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Annotated Bibliography on Forest Practices Legislation Related to Water Quality

Abstract

Includes annotated citations of literature on forest practices regulations related to all aspects of water quality protection. The bibliography is divided into three sections: 1) Water-quality protection during timber harvesting; 2) Methods for assessing the costs and benefits of water quality protection; and 3) Effectiveness of regulatory programs in protecting water quality.

The Compilers

NEIL K. HUYLER is a research forester with the Northeastern Research Station's Forestry Sciences Laboratory in Burlington, Vermont. He joined the Northeastern Station in 1963.

DAVID MCMATH is a field forester with the Ken Davis Contracting Service, Hardwick, Vermont.

DAPHNE HEWITT is a graduate student with the University of Vermont, Department of Natural Resources, Burlington.

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Compiled by

Neil K. Huyler
David McMath
Daphne Hewitt

Foreword

During the past two decades, numerous federal, state, and local regulations have had a direct impact on forest harvesting operations. In particular, amendments to the Water Pollution Control Act of 1972 have focused attention on the quality of water flowing from forested lands and the impact of harvesting on water quality. Best Management Practices have been the regulatory choice of most states in minimizing the adverse impact of silvicultural practices activities on water quality in forested ecosystems.

This bibliography includes 80 annotated citations of literature on forest practices regulations related to all aspects of water quality protection. The bibliography is divided into three sections: 1) Water-quality protection during timber harvesting; 2) Methods for assessing the costs and benefits of water quality proteciton; and 3) Effectiveness of regulatory programs in protecting water quality.

Water-Quality Protection During Timber Harvesting

Agee, J. L. 1975. **A suggested state forest practice act: one implementing mechanism for improving water quality on forest lands.** Journal of Forestry. 73(1): 40-41.

The U. S. Environmental Protection Agency's (EPA) policy on water quality is discussed. The EPA supports educational programs and incentives to encourage improved forest management practices.

Berg, S. R. 1992. **Private forestry is heavily regulated, you just don't know it or haven't had it pointed out to you yet!** In: Proceedings of the 20th annual hardwood symposium; Cashiers, NC. Memphis, TN: Hardwood Research Council: 35-36.

Sixteen federal laws and their respective impacts are reviewed. Under the Clean Water Act, Best Management Practices are required by each state. The forest industry should become better acquainted with the laws that affect it and improve its practices to avoid additional regulation.

Bousquet, D. 1989. **Timber harvesting in Vermont: summary of laws and regulations: a resource guide.** Burlington, VT: University of Vermont Extension Service. 18 p.

Summarizes laws and regulations with respect to water quality that affect timber harvesting in Vermont. The legal requirements of Vermont's Acceptable Management Practices for maintaining water quality during logging operations are discussed.

Brynn, D. 1993. **A summary of regulations applying to forest practices in Vermont.** Vermont For. Exch. Inf. Bull. Waterbury, VT: Vermont Department of Forests, Parks, and Recreation. 2 p.

Lists regulations pertaining to forest industry in Vermont, including Acceptable Management Practices.

Cheng, A. S.; Ellefson, P. V. 1993. **State forest practice laws and regulations: a review of constitutional and legal environments.** Staff Pap. Ser. 88. St. Paul, MN: University of Minnesota, College of Natural Resources and Agriculture Experiment Station. 47 p.

Examines regulation of forestry practices on private property using case studies. Defines forest property and land-use rights and discusses constitutionality of forest practices regulations.

Cubbage, F. W. 1991. **Public regulation of private forestry—proactive public policy.** Journal of Forestry. 89(12): 31-35.

The significance and future ramifications of state regulation on forest practices are discussed. Foresters should become actively invovled in the drafting of legislation that affects their operations.

Cubbage, F. W. 1995. **Regulation of private forest practices: what rights, which policies?** Journal of Forestry. 93(6): 14-20.

Discusses state and federal authority to regulate private forests as well as states' voluntary Best Management Practices. Individual states should work toward achieving a balance between public benefits and private cost of regulations.

Cubbage, F. W.; Siegel, W. C. 1985. **The law regulating private forest practices—local, state, and federal rules pass most legal tests.** Journal of Forestry. 83(9): 538-545.

The legal standing and forest practices laws and their limits are examined through numerous case studies. Although the constitutionality of forest practices laws has been upheld, the trend toward favoring public welfare over private property has been the subject of widespread debate.

Cubbage, F. W.; Siegel, W. C. 1988. **State and local regulation of private property in the East.** Northern Journal of Applied Forestry. 5(2): 103-108.

Forest practices regulations in the Eastern United States is reviewed. Regulation in eastern states is likely to increase in response to a proliferation of local laws, and increase at a greater rate in the North than in the South.

Cubbage, F. W.; Siegel, W. C. 1990. **The impact of federal environmental law on forest resource management in the United States.** In: Forestry legislation. Report of the IUFRO working party S4.08-03 forest law and related legislation; Zurich, Switzerland. Zurich, Switzerland: International Union of Forestry Research Organizations. 10: 87-107.

Reviews major federal environmental laws, including the Water Pollution Control Act and amendments. Specific court cases are cited, including rulings that individual states have the authority to supplement Best Management Practices programs with their own water quality standards.

Cubbage, F. W.; Siegel, W. C.; Haines, T. K. 1987. **Water quality law affecting forestry in the Eastern United States.** In: Symposium on monitoring, modeling, and mediating water quality. Herndon, VA: American Water Resources Association: 597-609.

Summarizes the impact of forestry on water quality as well as federal legislation affecting the timber industry in the Eastern United States. The water quality programs for

various eastern states are described. Although most of these states have relied on voluntary Best Management Practices to control nonpoint source pollution, amendments to the Clean Water Act may result in increased enforcement efforts.

Ellefson, P. V. 1974. **Focus on the issue—state forest practices acts.** Journal of Forestry. 72(4): 196-197.

Describes forest practices legislation in 11 states.

Ellefson, P. V. 1988. **Private forest, public interest.** Habitat. 5(4): 28-30.

Discsses impetus for regulating private forest land and examines components of regulations, including intent, implementation, and target ownership group.

Ellefson, P. V. 1992. **Forestry practices and private owners of forest land: the costs of ensuring water quality.** Conference on forestry practices and water quality. Green Bay, WI: Lake States Forestry Alliance. 11 p.

Discusses issues surrounding the implementation of programs to protect water quality on private land. Describes three types of programs and the costs and benefits associated with each type. Recommendations for future programs include estimating actual costs and evaluating program effectiveness.

Ellefson, P. V. 1993. **State forestry practices laws, public restrictions on private forestry.** Forest Farmer. 5(4): 14-17, 35.

An overview of regulations, including water quality protection, in the United States. Discusses the value of educational programs and provides guidelines for developing a regulatory program. Actual administrative costs incurred by selected states are listed.

Ellefson, P. V.; Cubbage, F. W. 1980. **State forest practice laws and regulations: a review and case study for Minnesota.** Stn. Bull, 536. St. Paul, MN: University of Minnesota, Agricultural Experiment Station. 42 p.

Discusses regulation of private forestry practices in various states. The regulations that effect Minnesota's private forests are used as a case study.

Flich, W.A.; Barnes, A.; Tufts. R. A. 1995. **Public purpose and private property: the evolution of regulatory taking.** Journal of Forestry. 93(6): 21-24.

Discusses the legal basis of state and federal regulation and the increase in litigation concerning private property rights.

Goetzl, A.; Siegel, W. C. 1980. **Water quality laws in southern states: how they affect forestry.** Southern Journal of Applied Forestry. 4(1): 2-10.

Lists water quality laws in southern states and discusses the statutes' provisions, administering agencies, penalties, significance for forest managers, and related legislation. No state in the South has enforced water quality laws with respect to nonpoint source pollution. Most of these states have relied on voluntary programs to protect water quality.

Goodfellow, J. W.; Lea, R. V. 1985. **A town and its harvesting ordinance.** Journal of Forestry. 83(3): 159-161.

A case study of one community's experiences with its existing timber harvesting ordinance and the process used to update it.

Greene, J. L.; Siegel, W. C. 1994. **The status and impact of state and local regulation on private timber supply.** Gen. Tech. Rep. RM-255. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 22 p.

Reviews state and local regulatory acts as they affect water quality and wetlands, endangered species, and forestry practices. Water quality regulation is likely to increase during the next decade, particularly in the eastern states. Regulations significantly affect the timber supply from nonindustrial private forests in the Northern and Southern United States.

Greis, J. G. 1979. **Applying Best Management Practices on Florida's forestlands.** Southern Journal of Applied Forestry. 3(2): 43-47.

Examines Florida's efforts to prevent nonpoint source pollution due to forest management practices. The process of assessing pollution problems and identifying Best Management Practices that are most effective in minimizing the impact of timber harvesting is discussed.

Haines, T. K.; Siegel, W. C. 1986. **State forest practice regulation—the Massachusetts and California cases.** In: National symposium of current targets in forest research: emphasis on contributions by women scientists. Gen. Tech. Rep. SE-46. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station: 144-149.

Discusses forest practices regulations and their legal framework in Massachusetts and California. Regulation and enforcement generally are more strict in California than Massachusetts, possibly due to the greater fragility of California's forest ecosystems and the large proportion of land in federal ownership in that state compared to Massachusetts.

Hawkes, L. J.; Cubbage, F. W.; Haney, H. L., Jr.; Shaffer, R. M.; Newmann, D. 1993. **Forest water quality protection—a comparison of regulatory and voluntary programs.** Journal of Forestry. 93(5): 48-54.

Compares Maryland's regulatory approach to water quality protection with Virginia's voluntary program. There was little difference in the level of compliance between the two states, though costs differed considerably. In 1990, Virginia spent $0.50 to $0.58 per thousand board feet (Mbf) on water quality protection, while Maryland spent $1.70 to $3.20 per Mbf. The willingness of an individual state to fund programs to prevent nonpoint source pollution should be taken into account when comparing cost differences between regulatory and voluntary approaches (see Haney and Shaffer 1992).

Henly, R. K.; Ellefson, P. V.; Moulton, R. J. 1988. **State regulation of private forest practices: what accomplishments at what cost?** Western Wildlands. 13(4): 23-28.

Overview of regulation in the United States with emphasis on potential costs. Studies of individual states revealed that the cost required to comply with forest practices regulations ranged from $1.50 to $25 per thousand board feet.

Ice, G. D. 1986. **1983 review of the literature on forest management practices, hydrology, and water quality protection and management.** Tech. Bull. 507. Research Triangle Park, NC: National Council of the Paper Industry for Air and Stream Improvement. 73 p.

Reviews technical information and environmental literature related to forest management and water quality. Topics include regulatory, legislative, and research issues, runoff, sediment, nutrients, and forest chemicals.

Ice, G. D. 1986. **1984 review of the literature on forest management practices, hydrology, and water quality protection and management.** Tech. Bull. 510. Research Triangle Park, NC: National Council of the Paper Industry for Air and Stream Improvement. 64 p.

Irland, L. C. 1985. **Logging and water quality: state regulation in New England.** Journal of Soil and Water Conservation. 40(1): 98-104.

Examines the effect of logging on water quality in New England, and compares the regulatory strategies of individual states in this region.

Irland, L. C. 1992. **Environmental regulations and the forest products industry (revised draft).** Winthrop, ME: Irland Group. 20 p.

Reviews environmental regulations during the past 40 years and their impact on the location of industrial plants. Concerns related to water quality often prove the most influential in the selection of industrial sites. Guidelines on planning and selecting industrial locations are included.

Irland, L. C.; Connors, J. F. 1994. **State nonpoint pollution programs affecting forestry: the 12 Northeastern states.** Northern Journal of Applied Forestry. 11(1): 5-11.

Reviews state programs designed to protect water quality in the Northeast. Half of the 12 states studied have initiated voluntary programs; the other six states maintain a mandatory program.

Lickwar, P. M.; Cubbage, F. W.; Hickman, C. A. 1990. **Current southern state program for control of forestry nonpoint source pollution.** Southern Journal of Applied Forestry. 14(2): 64-69.

Results of a 1987 survey showed that southern states rely on voluntary programs and education initiatives to control nonpoint source pollution from silvicultural practices. Estimated costs incurred by the region for water quality programs during 1987 totaled $935 million.

Martus, C. E.; Haney, H. L., Jr.; Siegel, W. C. 1995. **Local forestry regulatory ordinances: trends in the Eastern United States.** Journal of Forestry. 93(6): 27-31.

A survey revealed 508 local ordinances to regulate forest practices in the eastern states. Eighty percent of these were adopted within the previous decade, the majority in the North. Local ordinances in this region primarily address environmental protection, while southern ordinances were primarily concerned with protecting financial investment in forest resources.

Maryland Department of Natural Resources and University of Baltimore. 1991. **A guide to Maryland's regulations of forest products industries: energy conservation, energy production, and environmental protection through production and utilization of a renewable resource.** Annapolis, MD: Maryland Department of Natural Resources. 171 p.

Handbook on Maryland's regulations pertaining to forest-based businesses in that state.

Miles, P. D. 1982. **Annotated bibliography of the economic implications of managing nonpoint forestry sources of water pollution.** Staff Pap. Ser. 28. St. Paul, MN: University of Minnesota, College of Forestry. 21 p.

Focuses on literature references related to the economic analysis of water quality protection measures.

Neibling, C.; Auger, P.; Lutz, J. 1992. **New Hampshire municipal officials guide to timber harvesting laws.** Durham, NH: New Hampshire Timberland Owners Association and University of New Hampshire Cooperative Extension. 20 p.

Describes New Hampshire's laws and regulations affecting timber harvesting, including water quality protection measures.

Pidot, J. R. 1982. **Maine's land-use regulation commission.** Journal of Forestry. 80(9): 591-593, 602.

In Maine, forest-land use is divided into three major zones: protection, development, and management. Landowner acceptance is the most significant issue surrounding this zoning program.

Salazar, D. J.; Cubbage, F. W. 1990. **Regulating private forestry in the West and South.** Journal of Forestry. 88(1): 14-19.

Reviews changes in forest practices regulations and focuses on two policy models, a comprehensive approach adopted by western states that considers all forest practices and a single-issue approach used by states in the South. That western states have been more successful than their southern counterparts in protecting water quality suggests that the potential cost and confusion arising from many different laws may be greater than from a single state law.

Shephard, J. P. 1993. **Effects of forest management on surface water quality in wetland forests.** Research Triangle Park, NC: National Council of the Paper Industry for Air and Stream Improvement. 32 p.

Reviews the impact of forest management on water quality in wetlands in Alabama, Florida, Mississippi, North Carolina, and South Carolina.

Siegel, W. C. 1974. **State forest practice laws today.** Journal of Forestry. 72(4): 208-211.

Overview of current regulation with specific examples of various approaches by states.

Siegel, W. C. 1990. **Legislative regulation of private forestry practices in the United States—recent trends.** In: Forestry legislation. Report of the IUFRO working party S4.08-03 forest law and related legislation; Zurich, Switzerland. Zurich, Switzerland: International Union of Forestry Research Organizations 10: 349-364.

Overview of forest legislation, including water quality protection and the legal basis of regulation. Discusses regulatory trends in the East, West, and South. Regulations in the western states may set precedents for the rest of the nation.

Siegel, W. C. 1991. **Emerging legal issues in hardwood management.** In: Facing uncertain futures and changing rules in the 1990's: proceedings of the 19th annual hardwood symposium of the Hardwood Research Council. Memphis, TN: Hardwood Research Council: 27-37.

Examines the role of government in the management of private forest land and the legal basis of regulation. The involvement of the forest community is required to prevent poorly conceived regulatory programs.

Siegel, W. C. 1991. **Forestry implications of water quality and wetland law.** In: agricultural outlook '92: new opportunities for agriculture; proceedings of the 68th annual outlook conference. Washington, DC: U.S. Department of Agriculture: 177-179.

Reviews the history, purpose, and implications of local, state, and federal legislation related to water quality protection.

Wilson, L. W. 1985. **The Oregon Forest Practices Act.** Journal of Soil and Water Conservation. 40(1): 103-104.

Oregon's forest industry, environmental agencies, and resource managers agree that the state's Forest Practices Act has had a positive impact on the protection of water quality and other natural resources.

Methods for Assessing Costs and Benefits of Water Quality Protection

Aust, W. M.; Shaffer, R. M.; Burger, J. A. 1996. **Benefits and costs of forestry "Best Management Practices" in Virginia.** Southern Journal of Applied Forestry. 20(1): 23-29.

Benefits and cost of Best Management Practices were assessed for the Coastal Plain, Piedmont, and Mountain regions of Virginia. The benefit/cost ratio was most favorable for the Piedmont. The assessment showed that the state's private landowners pay a large proportion of water protection costs but do not derive comparable benefits (see Shaffer et al. 1999).

Blinn, C. R.; Dahlman, R. 1996. **Timber harvester perceived costs and benefits of applying water quality Best Management Practices in Minnesota.** In: Planning and implementing forest operations to achieve sustainable forests: proceedings of papers presented at joint meeting of Council on Forest Engineering and International Union of Forestry Research Organizations. Gen. Tech. Rep. NC-186. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station: 55-60.

In a mail survey of timber harvesters in Minnesota, 85 percent of the respondents indicated a willingness to comply with Best Management Practices (BMP). However, 78 percent believed they would incur additional costs by applying BMP's. The benefits cited most frequently were increased productivity and an increase in the number of operable days.

Caulfield, J.; Welker, J.; Meldahl, R. 1992. **Economic tradeoffs of streamside management zones.** In: The economics of southern forest productivity: competing in world markets: proceedings of southern forest economics workshop; 1992 April 29 - May 1; Mobile, AL. Columbus, GA: Mead Corporation: 211-224.

The potential opportunity cost of streamside management zones (SMZ) on industrial forest land in Georgia's Piedmont region are estimated. The potential revenue that would be lost from the SMZ's was subtracted from the current value of the timber revenue over an unlimited period. Losses for the most intensive management scenario totaled $2.2 million or 14.4 percent of total forest value.

Cubbage, F.; Lickwar, P. 1991. **Estimating the costs of water quality protection on private forest lands in Georgia.** Res. Pap. 86. Macon, GA: Georgia Forestry Commission. 10 p.

Best Management Practices (BMP) that are used most frequently during timber harvesting operations on private forests were used to estimate water quality costs for three regions in Georgia. Three levels of regulation were considered: no regulation, current BMP guidelines, and an enhanced regulation scenario. Total average costs ranged from $21.73 per acre for current BMP implementation to $26.98 per acre for enhanced regulation.

Dykstra, D. P.; Froehlich, H. A. 1976. **Costs of stream protection during timber harvesting.** Journal of Forestry. 74(10): 684-687.

Compares the cost of three methods of stream protection used during timber harvesting operations: conventional felling, directional felling, and buffer strips. A deterministic simulation model was used to compute the total logging cost for a particular area. No method was clearly preferred over the others from a cost standpoint.

Ellefson, P. V.; Miles, P. D. 1985. **Protecting water quality in the Midwest: impact on timber harvesting costs.** Northern Journal of Applied Forestry. 2: 57-61.

The cost of six Best Management Practices designed to protect water quality were evaluated for 18 timber harvesting operations in the Midwest. Reduction in net revenue ranged from 1.3 percent to design skid trails to 59.1 percent to install broad-based dips.

Gregory, R.; Niemi, E.; Mendelson, R. 1989. **A model for evaluating the impacts of forest management regulations.** Journal of Environmental Management. 29: 129-144.

An analytical model was developed to evaluate the effect of regulations on the environment and forest economy in the State of Washington. The model presents information in a standard format and provides a framework for decisionmaking that reduces the time spent on negotiation.

Haney, H. L., Jr.; Cleaves, D. A. 1992. **Potential cost of forestry regulation in the South.** Forest Farmer. 3: 8-21.

To estimate the financial impact of future forest regulation in Georgia, the regulatory programs in Oregon were applied to a hypothetical forest tract that is typical of those found in Georgia. Oregon's programs were chosen because of their comprehensiveness and simularity with Georgia's programs. The estimated implementation cost of $173.54 per acre would reduce landowner's investment growth by $12.15 per acre.

Haney, H. L., Jr.; Shaffer, R. M. 1992. **Regulation of private forest land—an assessment of public and/or private costs of water quality protection.** In: Proceedings of the 20th annual hardwood symposium; Cashiers, NC. Memphis, TN: Hardwood Research Council: 21-34.

The mandatory water protection program in Maryland is more complex than Virginia's voluntary program and, therefore, is more costly to implement (see Hawkes et al. 1993).

Henly, R. K.; Ellefson, P. V. 1986. **State forest practice regulation in the United States: administration, cost, and accomplishment.** Stn. Bull. AD-SB-3011. St. Paul, MN: University of Minnesota, Agricultural Experiment Station. 154 p.

Overview of forest practices regulations in the United States. The total annual cost to state agencies that administer regulatory programs ranges from $500,000 in Massachusetts to $1.65 in Oregon. Costs incurred by the private sector range from $2,000 in Nevada to $52 million in California.

Hickman, C. A.; Jackson, B. D. 1979. **Economic impacts of controlling soil loss from silvicultural activities in east Texas.** Forest Science. 25(4): 627-640.

A linear programming model was used to study the economic effect of water quality measures designed to limit soil losses from silvicultural practices in northeastern Texas. No single control measure was preferable with respect to economic cost or soil retention.

Huyler, N. K.; LeDoux, C. B. 1995. **Estimating the cost of applying Vermont Acceptable Management Practices to logging on moderate slopes.** In: Sustainability, forest health, and meeting the nation's need for wood products: proceedings of the 18th annual meeting of the Council on Forest Engineering; 1995 June 5-8; Cashiers, NC. Raleigh, NC: North Carolina State University, College of Forest Resources: 165-171.

In Vermont, harvesting costs were compared for cable yarding versus the use of a rubber-tired skidder on a 47-acre forest tract with slopes of 35 percent. The cost to implement Acceptable Management Practices (AMP) was $55.54 per acre for the skidder versus $72.20 for cable yarding with no AMP's and $63.87 with AMP's.

Kemper, R. E.; Davis, L. S. 1976. **Costs of environmental constraints on timber harvesting and regulation.** Journal of Forestry. 74(11): 754-756, 761.

A linear programming model was used to assess the economic and aesthetic effects of regulatory constraints on two national forests in the Western United States.

Lickwar, P. M.; Hickman, C. A.; Cubbage, F. W. 1992. **Costs of protecting water quality during harvesting on private forestlands in the Southeast.** Southern Journal of Applied Forestry. 16(1): 13-20.

An economic engineering approach was used to estimate the cost of implementing standard and enhanced Best Management Practices (BMP) in three southeastern states. The number of recommended structures was estimated from topographic maps and unit costs were derived from loggers' estimates. Total implementation costs ranged from $12.45 per acre for standard BMP's to $21.94 per acre for enhanced BMP's.

Miller, W. L.; Everett, H. W. 1975. **The economic impact of controlling nonpoint pollution in hardwood forestland.** American Journal of Agricultural Economics. 57(4): 576-583.

Two economic models were used to determine the economic impact of controlling soil loss due to changing forest management practices. Substantial costs were incurred both by individual landowners and regional businesses.

Olsen, E. D.; Keough, D. D.; LaCourse, D. K. 1987. **Economic impact of proposed Oregon forest practice rules on industrial forest lands in the Oregon Coast Range: a case study.** Res. Bull. 61. Corvallis, OR: Oregon State University, Forest Research Laboratory. 16 p.

Three timber harvesting systems applied within the riparian zones of a 1,336-acre tract in Oregon were compared. One harvesting system was based on current regulations affecting buffer zones and two systems were based on more increasingly restrictive regulation. Landowner costs increased from $75 to $653 per acre, primarily from restrictions on the harvesting of conifers in buffer strips.

Shaffer, R. M.; Haney, H. L., Jr.; Worrell, E. G.; Aust, W. M. 1999. **Forestry BMP implementation costs for Virginia.** Forest Products Journal. [in press].

Costs to implement Best Management Practices (BMP) on 47 harvesting sites in the Coastal Plain, Piedmont, and Mountain regions of Virginia were compared. Average BMP costs per acre totaled $8.11 in the Coastal Plain, $25.75 in the Piedmont, and $29.29 in the Mountain region. The annual BMP cost to Virginia's loggers, landowners, and the forest industry is about $3.5 million (see Aust et al. 1996).

Washington Forest Protection Association. 1992. **Macro impact analysis of proposed forest practices rules.** Olympia, WA: Washington Forest Protection Association. 18 p.

The economic impact of proposed forest practices regulations on the forest industry, wetlands, size of clearcuts, critical habitat for wildlife, and other factors was estimated on the basis of annual harvest.

Woodman, J. N.; Cubbage, F. W. 1993. **Models for estimating costs and benefits of forestry nonpoint source pollution control programs in Georgia.** Final report to the EPA. [Place of publication unknown]: [Publisher name unknown]. 60 p.

Reviews Georgia's regulatory history, describes specific Best Management Practices (BMP) that must be implemented during timber harvesting to prevent nonpoint source pollution, and reports results of studies that estimated the cost of BMP's and forest practices regulations.

Effectiveness of Regulatory Programs in Protecting Water Quality

Briggs, R. D.; Kimball, A. 1998. **Compliance with forestry Best Management Practices in Maine.** Northern Journal of Applied Forestry. 15(2): 57-68.

A random sample of 120 sites in areas harvested from January 1, 1993 to December 31, 1994 was used in evaluating levels of compliance with 60 Best Management Practices (BMP) in Maine. The degree of compliance was similar to that reported in other studies for Vermont and Minnesota. The most commonly recommended BMP's have reduced levels of erosion and sedimentation in Maine.

Brown, G. W. 1978. **Oregon's Forest Practices Act: an early appraisal.** Journal of Forestry. 76(12): 782-783, 816.

Follow-up interviews with participants in a mail survey concerning the effectiveness of Oregon's Forest Practices Act revealed that goals for protecting water quality were being met.

Brynn, D. J.; Clausen, J. C. 1991. **Post-harvest assessment of Vermont's acceptable silvicultural management practices and water quality impacts.** Northern Journal of Applied Forestry. 8: 140-144.

A random sample of 78 completed harvesting operations was evaluated with respect to compliance with Acceptable Management Practices (AMP), soil erosion, and water quality. Although none of the truck roads and only 20 percent of the skid roads had properly-spaced drainage structures, the impact on water quality was negligible. Compliance with other AMP's was high.

Cheng, A. S.; Ellefson, P. V. 1993. **State programs directed at the forestry practices of private forest landowners: program administrators' assessment of effectiveness.** Staff Pap. Ser. 87. St. Paul, MN: University of Minnesota, College of Natural Resources and Agricultural Experiment Station. 32 p.

Results of a survey of forest practices throughout the United States revealed that officials in 26 states believe that technical assistance programs are the most effective for protecting water quality. There were regional differences in states' evaluations of voluntary and mandatory protection programs, i.e., the western states favored mandatory programs while states in other regions rated voluntary programs more highly.

Deforest, C. E. 1992. **Report on Georgia's BMP compliance.** Macon, GA: Georgia Forestry Commission: 12.

Georgia's first survey of compliance with Best Management Practices (BMP) was based on visits by commission members to 345 sites on which logging operations were recently completed. The compliance rate for all sites was 86 percent.

Floyd, D. W.; MacLeod, M. A. 1993. **Regulation and perceived compliance.** Journal of Forestry 91(5): 41-47.

Perceived compliance with voluntary and mandatory programs to control nonpoint source pollution was assessed in four states as part of a mail survey. Results revealed an ordered relationship between program type. The mean compliance score for Ohio's voluntary program was .231 versus .565 for Massachusetts' comprehensive Forest Practices Act. As the stringency of a program increases, perceived compliance also increases.

Gathman, J.; Troelstrup, N., Jr.; Phillips, M.; Perry, J. 1992. **A survey to assess adoption of Best Management Practices in Minnesota forestry.** Consultant's report. St. Paul, MN: University of Minnesota, Department of Natural Resources and Minnesota Department of Natural Resources, Division of Forestry. 47 p.

A survey of forest-land owners and forest managers revealed high compliance rates for Minnesota's Best Management Practices. Compliance was lowest among nonindustrial private landowners. The compliance rate did not appear to be related to ecoregion.

Hairston-Strang, A. B.; Adams, P. W. 1997. **Oregon's streamside rules. Achieving public goals on private land.** Journal of Forestry. 95(7): 14-18.

Results of a mail survey revealed that 61 percent of the respondents support Oregon's 1994 Water Protection Rules; 82 percent expressed strong support for the water quality provisions. However, only 52 percent of the respondents believed that the Water Protection Rules were very or mostly effective.

Henly, W. A.; Bliss, J. C. 1994. **Timber harvesting, regeneration, and Best Management Practices among west central Alabama NIPF owners.** Southern Journal of Applied Forestry. 18(3): 116-121.

A mail survey of nonindustrial forest-land owners revealed that most of the respondents were familiar with the environmental effects of timber harvesting on regeneration but less knowledgeable about the effects of harvesting on water quality. Compliance with Best Management Practices was adequate or better only on 15 of the 27 forest tracts featured in the survey.

Henly, R. K.; Ellefson, P. V.; Moulton, R. J. 1988. **Evaluating state regulation of private forest practices: what accomplishments at what costs.** Evaluation and Program Planning. 11: 325-333.

The estimated total cost of comprehensive state forest practices laws in seven states was $131 million in 1984. These regulations improved the quality of both timber and

nontimber resources but its cost effectiveness was questioned.

Ice, G. D.; Stuart, W.; Waide, J. B.; Irland, L. C.; Ellefson, P. V. 1997. **Twenty-five years of the Clean Water Act. How clean are forest practices?** Journal of Forestry. 95(7): 9-13.

The development and effectiveness of Best Management Practices (BMP) throughout the United States are discussed. The effectiveness of some BMP's may be reduced by uncontrollable hydrologic events.

Kilgore, M. A.; Ellefson, P. V. 1992. **Coordination of forest resource policies and programs—evaluation of administrative mechanisms used by state governments.** Stn. Bull. 598. St. Paul, MN: University of Minnesota, Agricultural Experiment Station. 43 p.

Reports results of mail survey of mechanisms used by government entities to implement environmental and forest resource policies and coordinate programs with a variety of natural resources groups.

Kochenderfer, J. N.; Edwards, P. J.; Wood, F. 1997. **Hydrologic impacts of logging an Appalachian watershed using West Virginia's Best Management Practices.** Northern Journal of Applied Forestry. 14(4): 207-218.

A 39-hectare watershed was harvested and compared with a nearby untreated watershed for impacts on streamflow, sediment loss, stream temperature, and water chemistry. All applicable recommended Best Management Practices (BMP) were implemented. Sedimentation doubled the first year after harvesting but returned to pretreatment levels by year 3. Stream chemistry and temperature were little affected by timber harvesting. These recommended BMP's were effective in protecting water quality.

Monteith, D. B. 1978. **An evaluation as to voluntary compliance with timber harvesting guidelines in the Adirondacks.** AFRI Res. Rep. 36. Syracuse, NY: State University of New York, Applied Forestry Research Institute. 20 p.

A random sample of logging operations was evaluated to determine compliance rates with New York's Timber Harvesting Guidelines. Most of the logging operations were in compliance with the guidelines.

Newton, C. M.; Brynn, D. J.; Capen, D. E.; Clausen, J. C.; Donnelly, J. R.; Shane, J. B., Jr.; Thomas, P. A.; Turner, T. L.; Vissering, J. E. 1991. **Impacting assessment of timber harvesting in Vermont.** Burlington, VT: University of Vermont, School of Natural Resources. 144 p.

Evaluates the effect of numerous harvesting operations in Vermont on timber quality, water quality, archeological sites, aesthetic values, and wildlife, including threatened and endangered species. It was concluded that the impacts of harvesting did not warrant additional regulation. However, it was recommended that programs that foster responsible forest stewardship in the state be initiated.

Puddister, M. J.; Lapping, M. B. 1963. **Regulating private forests: an evaluation of Ontario Tree Conservation Law.** In: Royer, Jack; Risbrudt, Chris, eds. Proceedings, symposium on nonindustrial private forest: a review of economic and policy studies. Durham, NC: Duke University, School of Forestry and Environmental Studies: 345-351.

A mail survey was conducted to determine the effectiveness of Ontario Conservation Law. Administrative processes, violations, exceptions, and public opinion were assessed. This legislation was considered punitive and counterproductive to the general objective of tree conservation.

Sachet, J.; Keller, S.; McCoy, A.; Orr, T., Jr.; Wolff, N. 1980. **An assessment of the adequacy of Washington's forest practices regulations in protecting water quality.** Tech. Rep. DOE 80-7A. Olympia, WA: Washington State Department of Ecology, Office of Water Quality. 78 p.

The effect of logging on water quality on 102 sites, as well as the degree of compliance with the requirements of Washington State's Forest Practices Act of 1974, were assessed in 1977-78. The compliance rate for all logging sites was 80 percent; water quality was maintained on sites where regulations were followed, and reduced on those that were not in compliance.

Vermont Forest Resources Advisory Council. 1997. **Report on field audit of Acceptable Management Practices for maintaining water quality on logging jobs in Vermont.** Waterbury, VT: Vermont Forest Resources Advisory Council. 16 p.

Compliance with Acceptable Management Practices on 17 harvesting sites in northeastern Vermont was assessed with respect to truck roads, protective strips, landings, skid trails, stream crossings, and sedimentation levels. Some sedimentation was observed but it was not known whether this resulted from an insufficient number of drainage structures on truck roads and skid trails.

Vermont Forest Resources Advisory Council. 1997. **Vermont Forest Resources Advisory Council—final report.** Waterbury, VT: Vermont Forest Resources Advisory Council. 52 p.

Following a 2-1/2 year study of rural economic development, sustainable forestry, the wood-products industry, herbicide use, heavy cutting, Acceptable Management Practices (AMP), and other natural resource issues, the Vermont Forest Resources Advisory Council concluded that AMP's need not be revised. However, the Council recommended mandatory protective strips along waterways.

Huyler, Neil K.; McMath, David; Hewitt, Daphne. 1999. **Annotated bibliography on forest practices legislation related to water quality.** Gen. Tech. Rep. NE-258. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Research Station. 9 p.

Includes annotated citations of literature on forest practices regulations related to all aspects of water quality protection. The bibliography is divided into three sections: 1) Water quality protection during timber harvesting; 2) Methods for assessing the costs and benefits of water quality protection; and 3) Effectiveness of regulatory programs in protecting water quality.

Keywords: water quality; forest regulations; timber harvesting; forest management

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