASURES FOR SIGNIFICANT WETLANDS

[629-645-000](#) Riparian Management Areas and Protection Measures for Significant Wetlands

[629-645-010](#) Live Tree Retention For Significant Wetlands

[629-645-020](#) Site Specific Vegetation Retention Prescriptions For Significant Wetlands

[629-645-030](#) Soil and Hydrologic Function Protection for Significant Wetlands

[629-645-040](#) Understory Vegetation Retention For Significant Wetlands

[629-645-050](#) Snag and Downed Wood Retention For Significant Wetlands

629-645-000 - Riparian Management Areas and Protection Measures for Significant Wetlands

(1)

(a) The purpose of these rules is to protect the functions and values of significant wetlands, including wetlands larger than eight acres, estuaries, bogs and important springs in eastern Oregon on forestlands.

(b) Significant wetlands on forestlands provide a wide range of functions and values, including those related to water quality, hydrologic function, fish and other aquatic organisms, and wildlife.

(c) Estuaries are unique systems because they form transitions between terrestrial, marine, and freshwater environments. Because of this link, estuarine systems are among the most biologically productive in the world. Estuaries support many resident species. Estuaries also provide food, spawning area, and shelter for numerous other species at critical points in their life cycles. Removal of shoreline trees reduces the overall productivity of the estuary by reducing leaf and litter fall, thus depriving the estuary of substrate, and by removing feeding and resting habitat for birds and small mammals.

(d) Bog communities are a result of specific hydrologic, soil, and nutrient conditions. Bogs are usually saturated, low in nutrients, and highly acidic. changes in runoff, sediment loading, and nutrient loading can alter the plant community composition. The peat soils have evolved over time. Compaction damages plant communities and may encourage the invasion of exotic species. Harvesting may disrupt shade tolerant vegetation, alter plant community characteristics, and hasten succession. Compaction, saturated conditions, and poor nutrient status make reforestation difficult.

(e) In arid parts of eastern Oregon, springs provide a critical source of water. These important springs have established wetland vegetation, flow year round in most years, and are used by a concentration of diverse animal species. By reason of sparse occurrence, important springs have a major influence on the distribution and abundance of upland species. Important springs shall be identified by the State Forester.

(2)

(a) The goals of significant wetland protection are to maintain the functions and values of significant wetlands on forestlands over time, and to ensure that forest practices do not lead to resource site destruction or reduced productivity, while at the same time ensuring the continuous growth and harvest of forest tree species. In order to accomplish these goals, the rules focus on the protection of soil, hydrologic functions, and specified levels of vegetation.

(b) The intent of the rules is to minimize soil disturbance and to minimize disturbance to the natural drainage patterns of the significant wetland.

(c) Vegetation retention (including understory vegetation, snags, downed wood, and live trees) is needed to prevent erosion and sedimentation into the significant wetland, minimize soil disturbance and hydrologic changes, and to maintain components of the vegetation structure to provide for other benefits, particularly fish and wildlife values.

(3) Significant wetlands other than estuaries, bogs or important springs in eastern Oregon shall have riparian management areas extending 100 feet from the wetlands.

(4) When an operation is proposed within 300 feet of an estuary, bog or important spring in eastern Oregon, the State Forester shall determine the riparian management area during the resource site inspection required by OAR 629-665-020. Riparian management areas shall extend outward 100 to 200 feet from the estuary, 50 to 100 feet from the bog, or 50 to 100 feet from the important spring in eastern Oregon. The distance determination of the State Forester shall depend on:

- (a) Stocking level of the timber stand adjacent to the estuary, bog or spring;
- (b) Ability of the area to withstand windthrow;
- (c) Size of the estuary, bog or spring. As the size increases, the size of the riparian management area shall increase; and
- (d) For bogs and springs only, topography and erodibility of adjacent uplands.

(5) For all significant wetlands, operators shall provide the following to the wetlands and riparian management areas:

- (a) Live tree retention (OAR 629-645-010);
- (b) Soil and hydrologic function protection (OAR 629-645-030);
- (c) Understory vegetation retention (OAR 629-645-040);
- (d) Snag and down wood retention (OAR 629-645-050).

(6) For forested significant wetlands, written plans must address reforestation.

629-645-010 - Live Tree Retention For Significant Wetlands

(1) In significant wetlands and their riparian management areas, operators shall retain approximately 50 percent of the original live trees, by species, in each of the following diameter classes (DBH):

- (a) 6 to 10 inches;
- (b) 11 to 20 inches;
- (c) 21 to 30 inches; and
- (d) larger than 30 inches.

(2) As part of the live trees in subsection (1) above, operators shall retain trees bordering significant wetlands.

(3) For estuaries and the adjacent riparian management areas, operators shall protect live trees that are:

- (a) Perch and nest trees for predatory birds and colonial nesting birds;
- (b) Likely to provide for future large woody debris to the estuaries' perimeters; and
- (c) Contributing to bank stability.

629-645-020 - Site Specific Vegetation Retention Prescriptions For Significant Wetlands

(1) Operators are encouraged to develop site specific vegetation retention prescriptions for significant wetlands by alternate plans.

(2) The functions and values of forested wetlands vary with species composition, stocking levels, and geographic location. Operators are encouraged to propose site specific vegetation retention prescriptions in alternate plans that allow for changes to the live tree requirements in OAR 629-645-010 and that provide equal or better protection of the functions and values of forested significant wetlands and forested stream-associated wetlands, and address operational concerns.

629-645-030 - Soil and Hydrologic Function Protection for Significant Wetlands

(1) In significant wetlands and their riparian management areas, operators shall protect soil from disturbances that result in impaired water quality, hydrologic functions, or soil productivity. Operators shall protect hydrologic functions by minimizing disturbances and shall prevent accelerating the natural conversion of the wetland to uplands.

(2) The written plan required under OAR 629-635-130 shall describe how the operation will be conducted to prevent adverse effects on water quality, hydrologic functions or soil productivity. The following practices shall be addressed in written plans when they are proposed in significant wetlands:

- (a) Filling within wetlands;
- (b) Machine activity within wetlands; and
- (c) Road construction within wetlands.

(3) Operators shall not drain significant wetlands.

(4) Notwithstanding subsection (3) of this rule, minor drainage for reforestation may be allowed through a written plan approved by the State Forester. Any drainage for reforestation must be designed so the significant wetland is not converted to an upland.

629-645-040 - Understory Vegetation Retention For Significant Wetlands

(1) The purpose of retaining understory vegetation is to provide soil stability and bank stability in and along significant wetlands, to maintain cover and shade for wildlife habitat and aquatic habitat, and to protect water quality.

(2) To achieve the purpose of understory retention, the operator shall limit disturbance of understory vegetation within significant wetlands and their riparian management areas to the minimum necessary to remove timber harvested from the area and achieve successful reforestation.

(3) The written plan required in OAR 629-635-130 for operations within 300 feet of significant wetlands shall describe how disturbance to the understory vegetation will be minimized during harvest or site preparation for reforestation.

629-645-050 - Snag and Downed Wood Retention For Significant Wetlands

(1) For significant wetlands, operators shall retain all snags and downed trees within the wetlands and the applicable riparian management areas.

(2) Notwithstanding subsection (1) of this rule, any snag defined to be a safety hazard under the safety requirements found in OAR 437, Division 6, Forest Activities, or determined to be a fire hazard by the State Forester, may be felled. Any snag felled because of a safety or fire hazard shall be left unyarded.

(3) Notwithstanding subsection (1) of this rule, retention requirements may be modified for reasons of forest health for trees that are dying or recently dead or dying because of fire, insect or disease epidemics, or other catastrophic events when addressed in a written plan approved by the State Forester.

(4) Snags and downed wood left pursuant to subsection (1) of this rule may not be counted toward the requirements of Section 9, Chapter 9, Oregon Laws 1996 Special Session.

DIVISION 650 -- WATER PROTECTION RULES: RIPARIAN MANAGEMENT AREAS AND PROTECTION MEASURES FOR LAKES

[629-650-000](#) Riparian Management Areas and Protection Measures For Lakes

[629-650-010](#) Live Tree Retention For Lakes

[629-650-020](#) Soil and Hydrologic Function Protection For Lakes

[629-650-030](#) Understory Vegetation Retention For Lakes

[629-650-040](#) Snag Retention and Downed Wood Retention For Lakes

629-650-000 - Riparian Management Areas and Protection Measures For Lakes

(1) The purpose of this rule is to protect the functions and values of lakes. Lakes on forestlands provide a wide range of functions and values, including those related to water quality, hydrologic functions, aquatic organisms, fish and wildlife.

(2) Operators shall protect riparian management areas extending:

(a) 100 feet from the high water level of large lakes; and

(b) 50 feet from the high water level of other lakes that have fish use or other lakes that are equal to or greater than one-half acre in size.

(c) No riparian management area is required for other lakes that do not have fish and that are less than one-half acre.

(3) For all lakes with riparian management areas, operators shall provide the following to the riparian management areas and the aquatic areas:

(a) Live tree retention (OAR 629-650-010);

(b) Soil and hydrologic function protection (OAR 629-650-020);

(c) Understory vegetation retention (OAR 629-650-030); and

(d) Snag and down wood retention (OAR 629-650-040).

(4) For all lakes not having riparian management areas, the lakes shall be protected as other wetlands (OAR 629-655-000).

629-650-010 - Live Tree Retention For Lakes

(1) Operators shall retain in the riparian management areas of lakes approximately 50 percent of the original live trees, by species, in each of the following diameter classes (DBH):

(a) 6 to 10 inches;

(b) 11 to 20 inches;

(c) 21 to 30 inches; and

(d) larger than 30 inches.

(2) As part of the live trees in subsection (1) above, trees on the edge of lakes shall be retained.

629-650-020 - Soil and Hydrologic Function Protection For Lakes

(1) Operators shall protect soil within the riparian management areas of lakes from disturbances that result in impaired water quality, hydrologic functions, or soil productivity. Operators shall protect hydrologic functions by minimizing disturbances and shall prevent acceleration the natural conversions of lakes to uplands.

(2) Operators shall not drain lakes except for lakes formed by plugged culverts or beaver dams and as allowed in the rule for road maintenance.

629-650-030 - Understory Vegetation Retention For Lakes

(1) The purpose of retaining understory vegetation is to provide soil stability and bank stability along lakes, to maintain cover and shade for wildlife habitat and aquatic habitat, and to protect water quality.

(2) To achieve the purpose of understory retention, operators shall limit disturbance of understory vegetation within riparian management areas of lakes to the minimum necessary to remove timber harvested from the areas and to achieve successful reforestation.

629-650-040 - Snag Retention and Downed Wood Retention For Lakes

(1) For lakes, operators shall retain all snags and downed trees within the lakes and the applicable riparian management areas.

(2) Notwithstanding subsection (1) of this rule, any snag defined to be a safety hazard under the safety requirements found in OAR 437, Division 6, Forest Activities, or determined to be a fire hazard by the State Forester, may be felled. Any snag felled because of a safety or fire hazard shall be left unyarded.

(3) Notwithstanding subsection (1) of this rule, retention requirements may be modified for reasons of forest health for trees that are dying or recently dead because of fire, insect or disease epidemics, or other catastrophic events when addressed in a written plan approved by the State Forester.

(4) Snags and downed wood left pursuant to this rule may not be counted toward the requirements of Section 9, Chapter 9, Oregon Laws 1996 Special Session.

Attachment 2: Timber Harvesting Riparian Guidelines in Washington

Forest Practices Emergency Rules

Adopted by the Forest Practices Board

January 20, 2000

Effective Date: March 20, 2000

For Emergency Rules Training February-March 2000

Posted February 2, 2000

Table of Contents

Introduction	ii
Part 1 Water typing	5
Part 2 Riparian management zones	2.10
Part 3 Potentially unstable slopes and landforms	3.45
Part 4 Forest roads and wetlands	4.50
Part 5 Watershed analysis	5.76
Part 6 Adaptive management	6.81
Part 7 Enforcement and consultation	7.83
Part 8 Pesticides	8.86
Part 9 Multiyear permits	9.95
Part 10 Other rules	10.97

Introduction

The 1999 Legislature authorized the Forest Practices Board to adopt emergency rules consistent with the Forests and Fish Report dated April 29, 1999.

The Forest Practices Board proposed the forests and fish emergency rules in October of 1999 and held a public hearing on November 9, 1999. The Board received both oral and written testimony on the proposed rules, and modified the proposed emergency rules based on public comment.

The Board finalized and adopted the emergency rules at a special meeting on January 20, 2000. The rules become effective on March 20, 2000. The official version of these rules will be filed with the Code Reviser and published in the Washington State Register. This may result in some minor, editorial corrections to this "training session version" of the emergency rules.

The Forest Practices Board also approved new and revised board manuals to accompany the emergency rules. These emergency rule manuals also go into effect on March 20, 2000.

The emergency rules will remain in effect until June 30, 2001, or until new permanent rules are adopted by the Board, whichever is sooner.

The Board will consider adding more sections to this emergency rules later this year, including rules for hardwood conversions, tractor and wheeled skidding systems, and the forest riparian easement program for small landowners. Other changes may also be made.

Additional Copies of Emergency Rules

The emergency rules are posted on the Forest Practices Board's website:www.wa.gov/dnr

Click on "regulation", then "emergency rules".

PART 1 - WATER TYPING RULES

The water typing section of the emergency rules incorporates the following changes:

Revised criteria for identifying Type 4 (perennial) Waters and Type 5 (seasonal) Waters.

Type 4 Waters are non-fish bearing perennial streams. Perennial streams include streams from a perennial initiation point downstream to a Type 1, 2, or 3 Water.

Type 5 streams are nonfish bearing seasonal streams.

The water typing system is still based on presence or absence of fish, until a model to determine fish habitat is available.

This section also defines the channel migration zone which is a critical part of the riparian protection on Type 1, 2 and 3 Waters in the proposed emergency rules.

AMENDATORY SECTION

WAC 222-12-090 Forest practices board manual.

(13) Guidelines for determining fish use for the purpose of typing waters under WAC 222-16-030.

AMENDATORY SECTION

WAC 222-16-010 **General definitions.*** Unless otherwise required by context, as used in these ~~((regulations))~~ rules:

"Bankfull depth" means the elevation of the water surface of a stream flow having a return period of approximately 1.5 years measured from the line of maximum depth of the stream or thalweg. (See board manual for measuring guidelines.)

"Bankfull width" means the horizontal projection of bankfull depth to the stream bank. (See board manual for measuring guidelines.)

"Channel migration zone" (CMZ) means the area where the active channel of a stream is prone to move and this results in a potential near-term loss of riparian habitat adjacent to the stream. (See the board manual for descriptions and illustrations of CMZs, delineation guidelines, including modifications to CMZs by a permanent levee or dike.)

"Diameter at breast height (dbh)" means the diameter of a tree at 4½ feet above the ground.

"Fish" means for purposes of these rules, species of the vertebrate taxonomic groups of *Cephalospidomorphi* and *Osteichthyes*.

"Perennial initiation point" means the place where perennial flow begins on a Type 4 Water. If the point of initiation of perennial flow using indicators such as non-migrating seeps or springs cannot be identified with simple, non-technical observations, then the following shall apply:

(a) Western Washington Type 4 Waters are perennial streams if their basin size is greater than the following minimums:

(i) 13 acres in the coastal zone (which corresponds to the Sitka spruce zone defined in Franklin and Dyrness, 1973); or

(ii) 52 acres for all other western Washington locations.

(b) Eastern Washington Type 4 Waters are perennial streams if their basin size is greater than 300 acres.

"Perennial streams." See WAC 222-16-030*(4).

"Seasonal streams." See WAC 222-16-030*(5).

AMENDATORY SECTION

WAC 222-16-030 **Water typing system.**

*The department in cooperation with the departments of fish and wildlife, and ecology, and in consultation with affected Indian tribes ~~((shall))~~ will classify streams, lakes and ponds and prepare ~~((stream classification))~~ water type maps showing the location of ~~((Type 1, 2, 3, and 4 W))~~ waters within the ~~((various))~~ forested areas of the state. The maps 145

will be based on a multi-parameter, field-verified geographic information system (GIS) logistic regression model. The multi-parameter model will be "habitat driven" and will use geomorphic parameters such as basin size, gradient, elevation and other indicators.

Until the habitat-driven water type maps mentioned above are available, the current maps will continue to be used. These maps shall be available for public inspection at region offices of the department. The waters will be classified using the following criteria. If a dispute arises concerning a water type, the department shall make available informal conferences, which shall include the departments of fish and wildlife, and ecology, and affected Indian tribes and those contesting the adopted water types. These conferences shall be established under procedures established in WAC 222-46-020.

***(1) "Type 1 Water"** means all waters, within their ordinary high-water mark, as inventoried as "shorelines of the state" under chapter 90.58 RCW and the rules promulgated pursuant to chapter 90.58 RCW, but not including those waters' associated wetlands as defined in chapter 90.58 RCW.

***(2) "Type 2 Water"** (~~shall~~) means segments of natural waters which are not classified as Type 1 Water and have a high fish, wildlife, or human use. These are segments of natural waters and periodically inundated areas of their associated wetlands, which:

(a) Are diverted for domestic use by more than 100 residential or camping units or by a public accommodation facility licensed to serve more than 100 persons, where such diversion is determined by the department to be a valid appropriation of water and the only practical water source for such users. Such waters shall be considered to be Type 2 Water upstream from the point of such diversion for 1,500 feet or until the drainage area is reduced by 50 percent, whichever is less;

(b) Are diverted for use by federal, state, tribal or private fish hatcheries. Such waters shall be considered Type 2 Water upstream from the point of diversion for 1,500 feet, including tributaries if highly significant for protection of downstream water quality. The department may allow additional harvest beyond the requirements of Type 2 Water designation provided the department determines after a landowner-requested on-site assessment by the department of fish and wildlife, department of ecology, the affected tribes and interested parties that:

(i) The management practices proposed by the landowner will adequately protect water quality for the fish hatchery; and
(ii) Such additional harvest meets the requirements of the water type designation that would apply in the absence of the hatchery;

(c) Are within a federal, state, local, or private campground having more than 30 camping units: *Provided*, That the water shall not be considered to enter a campground until it reaches the boundary of the park lands available for public use and comes within 100 feet of a camping unit, trail or other park improvement;

~~((e))~~ (d) Are used by substantial numbers of (~~(anadromous or resident game)~~) fish for spawning, rearing or migration. Waters having the following characteristics are presumed to have highly significant fish populations:

(i) Stream segments having a defined channel 20 feet or greater within the ((ordinary high water marks)) bankfull width and having a gradient of less than 4 percent.

(ii) Lakes, ponds, or impoundments having a surface area of 1 acre or greater at seasonal low water; or

~~((d))~~ (e) Are used by salmonids for off-channel habitat. These areas are critical to the maintenance of optimum survival of juvenile salmonids. This habitat shall be identified based on the following criteria:

(i) The site must be connected to a stream bearing salmonids and accessible during some period of the year; and

(ii) The off-channel water must be accessible to juvenile salmonids through a drainage with less than a 5percent gradient.

***(3) "Type 3 Water"** (~~shall~~) means segments of natural waters which are not classified as Type 1 or 2 Water and have a moderate to slight fish, wildlife, and human use. These are segments of natural waters and periodically inundated areas of their associated wetlands which:

(a) Are diverted for domestic use by more than 10 residential or camping units or by a public accommodation facility licensed to serve more than 10 persons, where such diversion is determined by the department to be a valid appropriation of water and the only practical water source for such users. Such waters shall be considered to be Type 3 Water upstream from the point of such diversion for 1,500 feet or until the drainage area is reduced by 50 percent, whichever is less;

(b) Are used by significant numbers of ~~((anadromous))~~ fish for spawning, rearing or migration. The requirements for determining fish use are described in the board manual section 13. If fish use has not been determined:

~~((Waters having the following characteristics are presumed to have significant anadromous fish use:~~

~~(i) Stream segments having a defined channel of 5 feet or greater in width between the ordinary high water marks; and having a gradient of less than 12 percent and not upstream of a falls of more than 10 vertical feet.~~

~~(ii) Ponds or impoundments having a surface area of less than 1 acre at seasonal low water and having an outlet to an anadromous fish stream.))~~

(i) Waters having the following characteristics are presumed to have fish use:

(A) Stream segments having a defined channel of ~~((40))~~ 2 feet or greater within the ~~((ordinary high water marks; and a summer low flow greater than 0.3 cubic feet per second;))~~ bankfull width in Western Washington; or 3 feet or greater in width within the bankfull width in Eastern Washington; and having a gradient of ~~((less than 12))~~ 16 percent or less.

(B) Stream segments having a defined channel of 2 feet or greater within the bankfull width in Western Washington; or 3 feet or greater within the bankfull width in Eastern Washington, and having a gradient greater than 16 percent and less than or equal to 20 percent, and having greater than 50 acres in contributing basin size in Western Washington or greater than 175 acres contributing basin size in Eastern Washington, based on hydrographic boundaries;

(C) Ponds or impoundments having a surface area of less than 1 acre at seasonal low water and having an outlet to a fish stream;

(D) Ponds or impoundments having a surface area greater than 0.5 acre at seasonal low water~~((; or))~~.

~~(e) ((Are used by significant numbers of resident game fish. Waters with the following characteristics are presumed to have significant resident game fish use:~~

~~((Are highly significant for protection of downstream water quality. Tributaries which contribute greater than 20 percent of the flow to a Type 1 or 2 Water are presumed to be significant for 1,500 feet from their confluence with the Type 1 or 2 Water or until their drainage area is less than 50 percent of their drainage area at the point of confluence, whichever is less.))~~

(ii) The department shall waive or modify the characteristics in subsection (i) of this subsection where:

(A) Waters have confirmed, long term, naturally occurring water quality parameters incapable of supporting fish;

(B) Snowmelt streams have short flow cycles that do not support successful life history phases of fish. These streams typically have limited flow in the winter months and discontinue flow by June 1; or,

(C) Sufficient information about a geographic region is available to support a departure from the characteristics in (i) of this subsection, as determined in consultation with the department of fish and wildlife, department of ecology, affected tribes and interested parties.

* (4) "**Type 4 Water**" ~~((classification shall be applied to segments of natural waters which are not classified as Type 1, 2 or 3, and for the purpose of protecting water quality downstream are classified as Type 4 Water upstream until the channel width becomes less than 2 feet in width between the ordinary high water marks. Their significance lies in their influence on water quality downstream in Type 1, 2, and 3 Waters. These may be perennial or intermittent.))~~ means all segments of natural waters within the bankfull width of defined channels that are not Type 1, 2 or 3 Waters and which

are perennial waters of non-fish-bearing streams. Perennial waters means waters downstream from a perennial initiation point. (See board manual, section 13, for the protocol for defining the upper extent of a perennial stream.)

~~*(5) Type 5 Waters ((classification shall be applied to all natural waters not classified as Type 1, 2, 3 or 4; including streams with or without well defined channels, areas of perennial or intermittent seepage, ponds, natural sinks and drainageways having short periods of spring or storm runoff.)) include all segments of natural waters within the bankfull width of defined channels that are not Type 1, 2, 3 or 4 Waters and which are seasonal non-fish bearing streams. "Seasonal stream" means those streams that are not perennial but are physically connected by a defined channel system to downstream waters so that water or sediment initially delivered to these waters may eventually be delivered to a Type 1, 2, 3 or 4 Water.~~

PART 2 - RIPARIAN MANAGEMENT ZONES

Background

Riparian rules are changing to increase protection of aquatic and riparian habitats. The basis for determining necessary resource protective measures is the ecological functions provided by riparian areas. The proposed riparian rules use the function / distance relationship to divide the riparian area into zones that provide essential ecological functions. Required protective measures differ between western Washington and eastern Washington and among three eastern Washington habitat types.

Important functions include: large woody debris, shade, sediment control, bank stability, nutrients, litter fall, and windthrow. Functions provided by riparian areas depend on distance from a stream. For example, bank stability is a function that occurs primarily within 30feet. Another factor considered when designing riparian protection was the natural wild fire and disease disturbance regime in eastern Washington.

Riparian protection on Type 1, 2, and 3 Waters is dependent on distance from the stream and is allocated based on three distinct riparian zones: the core, inner, and outer zones.

Riparian protection measures include protection of sensitive sites/features on Type 4 Waters and a 30' equipment limitation zone on both Type 4 and 5 Waters.

20-acre exemption from new riparian forest practices rules

Landowners with a total forest land ownership of less than eighty acres in the state shall not be required to adhere to the new riparian forest practices rules on parcels of 20 contiguous acres or less. These landowners shall be subject to the permanent forest practices rules in effect as of January 1, 1999 plus increased protection equal to 15 percent. All other landowners are subject to the new riparian forest practices rules.

How do the new rules work?

•Riparian management zone dimensions vary depending on the site class (tree growth potential) of the land adjacent to the typed water, the management harvest option, and the stream size. On Type 1, 2, and 3 Waters core zones are to be left unmanaged. Management will only be allowed in the inner zone to improve function and management is allowed in the outer zone for timber extraction as well as function improvement.

•If a tree within 75 feet of a Type 1, 2, or 3 Water is providing shade required by the temperature prediction method, the tree may not be removed. Within the bull trout overlay, all available shade must be maintained.

•Salvage logging within the RMZ is restricted.

•Cable yarding disturbance is restricted.

•When there is a stream-adjacent parallel road, mitigation measures explained in the proposed rules apply. 148

•There is no harvest in CMZs.

AMENDATORY SECTION

WAC 222-12-090 Forest practices board manual

(2) Standard methods for measuring physical parameters of ~~((a))~~ streams and channel migration zones.

(7) Guidelines for ~~((calculating average widths of))~~ riparian management zones.

AMENDATORY SECTION

WAC 222-16-010 General definitions.* Unless otherwise required by context, as used in these ~~((regulations))~~ rules:

"Alluvial fan" See "sensitive sites" definition.

"Basal area" means the area in square feet of the cross section of a tree bole measured at 4½ feet above the ground.

"Bull trout habitat overlay" means those portions of eastern Washington streams containing bull trout habitat as identified in the department of fish and wildlife's bull trout map. Prior to the development of a bull trout field protocol and of the habitat-based predictive model, the "bull trout habitat overlay" map may be modified to allow for locally-based corrections using current data, field knowledge, and best professional judgement. A landowner may meet with the departments of natural resources and fish and wildlife and, in consultation with affected tribes and federal biologists, determine whether certain stream reaches have habitat conditions that are unsuitable for supporting bull trout. If such a determination is mutually agreed upon, documentation submitted to the department will result in the applicable stream reaches no longer being included within the definition of bull trout habitat overlay. Conversely, if suitable bull trout habitat is discovered outside the current mapped range, those waters will be included within the definition of "bull trout habitat overlay" by a similar process.

An electronic copy can be found in the Oct. 15, 1999 proposed emergency rule, located on the Board's website: www.wa.gov/dnr.

"Aquatic resources" means water quality, fish, the Columbia torrent salamander (*Rhyacotriton kezeri*), the Cascade torrent salamander (*Rhyacotriton cascadae*), the Olympic torrent salamander (*Rhyacotriton olympian*), the Dunn's salamander (*Plethodon dunni*), the Van Dyke's salamander (*Plethodon vandyke*), the Tailed frog (*Ascaphus truei*) and their respective habitats.

"Desired future condition" (DFC) means the stand conditions of a mature riparian forest at 140 years of age.

"Eastern Washington" means ~~((the lands of the state lying east of an administrative line which approximates the change from the Western Washington timber types to the Eastern Washington timber types described as follows:~~

Beginning at the International Border and Okanogan National Forest boundary at the N1/4 corner Section 6, T. 40N, R. 24E., W.M., south and west along the Pasayten Wilderness boundary to the west line of Section 30, T. 37N, R. 19E., Thence south on range line between R. 18E. and R. 19E., to the Lake Chelan Sawtooth Wilderness at Section 31, T. 35N, R. 19E.,

Thence south and east along the eastern wilderness boundary of Lake Chelan Sawtooth Wilderness to the west line of Section 18, T. 31N, R. 19E. on the north shore of Lake Chelan,

Thence south on the range line between R. 18E. and R. 19E. to the SE corner of T. 28N, R. 18E.,

Thence west on the township line between T. 27N, and T. 28N to the NW corner of T. 27N, R. 17E.,

Thence south on range line between R. 16E. and R. 17E. to the Alpine Lakes Wilderness at Section 31, T. 26N, R. 17E.,

Thence south along the eastern wilderness boundary to the west line of Section 6, T. 22N, R. 17E.,

Thence south on range line between R. 16E. and R. 17E. to the SE corner of T. 22N, R. 16E.,

Thence west along township line between T. 21N, and T. 22N to the NW corner of T. 21N, R. 15E.,

Thence south along range line between R. 14E. and R. 15E. to SW corner of T. 20N, R. 15E.,

Thence east along township line between T. 19N, and T. 20N to the SW corner of T. 20N, R. 16E.,

Thence south along range line between R. 15E. and R. 16E. to the SW corner of T. 18N, R. 16E.,
 Thence west along township line between T. 17N, and T. 18N to the SE corner of T. 18N, R. 14E.,
 Thence south along range line between T. 14E. and R. 15E. to the SW corner of T. 14N, R. 15E.,
 Thence south and west along Wenatchee National Forest Boundary to the NW corner of T. 12N, R. 14E.,
 Thence south along range line between R. 13E. and R. 14E. to SE corner of T. 10N, R. 13E.,
 Thence west along township line between T. 9N, and T. 10N to the NW corner of T. 9N, R. 12E.,
 Thence south along range line between R. 11E. and R. 12E. to SE corner of T. 8N, R. 11E.,
 Thence west along township line between T. 7N, and T. 8N to the Gifford Pinchot National Forest Boundary,
 Thence south along Forest Boundary to SE corner of Section 33, T. 7N, R. 11E.,
 Thence west along township line between T. 6N, and T. 7N to SE corner of T. 7N, R. 9E.,
 Thence south along Skamania Klickitat County line to Oregon Washington state line.)) the geographic area in Washington east of the crest of the Cascade Mountains from the international border to the top of Mt. Adams, then east of the ridge line dividing the White Salmon River drainage from the Lewis River drainage and east of the ridge line dividing the Little White Salmon River drainage from the Wind River drainage to the Washington-Oregon state line.

An electronic copy can be found in the Oct. 15, 1999 proposed emergency rule, located on the Board's website: www.wa.gov/dnr.

"Eastern Washington timber habitat types" means:

<u>Tree species zone</u>	<u>Elevation</u>
<u>Ponderosa Pine</u>	<u>0 - 2500 feet</u>
<u>Mixed Conifer</u>	<u>2501 - 5000 feet</u>
<u>High Elevation</u>	<u>Above 5000 feet</u>

"Horizontal distance" means the distance on a line parallel to the horizon (not parallel to the slope).

"Hyporheic" means an area adjacent to and below channels where interstitial water is exchanged with channel water and water movement is mainly in the downstream direction.

"Preferred tree species" means

the following species listed in descending order of priority for each timber habitat type:

<u>Ponderosa pine habitat type</u>	<u>Mixed conifer habitat type</u>
<u>all hardwoods</u>	<u>all hardwoods</u>
<u>ponderosa pine</u>	<u>western larch</u>
<u>western larch</u>	<u>ponderosa pine</u>
<u>Douglas-fir</u>	<u>western red-cedar</u>
<u>western red-cedar</u>	<u>white pine</u>
	<u>Douglas-fir</u>
	<u>lodgepole pine</u>

"Riparian management zone" (RMZ) means

(1) **For western Washington**

(a) The area protected on each side of a Type 1, 2 or 3 Water measured horizontally from the bankfull width or the CMZ, whichever is greater, and

<u>Site Class</u>	<u>Western Washington Total RMZ Width</u>

<u>I</u>	<u>200'</u>
<u>II</u>	<u>170'</u>
<u>III</u>	<u>140'</u>
<u>IV</u>	<u>110'</u>
<u>V</u>	<u>90'</u>

(b) The area protected on both sides of Type 4 Waters, measured horizontally from the bankfull width. (See WAC 222-30-021 (2).)

(2) In eastern Washington

(a) The area protected on each side of a Type 1, 2 or 3 Water measured horizontally from the bankfull width or the CMZ, whichever is greater (see table below), and

<u>Site Class</u>	<u>Eastern Washington Total RMZ Width</u>
<u>I</u>	<u>130'</u>
<u>II</u>	<u>110'</u>
<u>III</u>	<u>90' or 110' *</u>
<u>IV</u>	<u>75' or 100' *</u>
<u>V</u>	<u>75' or 100' *</u>

* dependent upon stream size. (See WAC 222-30-022.)

(b) The area protected on both sides of Type 4 Waters, measured horizontally from the bankfull width. (See WAC 222-30-022 (2).)

(3) For both western and eastern Washington, the area within the equipment limitation zone on Type 4 and Type 5 Waters.

(4) For exempt 20 acre parcels, a specified area alongside Type 1, 2 and 3 Waters where specific measures are taken to protect water quality and fish and wildlife habitat.

"RMZ core zone" means

(1) For western Washington, the 50 foot buffer measured horizontally outside of the bankfull width or the channel migration zone, whichever is greater, of a Type 1, 2 or 3 Water. (See WAC 222-30-021.)

(2) For eastern Washington, the 30 foot buffer measured horizontally outside of the bankfull width or the channel migration zone, whichever is greater, of a Type 1, 2 or 3 Water. (See WAC 222-30-022.)

"RMZ inner zone" means

(1) For western Washington, the area measured horizontally from the outside boundary of the core zone of a Type 1, 2, or 3 Water to the outer limit of the inner zone. The outer limit of the inner zone is determined based on the width of the affected water, site class and the management option chosen for timber harvest within the inner zone. (See WAC 222-30-021.)

(2) For Eastern Washington, the area measured horizontally between the outer boundary of the core zone and a line 45 feet (for streams less than 15 feet wide) or 70 feet (for streams more than 15 feet wide) from the bankfull width or the channel migration zone, whichever is greater, (See WAC 222-30-022.)

"RMZ outer zone" means the area measured horizontally between the outer extent of the inner zone and the RMZ width as specified in riparian management zone definition above. Width is measured from the bankfull width or the

channel migration zone, whichever is greater. See WAC 222-30-021 and -022.

"Sensitive sites" means one of the following:

(1) **Headwall seep** is a seep located at the toe of a cliff or other steep topographical feature and at the head a Type 4 Water which connects to the stream channel network via overland flow, and is characterized by loose substrate and fractured bedrock with perennial water at or near the surface throughout the year.

(2) **Side-slope seep** is a seep within 100 feet of a Type 4 Water located on side-slopes which are greater than 20 percent, connected to the stream channel network via overland flow, and characterized by loose substrate and fractured bedrock with perennial water at or near the surface throughout the year. Water delivery to the Type 4 channel is visible by someone standing in or near the stream.

(3) **Side-slope spring** is an identified spring within 100 feet of a Type 4 Water which is the initiation point for a stream and is connected to the stream's channel network via a perennial channelized flow.

(4) **Perennial initiation points.** See WAC 222-16-010

(5) **Alluvial fan** means an erosional land form consisting of cone-shaped deposit of water-borne, often coarse-sized sediments.

(a) The upstream end of the fan (cone apex) is typically characterized by a distinct increase in channel width where a stream emerges from a narrow valley;

(b) The downstream edge of the fan is defined as the sediment confluence with a Type 1, 2, or 3 Water; and

(c) The lateral margins of a fan are characterized by distinct local changes in sediment elevation and often show disturbed vegetation.

Alluvial fan does not include features that were formed under climatic or geologic conditions which are not currently present or that are no longer dynamic.

"Site class" means

a grouping of site indices that are used to determine the 100 year site class. In order to determine site class, the landowner will obtain the site index from the state soil survey, place it in the correct index range shown in the two tables provided in this definition, and select the corresponding site class. The site class will then drive the RMZ width. (See WAC 222-30-021 and 222-30-022.):

(1) **For western Washington**

<u>Site class</u>	<u>50-year site index range</u> (state soil survey)
<u>I</u>	<u>137 +</u>
<u>II</u>	<u>119-136</u>
<u>III</u>	<u>97-118</u>
<u>IV</u>	<u>76-96</u>
<u>V</u>	<u><75</u>

(2) **For eastern Washington**

<u>Site class</u>	<u>100-year site index range</u> (state soil survey)	<u>50-year site index range</u> > (state soil survey)
<u>I</u>	<u>120 +</u>	<u>86 +</u>
<u>II</u>	<u>101-120</u>	<u>72-85</u>
<u>III</u>	<u>81-100</u>	<u>58-71</u>
<u>IV</u>	<u>61-80</u>	<u>44-57</u>
<u>V</u>	<u><60</u>	<u><44</u>

For purposes of this definition, the site index at any location will be the site index reported by the Washington State Department of Natural Resources State Soil Survey, and detailed in the associated forest soil summary sheets. If the site index reported by the Washington State Department of Natural Resources State Soil Survey is nonexistent or indicates noncommercial or marginal commercial species, or the major species table indicates red alder, the

following apply:

(a) If the site index in the soil survey is for red alder, and the whole RMZ width is within the site index, then use site class V. If the red alder site index is only for a portion of the RMZ width, then use the site class for conifer in the adjacent soil polygon.

(b) If there is no data on site index, use same procedure as for red alder.

(c) If the site index is noncommercial or marginally commercial then use the same procedure as for red alder.

"Stream-adjacent parallel roads" means

roads in a riparian management zone on a property that have an alignment that is parallel to the general alignment of the stream, including roads used by others under easements or cooperative road agreements. Also included are stream crossings where the alignment of the road continues to parallel the stream for more than 250 feet on either side of the stream. Not included are federal, state, county or municipal roads that are not subject to forest practices rules, or roads of another adjacent landowner.

"Western Washington" means ~~((the lands of the state lying west of the administrative line described in the definition of Eastern Washington))~~ The geographic area of Washington west of the Cascade crest and the drainages defined in "Eastern Washington".

"Yarding corridor" means a narrow, linear path through a riparian management zone to allow suspended cables necessary to support cable logging methods or suspended or partially suspended logs to be transported through these areas by cable logging methods.

AMENDATORY SECTION

222-30-010 Policy--Timber harvesting.

* (1) This ~~section~~ chapter covers all removal of timber from forest lands in commercial operations, commercial thinning, salvage of timber, relogging merchantable material left after prior harvests, postharvest cleanup, and clearing of merchantable timber from lands being converted to other uses. It does not cover removal of incidental vegetation or removal of firewood for personal use. To the extent practical the department shall coordinate the activities on a multiple disciplinary planning approach.

* (2) The goal of riparian rules is to protect aquatic resources and related habitat to achieve restoration of high levels of riparian function and maintenance of these levels once achieved. The riparian functions include bank stability, the recruitment of woody debris, leaf litter fall, nutrients, sediment filtering, shade, and other riparian features that are important to both riparian forest and aquatic system conditions.

* (3) The rules provide for the conversion and/or treatment of riparian forests which may be understocked, overstocked or uncharacteristically hardwood dominated while maintaining minimum acceptable levels of function on a landscape scale. The diversity of riparian forests across the landscapes is addressed by tailoring riparian prescriptions to the site productivity and tree community at any site.

* (4) Wetland areas serve several significant functions in addition to timber production: Providing fish and wildlife habitat, protecting water quality, moderating and preserving water quantity. Wetlands may also contain unique or rare ecological systems. The wetland management zone and wetland requirements specified in this ~~section~~ chapter are designed to protect these wetland functions when measured over the length of a harvest rotation, although some of the functions may be reduced until the midpoint of the timber rotation cycle. Landowners are encouraged to voluntarily increase wetland acreage and functions over the long-term.

AMENDATORY SECTION

WAC 222-030-020 Harvest planning and design

(1) **Logging system.** The logging system should be appropriate for the terrain, soils, and timber type so yarding or skidding can be economically accomplished in compliance with these ~~((regulations))~~ rules.

* (2) **Landing locations.** Locate landings to prevent damage to public resources. Avoid excessive excavation and

filling.

***(3) Western Washington riparian management zones.** (See WAC 222-30-021 and -023(1).)

***(4) Eastern Washington riparian management zones.** (See WAC 222-30-022 and -023(2).)

***(5) Riparian leave tree areas.** (See WAC 222-30-021, 222-30-022, and 222-30-023.)

The department will require trees to be left along Type 4 Water where such practices are necessary to protect public resources. Where such practices are necessary leave at least 25 conifer or deciduous trees, 6 inches in diameter or larger, on each side of every 1000 feet of stream length within 25 feet of the stream. The leave trees may be arranged to accommodate the operation.

***(12) Channel migration zones.** No harvest, construction or salvage will be permitted within the boundaries of a channel migration zone except for the construction and maintenance of road crossings in accordance with applicable rules and the creation and use of yarding corridors consistent with WAC 222-030-020*(5)(a), WAC 222-30-060 (1), and chapter 220-110 WAC.

NEW SECTION

WAC 222-30-021 Western Washington riparian management zones. These rules apply to all typed waters on forest land in western Washington, except as provided in WAC 222-30-023. RMZs are measured horizontally from the bankfull width or channel migration zone, whichever is greater, and extend to the limits as described in this section. See the board manual section 7 for riparian design and layout guidelines.

***(1) Western Washington RMZs for Type 1, 2 and 3 Waters** have three zones: the core zone is nearest to the water, the inner zone is the middle zone, and the outer zone is furthest from the water. (See definitions in WAC 222-16-010.) RMZ dimensions vary depending on the site class of the land adjacent to the typed water, the management harvest option, and the stream size. See tables for management options 1 and 2 below.

None of the limitations on harvest in each of the three zones listed below will preclude or limit the construction and maintenance of roads for the purpose of crossing streams in WAC 222-24-030 and -050, or the creation and use of yarding corridors in WAC 222-30-060(1).

The shade requirements in WAC 222-30-040 must be met regardless of harvest opportunities provided in the inner zone RMZ rules. See the board manual section 1.

(a) **Core zones.** No timber harvest or construction is allowed in the core zone except operations related to forest roads as detailed in subsection (1) of this subsection. Any trees cut for or damaged by yarding corridors in the core zone must be left on the site. Any trees cut as a result of road construction to cross a stream may be removed from the site, unless used as part of a large woody debris placement strategy or needed to reach stand requirements.

(b) **Inner Zones.** Forest practices in the inner zone must be conducted in such a way as to meet or exceed stand requirements. The width of the inner zone is determined by site class, stream width, and management option. Timber harvest in this zone must be consistent with the stand requirements in order to reach the desired future condition targets.

"Stand requirement" means a number of trees per acre, the basal area and the proportion of conifer in the combined inner zone and adjacent core zone so that the growth of the trees would meet the following basal area targets when the stand is 140 years old.

Site Class	Desired future condition target basal area per acre (at 140 years)
I	285 sq. ft.
II	275 sq. ft.
III	258 sq. ft.
IV	224 sq. ft.
V	190 sq. ft.

Growth modeling is necessary to calculate whether a particular stand meets stand requirement and is on a trajectory towards these desired future conditions. The appropriate growth model will be based on stand characteristics and will include at a minimum, the following components: the number of trees by diameter class, the percent of conifer and hardwood, and the age of the stand. See the board manual section 7.

(i) When the existing stands in the combined core and inner zone do not meet stand requirements, no harvest is permitted in the inner zone. When no

harvest is permitted in the inner zone or the landowner chooses not to enter the inner zone, the width of core, inner, and outer zones are as provided in the following table:

No inner zone management RMZ widths for western Washington

Site class	RMZ width	Core zone width (measured from bankfull width or CMZ of water)	Inner zone width (measured from outer edge of core zone)		Outer zone width (measured from outer edge of inner zone)	
stream width 10'	stream width >10'	stream width 10'	stream width >10'			
I	200'	50'	83'	100'	67'	50'
II	170'	50'	63'	78'	57'	42'
III	140'	50'	43'	55'	47'	35'
IV	110'	50'	23'	33'	37'	27'
V	90'	50'	10'	18'	30'	22'

(ii) If trees can be harvested and removed from the inner zone because of surplus basal area consistent with the stand requirement, the harvest and removal of the trees must be undertaken consistent with one of two options:

(A) **Option 1. Thinning from below.** The objective of thinning is to distribute stand requirement trees in such a way as to shorten the time required to meet large wood fish habitat and water quality needs. This is achieved by increasing the potential for leave trees to grow larger than they otherwise would without thinning. Thinning harvest under option 1 must comply with the following:

- (I) Residual trees left in the combined core and inner zones must meet stand requirements necessary to be on a trajectory to desired future condition. See board manual section 7 for guidelines.
- (II) Thinning must be from below, meaning the smallest dbh trees are selected for harvest first, then progressing to successively larger diameters.
- (III) Thinning cannot decrease the proportion of conifer in the stand
- (IV) Shade retention to meet the shade rule must be confirmed by the landowner for any harvest inside of 75 feet from the bankfull width or CMZ, whichever is greater.
- (V) The number of residual trees per acre in the inner zone will equal or exceed 57.

Option 1. Thinning from below.

Site class	RMZ width	Core zone width (measured from bankfull width or CMZ of water)	Inner zone width (measured from outer edge of core zone)		Outer zone width (measured from outer edge of inner zone)	
stream width ≤10'	stream width >10'	stream width ≤10'	stream width >10'			
I	200'	50'	83'	100'	67'	50'
II	170'	50'	63'	78'	57'	42'
III	140'	50'	43'	55'	47'	35'
IV	110'	50'	23'	33'	37'	27'
V	90'	50'	10'	18'	30'	22'

(B) **Option 2. Leaving trees closest to the water.** Management option 2 applies only to riparian management zones for site class I, II, and III on streams that are less than or equal to 10 feet wide and RMZs in site class I and II for streams greater than 10 feet wide. Harvest must comply with the following:

- (I) Harvest is not permitted within 30 feet of the core zone for streams less than or equal to 10 feet wide and harvest is not permitted within 50 feet of the core zone for streams greater than 10 feet wide;
- (II) Residual leave trees in the combined core and inner zone must meet stand requirements necessary to be on a trajectory to desired future condition. See board manual section 7 for calculating stand requirements;
- (III) A minimum of 20 riparian leave trees per acre will be retained in any portion of the inner zone where harvest occurs. These riparian leave trees will not be counted or considered towards meeting applicable stand requirements nor can the number be reduced below 20 for any reason.
- (IV) Trees are selected for harvest starting from the outer most portion of the inner zone first then progressively closer to the stream.
- (V) If (I) of this subsection results in surplus basal area per the stand requirement, the landowner may take credit for the surplus by harvesting additional riparian leave trees required to be left in the adjacent outer zone on a basal area-for-basal area basis. The number of leave trees in the outer zone can be reduced only to a minimum of 10 trees per acre.

Option 2. Leaving trees closest to water (packing).

Site class	RMZ width	Core zone width (measured from bankfull width or CMZ of water)	Inner zone width			Outer zone width measured from outer edge of inner zone		
			stream width >10'	stream width ≤10'	stream width >10'	stream width ≤10'	stream width >10'	stream width ≤10'
stream width ≤10'	stream width ≤10'	stream width >10'	stream width >10'	stream width ≤10'	stream width >10'	stream width ≤10'	stream width >10'	stream width ≤10'
(measured from outer edge of core zone)	minimum floor distance (measured from outer edge of core zone)	(measured from outer edge of core zone)	minimum floor distance (measured from outer edge of core zone)					
I	200'	50'	84'	30'	84'	50'	66'	66'
II	170'	50'	64'	30'	70'	50'	56'	50'
III	140'	50'	44'	30'	**	**	46'	**

** Option 2 for site class III on streams > 10' is not available.

(iii) **Where the basal area components of the stand requirement cannot be met** within the sum of the areas in the inner and core zone due to the presence of a stream-adjacent parallel road in the inner or core zone a determination must be made of the approximate basal area that would have been present in the inner and core zones if the road was not occupying space in the core or inner zone and the shortfall in the basal area component of the stand requirement. See definition of "stream-adjacent parallel road" in WAC 222-16-010.

(A) Trees containing basal area equal to the amount determined in (iii) of this subsection will be left elsewhere in the inner or outer zone, or if the zones contain insufficient riparian leave trees, substitute riparian leave trees will be left within the RMZ width of other Type 1, 2 or 3 Waters in the same unit or along Type 4 or 5 Waters in the same unit in addition to all other RMZ requirements on those same Type 1, 2, 3, 4, or 5 Waters.

(B) When the stream-adjacent road basal area calculated in (iii) of this subsection results in an excess in basal area (above stand requirement) then the landowner may receive credit for such excess which can be applied on a basal area by basal area basis against the landowner's obligation to leave trees in the outer zone of the RMZ of such stream or other waters within the same unit, provided that the number of trees per acre in the outer zone is not reduced to less than 10 trees per acre.

(C) When the basal area requirement cannot be met, as explained in (iii) of this subsection, the shortfall may be reduced through the implementation of an acceptable large woody debris placement plan. See board manual section 7 for guidelines.

(iv) If a harvest operation includes both yarding and harvest activities within the RMZ, all calculations of basal area for stand requirements will be determined as if the yarding corridors were constructed prior to any other harvest activities. If trees cut or damaged by yarding are taken from excess basal area, these trees may be removed from the inner zone. Trees cut or damaged by yarding in a unit which does not meet the basal area target of the stand requirements cannot be removed from the inner zone. Any trees cut or damaged by yarding in the core zone may not be removed.

(c) **Outer Zones.** Timber harvest in the outer zone must leave 20 riparian leave trees per acre after harvest. "**Riparian leave trees**" are trees that must be left after harvest in the outer zone in western Washington. Riparian leave trees must be left uncut throughout all future harvests:

Outer zone riparian leave tree requirements

Application	Leave tree spacing	Tree species	Minimum dbh required
Outer zone	Dispersed	Conifer	12" dbh or greater
Outer zone	Clumped	Conifer	12" dbh or greater
Protection of sensitive features	Clumped	Trees representative of the overstory including both hardwood and conifer	8" dbh or greater

The 20 riparian leave trees to be left can be reduced in number under the circumstances delineated in (c)(iv) of this subsection. The riparian leave trees must be left on the landscape according to one of the following two strategies. A third strategy is available to landowners who agree to a LWD placement plan.

(i) **Dispersal strategy.** Riparian leave trees, which means conifer species with a diameter measured at breast height (dbh) of 12 inches or greater, must be left dispersed approximately evenly throughout the outer zone. If riparian leave trees of 12" dbh or greater are not available, then the next largest conifers

must be left. If conifers are not present, riparian leave trees must be left according to the clumping strategy in subsection (ii) below.

(ii) **Clumping strategy.** Riparian leave trees must be left clumped in the following way:

(A) Clump trees in or around one or more of the following **sensitive features** to the extent available within the outer zone. When clumping around sensitive features, riparian leave trees must be 8 inches dbh or greater and representative of the overstory canopy trees in or around the sensitive feature and may include both hardwood and conifer species. Sensitive features are:

Seeps and springs;

Forested wetlands;

Topographic locations (and orientation) from which leave trees currently on the site will be delivered to the water;

Areas where riparian leave trees may provide windthrow protection;

Small unstable, or potentially unstable, slopes not of sufficient area to be detected by other site evaluations. (See WAC 222-16-050(1)(d).)

Archeological or historical sites registered with the Washington State Office of Archeology and Historic Preservation WAC 222-16-050(1)(g); or

Sites containing evidence of Native American cairns, graves or glyptic records WAC 222-16-050(1)(g).

(B) If sensitive features are not present, then clumps must be well distributed throughout the outer zone and the leave trees must be of conifer species with a dbh of 12 inches or greater. When placing clumps, the applicant will consider operational and biological concerns. Tree counts must be satisfied regardless of the presence of stream-adjacent parallel roads in the outer zone.

(iii) **Large woody debris in-channel placement strategy.** A landowner may design a LWD placement plan in cooperation with the department of fish and wildlife. The plan must be consistent with guidelines in the board manual section 7. The landowner may reduce the number of trees required to be left in the outer zone to the extent provided in the approved LWD placement plan. Reduction of trees in the outer zone must not go below a minimum of 10 trees per acre. If this strategy is chosen, a complete forest practices application must include a copy of the WDFW approved hydraulics project approval (HPA) permit.

(iv) **Twenty riparian leave trees must be left after harvest** with the exception of the following:

(A) If a landowner agrees to implement a placement strategy, see (iii) of this subsection.

(B) If trees are left in an associated channel migration zone, the landowner may reduce the number of trees required to be left according to the following:

(I) Offsets will be measured on a basal area for basal area basis.

(II) Conifer in a CMZ equal to or greater than 6" dbh will offset conifer in the outer zone at a one-to-one ratio.

(III) Hardwood in a CMZ equal to or greater than 10" dbh will offset hardwood in the outer zone at a one-to-one ratio

(IV) Hardwood in a CMZ equal to or greater than 10" dbh will offset conifer in the outer zone at a three-to-one ratio.

***(2) Western Washington RMZs for Type 4 and 5 Waters.**

(a) An **equipment limitation zone** is a 30 foot wide buffer measured horizontally from the bankfull width of a Type 4 or 5 Water where equipment is limited. It applies to all perennial and seasonal streams.

(i) On-site mitigation is required if any of the following activities disturbs more than 10percent of the zone:

(A) Ground based equipment;

(B) Skid trails;

(C) Stream crossings (other than existing roads); or

(D) Cabled logs that are partially suspended.

(ii) Mitigation must be designed to replace the equivalent of lost functions especially prevention of sediment delivery. Examples include water bars, grass seeding, mulching, etc.

(iii) Nothing in this subsection (2) reduces or eliminates the department's authority to prevent actual or potential material damage to public resources under WAC 222-46-030 or 222-46-040 or any related authority to condition forest practices notifications or applications.

(b) **Sensitive site RMZs on Type 4 Waters.** Forest practices must be conducted to protect sensitive sites as detailed below:

(i) A 50-foot, no-harvest buffer, measured horizontally from the bankfull width, will be established along each side of the Type 4 Water as follows:

Required no-harvest, 50-foot buffers on Type 4 Waters.

Length of Type 4 Water from the confluence of Type 1, 2, or 3 Water	Length of 50' buffer required on Type 4 Water (starting at the confluence of the Type 4 and connected water)
Greater than 1000'	500'
Greater than 300' but less than 1000'	Distance of the greater of 300' or 50percent of the entire length of the Type 4 Water
Less than or equal to 300'	The entire length of Type 4 Water

(ii) No timber harvest is permitted in an area within 50 feet of the outer perimeter of a soil zone perennially saturated from a headwall seep.

(iii) No timber harvest is permitted in an area within 50 feet of the outer perimeter of a soil zone perennially saturated from a side-slope seep.

(iv) No timber harvest is permitted in an area within 50 feet of a side-slope spring.

(v) No timber harvest is permitted within a 100-foot by 100-foot buffer patch centered on a perennial initiation point.

(vi) No timber harvest is permitted within an alluvial fan.

(vii) No timber harvest is permitted within a 100-foot by 100-foot buffer patch centered on the point of intersection of two or more Type 4 Waters.

(viii) At least 50percent of Type 4 Waters length must be protected by buffers. If an operating area is located more than 500 feet upstream from the confluence of a Type 1, 2, or 3 Water and the Type 4 Water is more than 1,000 feet in length, then buffer of the Type 4 Water according to the following table. If the percentage is not met by protecting sensitive sites listed in subsections (i) through (vii) above, then additional buffers are required on the Type 4 Water to meet the requirements listed in the table.

Minimum percent of length of Type 4 waters to be buffered when more than 1000 feet upstream

from the confluence of a Type 1, 2, or 3 Water

Total length of a Type 4 Water upstream from the confluence of a Type 1, 2, or 3 Water	Percent of length of Type 4 Water that must be protected with a 50 foot no harvest buffer more than 500 feet upstream from the confluence of a Type 1, 2 or 3 Water
1000 feet or less	refer to table in this subsection (i) above
1001 - 1300 feet	19percent
1301 - 1600 feet	27percent
1601 - 2000 feet	30percent
2001 - 2500 feet	38percent
2501 - 3500 feet	42percent
3501 - 5000 feet	44percent
Greater than 5000 feet	45percent

The landowner must select the necessary priority areas for additional buffers according to the following priorities:

- (A) Low gradient areas;
- (B) Perennial water reaches of non-sedimentary rock with gradients greater than 20 percent in the tailed frog habitat range;
- (C) Hyporheic and groundwater influence zones; and
- (D) Areas downstream from other buffered areas.

Except for the construction and maintenance of road crossings and the creation and use of yarding corridors, no timber harvest will be allowed in the designated priority areas. Landowners must leave additional acres equal to the number of acres (including partial acres) occupied by an existing, stream-adjacent parallel road within a designated priority area buffer.

(c) None of the limitations on harvest in or around sensitive sites listed in (b) of this subsection will preclude or limit:

- (i) The construction and maintenance of roads for the purpose of crossing streams in WAC 222-24-030 and 222-24-050.
- (ii) The creation and use of yarding corridors in WAC 222-30-060(1).

To the extent reasonably practical, the operation will both avoid creating yarding corridors or road crossings through sensitive sites and associated buffers and avoid management activities which would result in soil compaction, the loss of protective vegetation or sedimentation in perennially moist areas.

Where yarding corridors or road crossings through sensitive sites and their buffers cannot reasonably be avoided, the buffer area must be expanded to protect the sensitive site by an area equivalent to the disturbed area or by providing comparable functions through other management initiated efforts.

Landowners must leave additional acres equal to the number of acres (including partial acres) occupied by an existing, stream-adjacent parallel road within a sensitive site buffer.

NEW SECTION

WAC 222-30-022 Eastern Washington riparian management zones. For eastside forests, riparian management is intended to provide stand conditions that vary over time, and is designed to mimic eastside disturbance regimes, within a range that meets functional conditions and maintains general forest health. These desired future conditions are a reference point on the pathway to restoration of riparian functions, not an end point of riparian stand development.

These rules apply to all typed waters on forest land in eastern Washington, except as provided in WAC 222-30-023. RMZs are measured horizontally from the bankfull width or channel migration zone, whichever is greater, and extend to the limits as described in the following section.

Eastern Washington RMZ for streams less than or equal to 15 feet wide.

Site Class	Total RMZ Width	Core Zone Width From bankfull width or CMZ, whichever is greater	Inner Zone Width	Outer Zone Width
I	130'	30'	45'	55'
II	110'	30'	45'	35'
III	90'	30'	45'	15'
IV	75'	30'	45'	0
V	75'	30'	45'	0

Eastern Washington RMZs for streams greater than 15 feet wide.

Site Class	Total RMZ Width	Core Zone Width From bankfull width or CMZ, whichever is greater	Inner Zone Width	Outer Zone Width
I	130'	30'	70'	30'
II	110'	30'	70'	10'

III	100'	30'	70'	0
IV	100	30'	70'	0
V	100'	30'	70'	0

*(1) **Eastern Washington RMZs on Type 1, 2 and 3 Waters** have three zones: the core zone is adjacent to the water, the inner zone is the middle zone, and the outer zone is furthest from the water. Permitted forest practices vary by timber habitat type and site class.

None of the limitations on harvest in each of the three zones listed below will preclude or limit the construction and maintenance of roads for the purpose of crossing streams in accordance with WAC 222-24-030 and 222-24-050, or the creation and use of yarding corridors in accordance with WAC 222-30-060(1).

The shade requirements in WAC 222-30-040 must be met regardless of harvest opportunities provided in the inner zone RMZ rules. See the board manual, section 1.

(a) **Core zones.** The core zone extends 30 feet measured horizontally from the edge of the bankfull width or outer edge of the CMZ, whichever is greater, for all timber habitat types. No harvest or construction is allowed in the core zone except as detailed in (1) of this subsection. Any trees cut for or damaged by yarding corridors must be left on site. Any trees cut as a result of road construction to cross a stream may be removed from the site unless used as part of a large woody debris replacement strategy.

(b) **Inner zones.** Width and leave tree requirements of the inner zone vary by timber habitat type as outlined below.

(i) **Ponderosa pine habitat type**

(A) The width of the inner zone is 70 feet measured horizontally from the outer edge of the core zone on streams greater than 15 feet bankfull width or 45 feet measured horizontally from the outer edge of the core zone on streams with a bankfull width of 15 feet or less.

(B) No harvest within the inner zone is permitted unless the basal area of conifer and hardwoods is greater than 110 square feet per acre for trees greater than 6 inches dbh or unless the basal area of conifer and hardwoods is less than 60 square feet per acre for trees greater than 6 inches dbh.

(C) If the basal area is greater than 110 square feet, harvest is permitted. The harvest must leave at least 50 trees per acre AND a basal area of at least 60 square feet per acre as follows:

(I) The 21 largest trees per acre must be left.

(II) The remaining 29 trees per acre must be greater than or equal to 10 inches dbh. If there are not 29 10-inch dbh or greater trees per acre, then all 10 inch dbh or greater trees must be left plus the largest remaining trees to equal 29 trees per acre. Select the 29 trees based on the following priority order:

Provide shade to water;

Lean towards the water;

Preferred species, as defined in WAC 222-16-010;

Evenly distributed across the inner zone.

(III) If more than 50 trees are needed to meet the minimum basal area of 60 square feet in (C) of this subsection, then trees greater than 6 inches dbh must be left. Select these additional trees based on the above priority order.

No more than 100 trees per acre are required to be left however the 60 square feet per acre basal area must still be met.

(D) If the basal area is less than 60 square feet AND there are more than 100 trees per acre, harvest is permitted. The harvest must leave at least 100 trees per acre as follows:

(I) The 50 largest trees per acre must be left.

(II) The next 50 trees per acre are required to be greater than 6 inches dbh. If there are not 50 6-inch dbh or greater trees per acre, then all 6-inch dbh or greater trees per acre must be left plus the largest remaining trees to equal 50 trees per acre. Select the trees based on the following priority order:

Provide shade to water;

Lean towards the water;

Preferred species, as defined in WAC 222-16-010;

Evenly distributed across the inner zone.

(E) At least 12 tons per acre of down wood present on the site before harvest must be left as follows:

(I) A minimum of six pieces greater than 16 inches diameter and 20 feet in length; and,

(II) A minimum of 4 pieces greater than 6 inches in diameter and 20 feet in length.

Note: If the minimum tonnage is not present prior to harvest activities, the landowner must state this fact on the forest practices application. Landowners are not required to create down wood.

(F) See **stream-adjacent parallel roads for all timber habitat types** in (iv) of this subsection if there is a stream-adjacent parallel road in this zone.

(ii) **Mixed conifer habitat type**

(A) The width of the inner zone is 70 feet measured horizontally from the outer edge of the core zone on streams greater than 15 feet bankfull width or 45 feet measured horizontally from the outer edge of the core zone on streams with a bankfull width of 15 feet or less.

(B) No harvest is permitted within the inner zone unless the basal area of conifer and hardwoods for trees greater than 6 inches dbh is:

(I) Greater than 110 or less than 70 square feet per acre on low site indexes (site index less than 90); or

(II) Greater than 130 or less than 90 square feet per acre on medium site indexes (site index between 90 and 110); or

(III) Greater than 150 or less than 110 square feet per acre on high site indexes (site index greater than 110).

(C) If the basal area meets the maximum requirements in (B) of this subsection, harvest is permitted. Harvest must leave at least 50 trees per acre AND a

basal area of at least 70 square feet per acre on low site indexes or 90 square feet per acre on medium site indexes or 110 square feet per acre on high site indexes as follows:

(I) The 21 largest trees per acre must be left.

(II) The remaining 29 trees per acre must be greater than or equal to 10 inches dbh. If there are not 29 10-inch dbh or greater trees per acre, then all 10 inch dbh or greater trees per acre must be left plus the largest remaining trees to equal 29 trees per acre. Select the 29 trees per acres based on the following priority order:

Provide shade to water;

Lean towards the water;

Preferred species, as defined in WAC 222-16-010; or

Evenly distributed across the inner zone.

(III) If more than 50 trees are needed to meet the basal area minimum in (B) of this subsection then trees greater than 6 inches dbh must be left based on the above priority order:

No more than 120 trees per acre are required to be left. However, the minimum basal area required in (B) of this subsection must be met.

(D) If the basal area is less than the minimum requirements in (B) of this subsection AND there are more than 120 trees per acre, harvest is permitted. Harvest must leave 120 trees per acre. The following trees are required to be left:

(I) The 50 largest trees per acre must be left.

(II) The next 70 trees per acre are required to be greater than 6 inches dbh . If there are not 70 6-inch dbh or greater trees per acre, then all 6-inch dbh or greater trees per acre must be left plus the largest remaining trees to equal 70 trees per acre. Select the trees based on the following priority order:

Provide shade to water;

Lean towards the water;

Preferred species, as defined in WAC 222-16-010; or

Evenly distributed across the inner zone.

No more than 120 trees per acre are required to be left. However, the minimum square feet of basal area in (C) above must be left.

(E) At least 20 tons per acre of down wood present on the site before harvest must be left as follows:

(I) A minimum of 8 pieces greater than 16 inches diameter and 20 feet in length; and

(II) A minimum of 8 pieces greater than 6 inches in diameter and 20 feet in length.

Note: If the minimum tonnage is not present prior to harvest activities, landowners must identify this in the application for harvest. Landowners are not required to create down wood.

(F) See **stream-adjacent parallel roads for all timber habitat types** in (iv) of this subsection if there is a parallel road in this zone.

(iii) **High elevation habitat type**

(a) The width of the inner zone is 45 feet measured horizontally from the outer edge of the core zone on streams equal to or less than 15 feet bankfull width or 70 feet measured horizontally from the outer edge of the core zone on streams with a bankfull width of greater than 15 feet.

(b) Follow stand requirements for western Washington riparian management zones, WAC 222-30-021(1)(b). Note: Option 2 is not available for eastside use.

(c) At least 30 tons per acre of down wood present on the site before harvest must be left as follows:

(I) A minimum of 8 pieces greater than 16 inches diameter and 20 feet in length; and

(II) A minimum of 8 pieces greater than 6 inches in diameter and 20 feet in length.

Note: If the minimum tonnage is not present prior to harvest activities, landowners must identify this in the application for harvest. Landowners are not required to create down wood.

(C) See **stream-adjacent parallel roads for all timber habitat types** in (iv) of this subsection if there is a parallel road in this zone.

(iv) **Stream-adjacent parallel roads for all timber habitat types in the inner zone.** Where a stream-adjacent parallel road exists in the inner zone and the minimum required basal area cannot be met due to the presence of the road, then the location of the road determine the allowable operations as follows:

(A) For a bankfull width that is greater than 15 feet:

(I) **No harvest is permitted in the inner zone** if the edge of the road closest to the stream is 75 feet or more from the bankfull width of the stream or CMZ, which ever is greater. This includes trees within the inner zone on the uphill side of the road which are retained for shade, sediment filtering and other riparian functions.

(II) **No harvest is permitted in the inner zone on the streamside of the zone** if the edge of the road closest to the stream is less than 75 feet from the bankfull width of the stream or CMZ, which ever is greater. The department will require additional leave trees to be left near the streams of the unit to be harvested, which are equal in total basal area to the trees lost due to the road, to replace lost riparian function. See site specific management activities to replace lost riparian functions or the large woody placement guidelines in the board manual section 7.

(B) For a bankfull width that is equal to or less than 15 feet:

(I) **No harvest is permitted in the inner zone** if the edge of the road closest to the stream is 50 feet or more from the bankfull width or CMZ, whichever is greater. This includes trees within the inner zone on the uphill side of the road which are retained for shade, sediment filtering and other riparian functions.

(II) **No harvest is permitted in the inner zone on the streamside of the road** if the edge of the road closest to the stream is less than 50 feet from the bankfull width or CMZ, which ever is greater. The department will require additional leave trees to be left near the streams of the unit to be harvested, which are equal in total basal area to the trees lost due to the road, to replace lost riparian function. See site specific management activities to replace lost riparian functions or the large woody placement guidelines in the board manual section 7.

Note: The shade rule, WAC 222-30-040, must be met whether or not the inner zone includes a stream-adjacent parallel road.

(c) **Outer Zones.** This zone has three categories based on timber habitat type: ponderosa pine, mixed conifer and high elevation. The width of this zone is 0 to 55 feet (measured horizontally) from the outer edge of the inner zone depending on the site class and stream width. Riparian leave trees must be left uncut throughout all future harvests. (See WAC 222-16-010 definition of "RMZ outer zone".)

(i) Tree counts that must be left per acre, regardless of the presence of an existing stream-adjacent parallel road in the zone, are:

(A) Ponderosa pine habitat type - 10 dominant or co-dominant trees.

(B) Mixed conifer habitat type - 15 dominant or co-dominant trees.

(C) High elevation habitat type - See requirements for western Washington RMZs WAC 222-30-021(1)(c).

(ii) Trees in the high elevation timber habitat type must be left on the landscape according to one of the following two strategies:

(A) **Dispersal strategy.** Riparian leave trees are the dominant and co-dominant trees of a conifer species. If riparian leave trees of 12" dbh or greater are not available, then the next largest conifers must be left dispersed approximately evenly throughout the outer zone. If there are not conifers, riparian leave trees must be left according to the clumping strategy in subsection (ii) below.

(B) **Clumping strategy.** Riparian leave trees must be left clumped in one of the following ways:

(I) Clump trees in or around one or more of the following **sensitive features** (to the extent available within the outer zone). When clumping around sensitive features, riparian leave trees must be dominant and co-dominant and may include both hardwood and conifer species. The sensitive features are:

Seeps and springs;

Forested wetlands;

Topographic locations (and orientation) from which leave trees currently on the site will be delivered to the water;

Areas where riparian leave trees may provide windthrow protection;

Small unstable, or potentially unstable, slopes not of sufficient area to be detected by other site evaluations. See to WAC 222-16-050(1)(d);

Archeological or historical sites registered with the Washington State Office of Archeology and Historic Preservation WAC 222-16-050(1)(g); or

Sites containing evidence of Native American cairns, graves or glyptic records WAC 222-16-050(1)(g).

(II) If sensitive features are not present, then clumps must be well distributed throughout the outer zone and the dominant and co-dominant leave trees must be of conifer species. When placing clumps, the applicant will consider operational and biological concerns.

***(2) Eastern Washington RMZs on Types 4 and 5 Waters.**

(a) An **equipment limitation zone** is a 30 foot wide buffer measured horizontally from the bankfull width of a Type 4 or 5 Water where equipment is limited. It applies to all perennial and seasonal streams.

(i) On-site mitigation is required if any of the following activities disturbs more than 10percent of the zone:

(A) Ground based equipment;

(B) Skid trails;

(C) Stream crossings (other than existing roads); or

(D) Cabled logs that are partially suspended.

(ii) Mitigation must be designed to replace the equivalent of lost functions, especially prevention of sediment delivery. Examples include water bars, grass seeding, mulching, etc.

(iii) Nothing in this subsection (2) reduces or eliminates the department's authority to prevent actual or potential material damage to public resources under WAC 222-46-030 or 222-46 040 or any related authority to condition forest practices notifications or applications.

(b) Type 4 Waters.

(i) Within 50 horizontal feet of the bankfull width of the stream, the landowner must identify either a partial cut and/or clearcut strategy for each unit to be harvested as follows:

(A) For partial cuts:

(I) Basal areas must meet the timber type dependent basal areas required for the eastern Washington RMZ inner zone.

(II) Where a stream-adjacent parallel road exists, the basal area required in (I) of this subsection is required to be left. (See stream-adjacent parallel roads for Type 4 Waters in (c) below.)

(III) The trees to be included in the basal area determination and left after harvest must include:

The 10 largest trees per acre;

Up to an additional 40 trees per acre greater than or equal to 10 inches dbh must be left. If all or some of the trees are not at least 10 inches dbh then the largest of the remaining trees must be left. Select trees based on the following priority order:

>Provide streambank stability;

> Provide shade to water

> Lean towards the water;

> Preferred species, as defined in WAC 222-16-010; or

> Evenly distributed across the inner zone; and

If the basal area target has not been met with the trees required above, up to an additional 50 trees are required greater than 6 inches in dbh based on the above priority order.

(IV) Side slope seeps must be protected with a 50-foot partial cut buffer.

(B) For clearcuts:

(I) The streamside boundary of all clearcuts must:

Not exceed in total 30percent of the total stream reach in the harvest unit;

Not exceed 300 continuous feet in length;

Not be located within 500 feet of the intersection of a Type 1, 2 or 3 Water; and

Not occur within 50 feet of the sensitive sites as defined in WAC 222-16-010:

The outer perimeter of a soil zone perennially saturated from a headwall seep;

The outer perimeter of a soil zone perennially saturated from a side-slope seep;

A side-slope spring;

The center of a perennial initiation point;

An alluvial fan;

The center point of intersection of two or more Type 4 Waters.

(II) When the clearcut strategy in (I) of this subsection is selected, the landowner must simultaneously designate a no-cut zone buffer along the stream reach in the harvest unit that is equal in total area to the clearcut portion of the stream reach in the harvest unit.

Note: Once approved by the department, the selected strategy will remain in effect until July 1, 2051. If a landowner transfers title of the harvest unit, the 161

landowner must provide written notice of this continuing obligation to the new owner and send a copy to the department. See WAC 222-20-055.

(c) Stream-adjacent parallel roads for Type 4 Waters.

If a road exists in a Type 4 RMZ and the basal area required to be left cannot be met within 50 horizontal feet of the bankfull width of the stream due to the presence of the road, then the distance of the road to the stream determines the allowable operations as follows:

(i) A road that is within 30 to 49 horizontal feet from the bankfull width of the stream requires

(A) A total of 100 horizontal feet of riparian zone (both sides of the stream count towards the total) must be left in a manner to provide maximum functions for non-fish use streams. If harvest is taking place on only one side of the stream, then 50' of RMZ must be left, regardless of presence of a stream-adjacent parallel road.

(B) The location of the riparian zone required in (A) of this subsection will be based on the following:

(I) Preferred: the area between the stream and the stream side edge of the road

(II) The area that provides the most shade to the channel

(III) The area that is most likely to deliver large woody debris to the channel.

(ii) A road that is within less than 30 horizontal feet from the bankfull width of the stream requires, in addition to (c)(i) (A) and (B) of this subsection, that all trees between the stream and the streamside edge of the road must be left.

NEW SECTION

This note redlined

*NOTE to the reader: This following section is an edited version of *(3) and *(4) in permanent rules effective January 1, 1999. The number changes reflect the additional 15percent that's required to be left, per ESHB 2091.*

End redline

WAC 222-20-023 Riparian management zones for exempt 20-acre parcels.

On parcels of 20 contiguous acres or less, landowners with total parcel ownership of less than 80 forested acres shall not be required to leave the riparian buffers described in WAC 222-30-021 and 222-30-022. As required by RCW 76.13.130, these landowners are subject to the permanent riparian management zone rules and watershed analysis prescriptions in effect as of January 1, 1999, plus an additional fifteen percent volume requirement where watershed analysis prescriptions are not in effect.

***(1) Western Washington RMZs for exempt 20-acre parcels.**

Riparian management zones are measured horizontally from the bankfull width of a Type 1, 2 or 3 Water and extend to the line where vegetation changes from wetland to upland plant community, or the line required to leave sufficient shade as required by WAC 222-30-040, whichever is greater, but must not be less than 29 feet in width nor more than the maximum widths described in (c) of this subsection, provided that the riparian management zone width shall be expanded as necessary to include wetlands or ponds adjacent to the stream. When the riparian management zone overlaps a Type A or B Wetland or a wetland management zone, the requirement which best protects public resources shall apply.

(a) Harvest units shall be designed so that felling, bucking, yarding or skidding, and reforestation can be accomplished in accordance with these regulations, including those regulations relating to stream bank integrity and shade requirements to maintain stream temperature. Where the need for additional actions or restrictions adjacent to waters not covered by the following become evident, WAC 222-12-050 and 222-12-060 may apply.

(b) When requested in writing by the applicant, the department shall assist in preparation of an alternate plan for the riparian management zone.

(c) Within the riparian management zone, there shall be trees left for wildlife and fisheries habitat as provided for in the chart below. Fifty percent or more of the trees shall be live and undamaged on completion of the harvest. The leave trees shall be randomly distributed where feasible; some clumping is allowed to accommodate operational considerations. The number, size, species and ratio of leave trees, deciduous to conifer, is specified by the bed material and average width of the water type within the harvest unit. Trees left according to (d) of this subsection may be included in the number of required leave trees in this subsection.

Western Washington riparian leave tree requirements for exempt 20-acre parcels

Water Type/ Average Width	RMZ Maximum Width	Ratio of Conifer to Deciduous/ Minimum Size Leave Trees	# Trees/1000 ft. each side	
Gravel/ Cobble <10" Diameter	Boulder/ Bedrock			
1 & 2 Water 75' & over	115'	representative of stand	58 trees	29 trees
1 & 2 Water under 75'	86'	representative of stand	115 trees	60 trees
3 Water 5' & over	58'	2 to 1/12" or next largest available	86 trees	29 trees

3 Water less than 5'	29'	1 to 1/6" or next largest available	29 trees	29 trees
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"Or next largest available" requires that the next largest trees to those specified in the rule be left standing when those available are smaller than the sizes specified.

Ponds or lakes which are Type 1, 2 or 3 Waters shall have the same leave tree requirements as boulder/bedrock streams.

(d) For wildlife habitat within the riparian management zone, leave an average of 5 undisturbed and uncut wildlife trees per acre at the ratio of 1 deciduous tree to 1 conifer tree equal in size to the largest existing trees of those species within the zone. Where the 1 to 1 ratio is not possible, then substitute either species present. Forty percent or more of the leave trees shall be live and undamaged on completion of harvest. Wildlife trees shall be left in clumps whenever possible.

(e) When 10 percent or more of the harvest unit lies within any combination of a riparian management zone of Type 1, 2 or 3 Waters or a wetland management zone and the harvest unit is a clearcutting of 20 acres or less, leave not less than 50 percent of the trees required in (c) of this subsection.

***(2) Eastern Washington riparian management zones for exempt 20-acre parcels.** These zones shall be measured horizontally from the bankfull width of Type 1, 2 or 3 Waters and extend to the line where vegetation changes from wetland to upland plant community, or to the line required to leave sufficient shade as required by WAC 222-30-040, whichever is greater, but shall not be less than the minimum width nor more than the maximum widths described in (c) of this subsection, provided that the riparian management zone width shall be expanded as necessary to include wetlands or ponds adjacent to the stream. When the riparian management zone overlaps a Type A or B Wetland or a wetland management zone, the requirement which best protects public resources shall apply.

(a) Harvest units shall be designed so that felling, bucking, yarding or skidding, and reforestation can be accomplished in accordance with these rules, including those rules relating to stream bank integrity and shade requirements to maintain stream temperature. Where the need for additional actions or restrictions adjacent to waters not covered by the following become evident, WAC 222-12-050 and 222-12-060 may apply.

(b) When requested in writing by the applicant, the department shall assist in preparation of an alternate plan for the riparian management zone.

(c) Within the riparian management zone, there shall be trees left for wildlife and fisheries habitat as provided for below. Fifty percent or more of the trees shall be live and undamaged on completion of the harvest. The leave trees shall be randomly distributed where feasible; some clumping is allowed to accommodate operational considerations.

(i) The width of the riparian management zone shall be based on the adjacent harvest type as defined in WAC 222-16-010 "Partial cutting." When the adjacent unit harvest type is:

Partial cutting - The riparian management zone width shall be a minimum of 35 feet to a maximum of 58 feet on each side of the stream.

Other harvest types - The riparian management zone shall average 58 feet in width on each side of the stream with a minimum width of 35 feet and a maximum of 345 feet on each side of the stream.

(ii) Leave tree requirements within the riparian management zones of Type 1, 2 or 3 Waters:

(A) Leave all trees 12 inches or less in diameter breast height (dbh); and

(B) Leave all wildlife reserve trees within the riparian management zone where operations in the vicinity do not violate the state safety regulations (chapter 296-54 WAC and chapter 49.17 RCW administered by department of labor and industries, safety division); and

(C) Leave 18 live conifer trees/acre between 12 inches dbh and 20 inches dbh distributed by size, as representative of the stand; and

(D) Leave 4 live conifer trees/acre 20 inches dbh or larger and the 2 largest live deciduous trees/acre 16 inches dbh or larger. Where these deciduous trees do not exist, and where 2 wildlife reserve trees/acre 20 inches or larger do not exist, substitute 2 live conifer trees/acre 20 inches dbh or larger. If live conifer trees of 20 inches dbh or larger do not exist within the riparian management zone, then substitute the 5 largest live conifer trees/acre; and

(E) Leave 3 live deciduous trees/acre between 12 inches and 16 inches dbh where they exist.

(iii) Minimum leave tree requirements per acre for Type 1, 2 and 3 Waters. Trees left for (c)(ii) of this subsection shall be included in the minimum counts.

(A) On streams with a boulder/bedrock bed, the minimum leave tree requirements shall be 75 trees/acre 4 inches dbh or larger.

(B) On streams with a gravel/cobble (less than 10 inches diameter) bed, the minimum leave tree requirement shall be 155 trees/acre 4 inches dbh or larger.

(C) On lakes or ponds the minimum leave tree requirement shall be 86 trees/acre 4 inches dbh or larger.

Note: See the board manual section 7 for guidelines for calculating trees/acre and average RMZ widths.

(d) When 10 percent or more of the harvest unit lies within any combination of a riparian management zone of Type 1, 2 or 3 Waters or a wetland management zone and the harvest unit is 20 acres or less or, leave not less than 50 percent of the trees required in (c) of this subsection. (See WAC 222-16-010 "Partial cutting.")

***(3) Riparian leave tree areas for exempt 20-acre parcels.** The department will require trees to be left along Type 4 Water where such practices are necessary to protect public resources. Where such practices are necessary leave at least 29 conifer or deciduous trees, 6 inches in diameter or larger, on each side of every 1000 feet of stream length within 29 feet of the stream. The leave trees may be arranged to accommodate the operation.

AMENDATORY SECTION

WAC 222-30-040 Shade requirements to maintain stream water temperature.

***(1) Determination of adequate shade.** The temperature prediction method mentioned in subsections (2) and (3) of this section shall be used to determine appropriate shade levels for flowing Type 1, 2 and 3 Waters to prevent excessive water temperatures which may have detrimental impact on aquatic resources. No tree may be harvested from the RMZ inner zone of any Type 1, 2, or 3 Water if, according to the methodology, that tree is providing shade to the stream necessary to maintain compliance with temperature standards. If a landowner elects to remove any tree within 75 feet of any Type 1, 2, or 3 Water, the landowner must demonstrate, using the methods in the board manual section 1, that the removal of the tree would not be contrary to the restrictions of this subsection.

Note: Within the bull trout overlay, all available shade will be retained within 75 feet of bankfull width or CMZ of the stream.

*** (2) Temperature prediction method.** In addition to the riparian management zone requirements, leave trees shall be retained in riparian management zones on flowing Type 1, 2 and 3 Waters as provided by the method described in the board manual which includes the following considerations:

- (a) Minimum shade retention requirements; and
- (b) Regional water temperature characteristics; and
- (c) Elevation; and
- (d) Temperature criteria defined for stream classes in chapter 173-201A WAC.

*** (3) Leave tree requirements for shade.** The method described in subsection (2) of this section (~~shall~~) must be used to establish the minimum required shade cover based on site specific characteristics. When site specific data indicate that pre-harvest conditions do not meet the minimums established by the method, no additional shade removal from riparian management zones will be allowed.

*** (4) Shade requirements must be satisfied whether or not the inner zone includes a stream-adjacent parallel road. Nothing will preclude or limit the harvest of shade trees in connection with the construction and maintenance of road crossings or the creation and use of yarding corridors.** (See WAC 222-30-060(1).

~~((4))~~ *** (5) Waivers.** The department may waive or modify the shade requirements where:

- ~~((a))~~ The applicant agrees to a staggered setting program producing equal or greater shade requirements to maintain stream temperature; or
- ~~(b))~~ The applicant provides alternative means of stream temperature control satisfactory to the department; or
- ~~((c))~~ (a) The temperature method indicates that additional shade will not affect stream-water temperature.

NEW SECTION

WAC 222-30-045 Salvage logging within riparian management zones. Salvage logging within a riparian management zone is based upon the zone (core, inner or outer) in which the tree was originally located, applicable riparian stand requirements and the extent of previous harvest activities in the zone.

- (1) **Salvage logging within the bankfull width of any typed water.** No salvage may take place within the bankfull width of any typed water.
- (2) **Salvage logging in a core zone or channel migration zone.** No salvage may take place within the RMZ core zone or a channel migration zone, including any portion of those trees that may have fallen outside of these zones.
- (3) **Salvage logging in the inner zone.** Salvage may not take place within the inner zone if the stand requirements cannot be met by the residual stand. If the proposed salvage involves down tree(s) that originated from the inner zone, salvage of down wood may only be permitted if the down wood was not needed to meet stand requirements in the inner zone. Salvage of any existing down wood may not take place if the unremoved balance of down wood is insufficient to meet the regional down wood guidelines in (a) and (b) of this subsection. Conduct of salvage within the inner zone must be conducted to protect residual undamaged trees within the inner zone. Down wood guidelines for salvage in RMZ inner zones are:

(a) **In western Washington**

Logs with a solid core	< 1 foot diameter	1-2 foot diameter	> 2 foot diameter	Total
Number of logs/acre	85	83	26	194

(b) **In eastern Washington** ponderosa pine, mixed conifer and high elevation habitat types: Follow the down wood requirements for each type in WAC 222-30-022.

(4) **Salvage logging in the outer zone.** Salvage may not take place within the outer zone if the riparian leave tree requirements cannot be met by the residual stand. If the proposed salvage involves tree(s) that are down that originated from the outer zone, salvage may only be permitted of down wood if the down wood was not needed to meet leave tree requirements in the outer zone.

AMENDATORY SECTION

WAC 222-30-060 Cable Yarding.

*** (1) Type 1, 2 and 3 Waters.** No timber shall be cable yarded in or across a Type 1, 2 or 3 Waters except where the logs will not materially damage the bed of waters, banks or riparian management zones, ~~((and removals from Type 1, 2, or 3 Waters have hydraulic project approval of the departments of fisheries or wildlife.))~~ If yarding across Type 1, 2 or 3 Waters is permitted, then yarding is limited to cable or other aerial logging methods. Any work in or above Type 1, 2 or 3 Waters requires a hydraulics project approval (HPA). Any work in or above a Type 4 or 5 Water may require a HPA. Logs must be fully suspended above the water unless otherwise allowed in the applicable HPA. Yarding corridors must be no wider or more numerous than necessary to accommodate safe and efficient transport of logs. Generally, yarding corridors should be located no closer to each other than 150 feet (measured edge to edge) and should be no wider than 30 feet. Safety is a prime consideration in the location of yarding corridors. Total openings resulting from yarding corridors must not exceed 20 percent of the stream length associated with the forest practices application. When changing cable locations, care must be taken to move cables around or clear of the riparian vegetation to avoid damage to riparian vegetation.