ncasi technical bulletin

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC., 260 MADISON AVENUE, NEW YORK, N.Y. 10016

SOUTHERN REGIONAL REVIEW OF STATE NONPOINT SOURCE CONTROL PROGRAMS AND BEST MANAGEMENT PRACTICES FOR FOREST MANAGEMENT OPERATIONS

TECHNICAL BULLETIN NO. 686

DECEMBER 1994

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SOUTHERN REGIONAL REVIEW OF STATE NONPOINT SOURCE CONTROL PROGRAMS AND BEST MANAGEMENT PRACTICES FOR FOREST MANAGEMENT OPERATIONS

Since 1979 NCASI has provided periodic reviews of state silvicultural nonpoint source control programs. These surveys have summarized the assessment techniques, Best Management Practices (BMPs), and BMP implementation approaches used by the different state agencies. The last complete survey (NCASI Special Report 83-01) was distributed in 1983. In 1992 NCASI contracted to have all state silvicultural nonpoint source control programs resurveyed. This report is the first of four summarizing these surveys and covers the twelve southern states.

This review was designed to answer seven (7) basic questions posed by the industry concerning the current silvicultural nonpoint source control programs in the South. The first question was, "How does forestry compare to other nonpoint sources in terms of extent and nature of effect on water quality?" Despite the fact that forests cover over 50 percent of the South, state assessments show silviculture to be a relatively minor source of NPS impacts, ranking far behind other categories such as agriculture and urban.

The second question was "Do all states with substantial commercial forest management activities have regulatory or nonregulatory programs in place to control nonpoint source pollution from forest management operations?" All twelve states were found to have active NPS control programs. This represents a change from 1983 when four states did not have active programs.

The third question asked was "What is known about rates of compliance with BMPs?" It was found that eleven states have compliance monitoring programs. Most compliance surveys have found BMP implementation in the range of 80 to 90 percent. An encouraging trend has been improving levels of implementation with resurveys. Non-industrial, private landowners operating without the guidance of professional foresters were consistently found to be the group with the lowest level of BMP implementation.

The industry's fourth question was "When BMPs are implemented, do they effectively control NPS pollution from forest management operations?" This survey found that the state BMPs were based on extensive watershed and water quality research in the region. There remains room for improvement in BMPs and related water quality protection measures, but it appears that failure of some landowners and loggers to implement existing BMPs consistently is a far more significant issue than the effectiveness of the BMPs themselves.

Question five was "In each state with voluntary BMPs, what authority does the state have to control the actions of a logger or landowner who is blatantly disregarding BMPs and causing obvious impacts to water quality?" It was found that eleven states have clear authority to control silvicultural operations which blatantly disregard BMPs. Six states are actively using their authority to investigate complaints and levy substantial fines.

The sixth question was "What extension/educational activities are planned or underway to promote compliance with BMPs and other programs to control NPS pollution from forest management operations?" All twelve states were found to have "aggressive and innovative educational and training programs designed to enhance compliance with BMPs . . . "

The seventh and final question was about " . . . locations and/or site conditions in the region where the potential for nonpoint source pollution is substantially greater than average?" Contacts in most states could identify sensitive regions. Some special programs were developed for these areas but most states relied on the proper application of the general BMPs to protect sensitive areas.

This report was prepared by Dr. Jack Waide with FTN Associates, Ltd., 3 Innwood Circle, Suite 220, Little Rock, AR 72211. The Project Manager for this report was Dr. George Ice at the NCASI West Coast Regional Center in Corvallis. Questions or comments on this report should be directed to Dr. Ice at 503/752-8801.

Very truly yours,

Dr. Isaiah Gellman
President

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SOUTHERN REGIONAL REVIEW OF STATE NONPOINT SOURCE CONTROL PROGRAMS AND BEST MANAGEMENT PRACTICES FOR FOREST MANAGEMENT OPERATIONS

TECHNICAL BULLETIN NO. 686
DECEMBER 1994

ABSTRACT: This technical bulletin reviews state nonpoint source (NPS) control programs in the twelve southern states. All states were found to have active NPS control programs. Despite the fact that forests cover 55 percent of the South, state assessments show silviculture to be a relatively minor source of NPS impacts, ranking far behind other categories such as agriculture and urban. Compliance surveys have found implementation rates for state Best Management Practices of 80-90 percent. Although there remains room for improvement in BMPs and related water quality protection measures, the greatest threat to forest water quality comes, not from any lack of effectiveness of existing BMPs, but rather from the failure of some forest operators and landowners to implement BMPs properly and consistently. Eleven states have clear authority to control silvicultural operations which blatantly disregard BMPs. Six states are actively using their authority to investigate complaints and levy substantial fines. All twelve states were found to have aggressive and innovative educational and training programs designed to enhance compliance with BMPs.

KEYWORDS: Nonpoint Source (NPS), Best Management Practices (BMPs), Forest Practices Act, Water Quality, Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia.

RELATED NCASI PUBLICATIONS:

"*Forests as Nonpoint Sources of Pollution, and Effectiveness of Best Management Practices,*" NCASI Technical Bulletin No. 672 (July 1994).

"*Benefits and Costs of Programs for Forest Nonpoint Pollution Control in Washington and Virginia,*" NCASI Technical Bulletin No. 660 (April 1994).

"*A Summary of Silvicultural Nonpoint Source Control Programs for the United States – 1992,*" NCASI Special Report 83-01 (January 1983).

SOUTHERN REGIONAL REVIEW OF STATE NONPOINT SOURCE CONTROL PROGRAMS AND BEST MANAGEMENT PRACTICES FOR FOREST MANAGEMENT OPERATIONS

I INTRODUCTION AND OBJECTIVES

A. Project Overview and Background

Interest remains strong in assessing and preventing impacts of nonpoint sources (NPS) of pollution resulting from forest management operations on water quality and identified beneficial uses of water. Much of this interest is focused on evaluating the implementation and effectiveness of established Best Management Practices (BMPs) in reducing or preventing NPS pollution and in protecting water quality and beneficial uses. BMPs are recognized as important tools for achieving water quality goals, and for protecting beneficial uses of water from NPS generating activities. Most commonly, states develop and promote the use of BMPs -- through targeted training and educational programs -- as part of their overall NPS control programs for forest management operations.

The continuing interest in the role and effectiveness of BMPs in preventing NPS pollution from forest management operations has generated a growing amount of literature. Solomon (1) analyzed the role of BMPs in achieving NPS control in relation to the attainment of state water quality standards. Ice (2) summarized the rationale behind the use of BMPs in state NPS control programs and analyzed the effectiveness of silvicultural NPS control programs in the southern U.S. Both Neary et al. (3) and Riekerk et al. (4) summarized and analyzed information on the types, sources, trends, and magnitude of forestry-generated NPS pollution in relation to BMPs for the southern U.S. Several recent reports (5,6) summarized information on the status of forestry NPS management in the southern U.S., focusing on recent activities by the State Foresters and on recent developments in NPS management at both state and federal levels. A series of reports by Siegel, Cubbage, and colleagues (7-13) analyzed impacts of state and federal water quality laws and programs for controlling NPS pollution on forestry operations in the eastern and southern U.S.

A large amount of research has been conducted to evaluate the effectiveness of specific forestry practices in achieving water quality protection. One of the clearest recent examples of a study of specific BMPs is provided by Lynch and Corbett (14), who analyzed a 15-year record of streamflow and water quality data to determine the effectiveness of BMPs in controlling NPS pollution from a 110-acre clearcut in the Ridge and Valley Province of central Pennsylvania. Glasser (15) summarized results of a large number of watershed research studies conducted throughout the southern U.S. in terms of the effects of common

forest management practices on water quality. His summary demonstrated that established BMPs were effective in minimizing management effects on water quality.

In addition to the growing amount of literature, a number of recent and ongoing activities are attempting to summarize and document information on the effectiveness of forestry BMPs in achieving water quality standards. For example, the USDA Forest Service (USDA-FS) has assembled an interagency National Task Force charged with developing a national literature summary and a process for evaluating BMP effectiveness. This effort was designed to initiate and accelerate the "BMP effectiveness component" of the National Association of State Foresters (NASF) Soil and Water Program (16). To cite a second example, the Southern Group of State Foresters, in cooperation with the USDA-FS Southern Region, recently sponsored a Workshop ("Forest Water Quality Issues and Action Needs in the South") emphasizing evaluations of BMP effectiveness. This Workshop resulted in the updating of the Southern Region's Non-Point Source Action Plan, as well as in the coordination of NPS control activities affecting both the National Forests and the State Foresters in the southern U.S. These same two groups had previously co-sponsored an earlier "Workshop on Implementation Monitoring of Forestry Best Management Activities" (17).

In parallel with these issues and concerns and partly to prepare for upcoming debates and discussion regarding renewal of the federal Clean Water Act, the National Council of the Paper Industry for Air and Stream Improvement, Inc. (NCASI) initiated a series of Regional Reviews of State Nonpoint Source Control Programs and Best Management Practices for Forest Management Operations. Reviews of state NPS control programs were funded for four discrete regions of the U.S. (South, Central-Lake States, Northeast, and West Region). These reviews were designed to update the last review and summary of silvicultural NPS control programs undertaken by NCASI over a decade ago (18). The project described in this report was designed to complete the Regional Review for the twelve states of the Southern Region.

The Southern Region is a particularly interesting one for analysis. Although the twelve states in this region have broadly similar programs, they differ in emphasis and combination of specific program elements (10). Moreover, existing state water quality laws have the potential for more stringent enforcement than has been true in the past to control NPS pollution from forestry operations (8). And, a number of the state NPS control programs within this region have changed substantially since the last general review. Perhaps the greatest reason for interest in the Southern Region is provided by Ice's (19) 1985 assessment "that regulatory NPS control programs may be required for Southern States in the near future unless voluntary program

to demonstrate progress in controlling NPS from silviculture in the next few years or mandatory programs may be required by Congress." Because the majority of timberlands throughout the southern U.S. are privately owned, activities of the southern State Foresters, their staffs, and the state forestry communities are key to the control of NPS pollution resulting from forest management activities throughout the region.

B. Project Objectives

The purpose of this NCASI-funded project was to conduct a review of state NPS control programs and BMPs for forest management operations, focused on the twelve states of the Southern Region: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. The specific objectives of this Southern Regional Review project were to:

1) Summarize available information about the magnitude of forest management effects on water quality and the relative importance of forestry and other nonpoint sources;

2) Identify and describe state statutes, regulations, and programs for controlling nonpoint source pollution from forest management operations;

3) Summarize studies of compliance with regulatory and/or non-regulatory nonpoint source control programs for forestry;

4) Identify and describe educational/extension efforts to promote compliance with regulatory and non-regulatory nonpoint source control programs for forestry; and

5) Summarize studies of the effectiveness of regulatory and/or non-regulatory nonpoint source control programs for forestry.

Results and analyses presented in this summary report were synthesized from information obtained from appropriate contacts within each of the twelve southern states, both in the state forestry/silvicultural NPS control agency and in the state environmental/water quality/NPS management agency, as well as from other individuals located in the 12-state Southern Region.

C. Methods of Information Gathering

Once written notification to proceed was received from NCASI for this Southern Regional Review Project, FTN focused initial efforts on identifying key contacts within each of the twelve states covered by this review. Appropriate contacts were

identified in both the state NPS management agency and the state silvicultural NPS control agency. Additional contacts were sought within the southern U.S. for other types of information relevant to the objectives of this review. Subsequently, FTN distributed a summary of this project, and a request for the specific information required to complete the review and each state summary, to each of these key state contacts. A copy of the Project Summary and information request is included as Appendix A. Following distribution of this document, a follow-up phone call was made to each contact person to discuss the project and information needs identified in this brief document and clarify any questions concerning the nature and type of information requested for each state.

Appendix B lists, by state, the names, titles, and addresses of each of the key individuals contacted, and the specific information received from each in response to our summary/request. As information was received from each state contact, it was carefully reviewed and summarized; select information was extracted for inclusion in this summary report in accordance with specifications contained in the original NCASI Request for Proposals (RFP). Follow-up phone calls were made to each state contact to clarify and resolve any questions regarding the information received and request any additional information/materials not received in the initial transmission from that state. Additionally, frequent follow-up requests and phone calls were made throughout the life of this project to those states that did not respond, within a reasonable time frame, to the initial request for information on their silvicultural NPS control programs. Considerable effort was required, in the form of repeated follow-ups to state contacts, to obtain the information needed to complete this project. All information requested for this project was not finally received until January 1993.

D. Report Organization

The second section of this report provides a regional overview of forests and forest practices and summarizes information on the regional extent and distribution of major forest types and forest management activities. Sections III through XIV provide discrete summaries of information on silvicultural NPS control programs and BMPs for forest management operations for each of the twelve states of the Southern Region. Each of these state summaries presents information on state water quality and NPS control statutes, regulations, and programs relevant to forest management activities; results from the state 319 Assessment Report and Management Plan; state forestry BMP manual(s); state forest practice rules (if any); special rules for wetlands, cumulative effects, or groundwater; changes in state programs, rules, or BMPs since 1980; educational and training programs to promote compliance with NPS control

programs; results and methods of compliance surveys; research on BMP effectiveness; and any special issues affecting that state. Section XV presents a summary of the information contained in this report for the Southern Region. The final section lists all references from which information was obtained during the course of this Southern Regional Review Project.

Additional information is contained in two appendices. Appendix A contains the Project Summary mailed to all key state contacts. Appendix B lists the names, titles, and addresses of all state and other contacts, as well as the specific information received from each. Each report, document, statute, regulation, or other information mentioned in the body of the text that follows and listed in the References (Section XVI) can be obtained from the individuals listed in this appendix.

II REGIONAL OVERVIEW OF FORESTS AND FOREST PRACTICES

Extensive information is available for the southern U.S. on the distribution of forest types and forest management activities, and on the economic importance of forest industries, in two USDA-FS publications -- the comprehensive Forest Resource Report titled "The South's Fourth Forest: Alternatives for the Future" (20), and "A Forest Atlas of the South" (21). Data and information taken from these two publications provide the basis for the regional overview of southern forests and forest practices presented in this section.

A. Extent and Geographic Distribution of Major Forest Types

Forests account for about 182 million acres, or about 55% of the total land area, in the southern U.S. They represent a slightly higher percentage of the total land base in the five southeastern states (58%; FL, GA, NC, SC, and VA) than in the seven south central states (53%; AL, AR, LA, MS, OK, TN, and TX). Alabama (66%), South Carolina (63%), and Georgia (63%) have the highest percentages of forest land, while Florida (44%), Oklahoma (45%), Arkansas (48%), Louisiana (49%), and Tennessee (49%) have the smallest percentages (note that figures for OK and TX apply only to the eastern, forested parts of these two states). This forest land is highly diverse, and is made up of a large number of forest tree species and forest types. Based on information compiled by forest survey units in the Southern and Southeastern Forest Experiment Stations, the USDA-FS recognizes seven broad forest types in the southern U.S. These types, and their distribution in the South, may be summarized as follows:

1) White Pine - Hemlock: forests in which 50% or more of the stand is eastern white pine and hemlock, singly or in combination. Common associates include oak and

yellow poplar. A minor component of southern forests, distributed at higher elevations along peaks in the southern Appalachian Mountains of Tennessee, North Carolina, and Virginia.

2) Longleaf - Slash Pine: forests in which 50% or more of the stand is longleaf and slash pine, singly or in combination. Common associates include other southern pines, oak, and gum. Distributed in a broad, essentially continuous band along the coastal areas and Coastal Plains of east Texas, eastern Louisiana, Mississippi, Alabama, Florida, and Georgia; also as isolated patches in the inner Coastal Plains of east Texas, Alabama, Georgia, South Carolina, and North Carolina.

3) Loblolly - Shortleaf Pine: forests in which 50% or more of the stand is loblolly pine, shortleaf pine, and other southern pines, except longleaf or slash, singly or in combination. Common associates include oak, hickory, and gum. The most extensive forest type in the southern U.S., distributed in a broad and continuous band (broken only by bottomland hardwood forests along the Mississippi River) from Virginia to east Texas. Occurs in both Coastal Plain and Piedmont of Virginia, and North and South Carolina; but inland of longleaf-slash pine forests in Georgia, Alabama, Mississippi, Louisiana, and Texas.

4) Oak - Pine: forests in which 50% or more of the stand is hardwood, usually upland oak, and southern pines make up 25 - 49%. Common associates include gum and hickory. Generally distributed in a fairly continuous but narrow band, just north of loblolly-shortleaf pine stands, in northern Georgia and Alabama, along the north-south axis through the center of Mississippi, and scattered in Texas, Oklahoma, and Arkansas.

5) Cedar: forests in which 25% or more of the stand is eastern redcedar and southern pines make up less than 25%. Common associates include oak and hickory. The second least extensive southern forest type, found as a broad pocket in central Tennessee.

6) Oak - Hickory: forests in which 50% or more of the stand is upland oak and hickory, singly or in combination, and southern pines and redcedar make up less than 25%. Common associates include gum, yellow poplar, elm, and maple. Distributed as a fairly extensive and continuous band from western Virginia and North Carolina, through Tennessee, north Georgia and Alabama, northern and western Mississippi, northern

Arkansas, and east Texas and Oklahoma; in isolated patches in the Piedmont of North and South Carolina; and in both the interior and panhandle of Florida.

7) Oak - Gum - Cypress: bottomland forests in which 50% or more of the stand is tupelo, blackgum, sweetgum, oak, and southern cypress, singly or in combination, and southern pines make up less than 25%. Found in all twelve southern states, distributed as isolated strands extending inland from the coast along all major streams and rivers; especially prominent along the Mississippi River drainage in Louisiana, Mississippi, Arkansas, and west Tennessee; also prominent along the major rivers passing through the Coastal Plains of Texas, Alabama, Florida, Georgia, North and South Carolina, and Virginia.

B. Extent, Geographic Distribution, and Nature of Forest Management Activities

Information on forest management activities can best be summarized by examining two characteristics of the southern forest types described above: the distribution of forest management types, and the distribution of forest ownerships, supplemented by additional information on the relative importance of different timber products.

Of the approximately 182 million acres of forest land in the South, 20.9M acres are in pine plantations (11%), 40.9M acres in natural pine stands (22%), 26.9M acres in mixed pine-hardwoods (15%), 63.2M acres in upland hardwoods (35%), and 30.2M acres in bottomland hardwoods (17%). For the five southeastern states, the percentage distribution of these management types is: pine plantations - 15%, natural pine stands - 25%, mixed pine hardwoods - 11%, upland hardwoods - 32%, and bottomland hardwoods - 16%. Comparable values for the seven south central states are: pine plantations - 9%, natural pine stands - 20%, mixed pine hardwoods -18%, upland hardwoods - 37%, and bottomland hardwoods - 17%. Thus, pine plantations and natural pine stands are relatively more abundant in southeastern states, while mixed pine hardwoods and upland hardwoods are relatively more abundant in the south central states. Bottomland hardwoods are about equally abundant in both sub-regions.

In terms of ownership characteristics, over 90% of forest land in the southern U.S. is privately owned. Forest industries account for about 42M acres, or about 23% of the total. Forest industries own substantial acreages in all southern states, but a proportionately larger share of forest land in Florida and Georgia in the Southeast, and in Arkansas, Louisiana, and Texas in the south central region. Over 65% of pine plantations in the South occur on industry lands. In the Southeast, over 40% of

industry forest lands are in planted pine; bottomland hardwoods account for another 20%. In the south central region, natural pine stands and pine plantations each represent about 20% of industry forest land holdings. Mixed pine-hardwood and upland hardwoods account for a greater fraction of industry holdings in this region than in the southeast region.

Approximately 122M acres of southern forest lands, or about 67%, are owned by other private individuals or organizations, including farmers (22%), other individuals (36%), and corporations (e.g., utilities, railroads, realty firms, hunting clubs, insurance companies, banks) not operating wood processing plants (9%). Ownership of forest lands by farmers tends to be concentrated in North Carolina, Georgia, and Virginia in the southeast, and Alabama, Mississippi, and Tennessee in the south central region. Over 30% of forest land owned by other corporate owners is located in Florida and Louisiana. The predominant management type found on forest land owned by other private is upland hardwoods. However, bottomland hardwoods represent a large proportion of forest lands held by other corporate owners.

Many private ownerships in the South represent small individual holdings (i.e., small, private, non-industrial forest owners). In 1978, 92% of forest ownership units in the South were < 100 acres in size. These ownerships, while accounting for a large fraction of the forest owners -- and thus a large fraction of the population that must be reached by education components of NPS control programs -- represent only about 20% of total forest area. Forest ownerships in the West Gulf (AR, LA, TX, and OK) and in the East Gulf (FL and GA), where industry or corporate holdings are more common, tended to be larger than in the South Atlantic (NC, SC, and VA) and Central Gulf States (AL, MS, and TN), where farm ownerships were concentrated. Over 50% of forest lands in the East and West Gulf were in tracts > 1000 acres, whereas only about 30% of forest lands in the South Atlantic and Central Gulf were in units this large.

Public ownerships account for only about 10% of forest land in the southern U.S. These include national and state forests, wildlife refuges, and other federal, state, county, or municipal lands. National Forests account for about 60% of all publicly owned forest land. Over 50% of National Forest lands in the South are located in four states (AR, MS, NC, and VA). In the Southeast, National Forests primarily consist of upland hardwoods in the Appalachian Mountains. Natural pine is the predominant management type on National Forests in the south central region, although upland hardwoods and mixed pine-hardwoods are also important. The 4% of forest lands in other public ownerships are mostly natural pine or upland hardwoods in the Southeast, as opposed to bottomland or upland hardwoods in the south central region.

Timber harvests in the South support a variety of products. Larger, high quality trees are used mostly as sawlogs. Smaller, lower grade trees are the primary source of pulpwood processed into wood fiber by pulp, paper, and paperboard mills. Sawlogs and pulpwood together accounted for 80% of roundwood production for the South in 1984. Throughout the South, more softwood and hardwood timber is harvested for pulpwood than for any other product (42% of total roundwood production). Sawlogs accounted for about 37% of total roundwood harvest. Comparable values for other forest products in 1984 were veneer logs, 9%; other industrial products (poles and piling, fenceposts, cooperage logs and bolts, mine timbers, shingle bolts, bolts for handles, wood turnings, panel products, and others), less than 2%; and fuelwood for industrial and residential uses, 10%. More softwoods were harvested for all forest products except fuelwood, where hardwoods predominated by a large margin. Southern pines supplied twice the volume of pulpwood and three times the volume of sawlogs and veneer logs compared to hardwood species; the latter supplied about 90% of fuelwood volumes.

C. Economic Importance of Forest-Based Industries

Forests play a vital role in the social, cultural, and economic life of the southern U.S. Approximately 40% of the total U.S. timberland is located in the South. In 1976, the South supported over 20% of the softwood growing stock and over 40% of the hardwood growing stock in the U.S., and accounted for over 50% of the net annual growth for both hardwoods and softwoods nationwide. The diversity and extent of its timber resources has made the South a major producer of nearly all types of forest products. In 1984, the twelve southern states accounted for over 30% of the softwood lumber and over 40% of the hardwood lumber produced nationally, nearly 50% of national production of hardwood and softwood plywood, and over 65% of the wood pulp.

Southern forests provide many benefits in addition to timber. In 1985 they produced nearly 8 million tons of forage for domestic livestock and wildlife. Southern forests protect watersheds on over half the land area of the South, are the source of much of the region's drinking water, provide habitat for numerous species of wildlife and fish, and provide sites for recreation for millions of people. Recreational uses of southern forests contribute over $1.0 billion annually to state and local economies in the southern U.S.

Among the many benefits associated with southern forests, however, timber is usually considered the most important in economic terms. Timber generates income and employment throughout the southern economy, both in jobs directly related to timber management, harvesting, and processing of wood products; in the manufacture of products containing wood or wood fiber; and

in wholesale and retail trade, transportation, and construction. The importance of forest land and forest products to the South's economy is evident from comparisons of the value of timber products with that of other crops from agricultural lands, as well as from comparisons of forest industry manufacturing with other manufacturing.

For the South as a whole in 1984, the value of timber products was at least twice that of soybean or cotton production, and over three times that for tobacco, wheat, or corn crops. The value of timber production in 1984 ranked among the top three crops produced in all twelve southern states. Timber production, compared to that of other crops, ranked first in six states (AL, GA, LA, MS, SC, and VA); second in three states (NC, OK, and TX); and third in three other states (AR, FL, and TN). The value of timber production was exceeded by only that of wheat in Oklahoma, cotton in Texas, tobacco in North Carolina, soybeans and rice in Arkansas, soybeans and tobacco in Tennessee, and fruit and nut production and commercial vegetables in Florida.

In comparison with all other manufacturing in the South, forest-based industries accounted for about 20% of all manufacturing establishments, employed about 11% of all workers, paid about 10% of all wages and salaries, and produced about 9% of all value added to the southern economy by manufacturing. Aggregate employment and wages and salaries from forest industries in the southern U.S. exceeded those for all other major industries. In terms of manufacturing wages and salaries in individual states, forest industries ranked first in three states (AL, AR, and MS); second in four others (GA, NC, TN, and VA); and tenth or better in all other states (FL - 6th, LA - 4th, OK - 10th, SC - 4th, and TX - 9th). Forestry ranked second to textile mills in Georgia and North Carolina, and second to chemical manufacturing in Tennessee and Virginia.

III STATE REPORT FOR ALABAMA

A. Program Overview

The Alabama Department of Environmental Management (ADEM) has been designated as the lead agency responsible for assessing and managing NPS pollution within the state and for meeting the state's responsibilities under relevant federal water quality legislation including Section 319 of the Clean Water Act of 1987. Responsibility for controlling NPS pollution resulting from forest management operations has in turn been delegated to the Alabama Forestry Commission (AFC). A Memorandum of Agreement (MOA) between AFC and ADEM specifies the responsibilities of each agency in preventing and abating NPS impairment of water quality from forest management operations within the state (22).

The ADEM manages NPS pollution problems that result from silvicultural and other sources pursuant to the Alabama Water Pollution Control Act and the Alabama Environmental Management Act. In the case of silviculture, the Department manages what it describes (23) as a limited, semi-regulatory program: it investigates and regulates NPS pollution from silviculture on a complaint basis. Both the MOA referenced above and the AFC Procedural Manual (Section P-11, Environmental Forestry; 24) specify steps AFC is to follow in an attempt to resolve a problem prior to reporting it to ADEM. Formal report of a forestry NPS problem triggers inspection by ADEM technical staff. If warranted, corrective actions are implemented through formal enforcement action. Relevant statutes specify penalties for continued violation, which may be substantial -- up to $25,000 per day per violation (5, 7, 9). This activity, however, is reactive rather than preventative, is rarely invoked, and depends heavily on cooperation of AFC, the forestry community, landowners, and citizens (23).

The AFC has developed a voluntary program of BMP implementation and promotion for the control of NPS pollution from forest management operations (22, 24). AFC assists ADEM with silvicultural portions of state water quality assessments and management plans; works with others in the state to develop, improve, and maintain minimum standards for forestry BMPs; and disseminates information to landowners, professional forestry practitioners, and the general public on BMPs and NPS control programs through training and public education programs. AFC also provides professional technical advice and assistance to landowners, forest resource managers, and ADEM to prevent or abate water quality problems; provides cost-share assistance and incentives through the Forest Incentives Program and the USDA-ASCS Agricultural Conservation Program for BMP-based conservation measures on forest lands; and incorporates BMPs as appropriate into any forest management advice given to any Alabama forest landowner, including TREASURE Forest management plans, cost-share plans, or sample forestry contract clauses. The agency maintains an active program of BMP compliance monitoring and serves as an example of good stewardship by using BMPs during forestry operations on state lands. Finally, AFC responds to reported silvicultural water quality violations and attempts to effect a voluntary solution among all involved and responsible parties. Infrequently, in the absence of an effective solution, violators are reported to ADEM for formal enforcement action.

Thus, Alabama has a non-regulatory program for silvicultural NPS control, backed up by a limited regulatory program for violators, and the authority to make the entire program regulatory if current voluntary approaches are not effective in protecting water quality.

B. Water Quality and NPS Control Statutes and Regulations Relevant to Forest Management

The primary statute pertaining to control of NPS pollution is the Alabama Water Pollution Control Act, as amended (7, 9, 25). This Act was established to conserve waters of the state (as defined in the Act); to protect the quality of these waters for public water supplies, for propagation of wildlife, fish, and aquatic life and for beneficial uses; to provide for prevention, abatement, and control of new or existing water pollution; and to provide for cooperation between and among state and federal agencies in carrying out provisions of the Act. This Act is currently administered by the ADEM, established by the Alabama Environmental Management Act, as amended (26). Although this Act does not explicitly address forest management operations, it can be used against forest operators if pollution resulting from their activities clearly results in damage (or the potential of damage) to aquatic life, wildlife, or humans (7, 9).

A related statute is the Alabama Coastal Preservation Act (7, 9, 27). Activities permitted under this Act include planting and harvesting of trees, including normal road construction activities associated with forestry operations.

C. State 319 Assessment Report

The Alabama Nonpoint Source (Section 319) Assessment Report was completed and submitted to EPA in April 1989 (28). Primary work on the Report was performed by the ADEM, with assistance from the USDA-SCS, the Alabama State Soil and Water Conservation Committee (ASSWCC), and the AFC. The 1989 Assessment was based on ambient monitoring data as well as evaluations using citizen complaints, fish kill reports, sediment surveys, and determinations involving best professional judgment. This Assessment Report was recognized as a dynamic document, subject to annual reevaluation and refinement. In particular, not all waterbodies in the state were assessed, the groundwater assessment was incomplete, and data collected by the ASSWCC with assistance from County Soil and Water Conservation Districts were not included because they were received too late to be thoroughly evaluated. These data showed 8,959 of 13,105 river miles evaluated to be impacted, a particularly high ratio of impacted to assessed river miles which was felt to be unrepresentative of actual water quality standards impairment within the state.

Alabama surface water resources include: 14 river basins; 40,600 miles of rivers and streams; 3.0M acres of tidal and freshwater marshes and wetlands; 504,336 acres of lakes, reservoirs, and ponds; 625 square miles of estuaries, harbors, and bays; and 50 miles of ocean shore. Of these resources, 527 miles of rivers and streams were assessed as not meeting standards due to NPS pollution, and 1,096 miles were assessed as

partially meeting standards. River/stream uses impacted were fish and wildlife (65%), primary contact (16%), domestic water supply (11%), agriculture (7%), and industry (1%). Primary causes of impairment were organic enrichment/low DO, siltation, and nutrients. Similarly, 1,850 acres of lakes, reservoirs, and bays were assessed as not meeting standards, and 167,100 acres were assessed as only partially meeting standards. Uses impacted were primary contact (61%), fish and wildlife (19%), shellfish production (19%), and domestic water supply (1%). Primary causes of impairment were pesticides, nutrients, and organic enrichment/low DO.

Agriculture (39.3%) and resource extraction (18.9%) were the two most important categories of NPS impacts to rivers and streams. Silviculture was ranked third (8.2%), followed by land disposal (7.8%), urban runoff (7.3%), construction (7.1%), other (5.7%), and hydro/habitat modification (5.6%). However, of those river/stream miles classified as having major NPS impacts, silviculture was the least important category (3.2%), following agriculture (47.0%), resource extraction (19.2%), land disposal (8.4%), other (7.1%), urban runoff (6.4%), hydro/habitat modification (4.9%), and construction (3.8%). For river/stream miles classified as having moderate/minor NPS impacts, silviculture again ranked third (14.1%), with other categories listed as agriculture (30.3%), resource extraction (18.7%), construction (11.1%), urban runoff (8.4%), land disposal (7.1%), hydro/habitat modification (6.4%), and other (3.9%).

D. State 319 Management Plan

The Alabama Nonpoint Source (Section 319) Management Program Plan was also completed and submitted to EPA in April 1989 (23). This Program was developed to ensure that the state achieves the goals of the federal Clean Water Act and to meet State Water Quality Standards developed pursuant to the Alabama Water Pollution Control Act. The goal of the Program is to protect and improve the quality of the state's water resources, including surface water, groundwater, wetlands, and coastal waters, from adverse impacts resulting from NPS pollution. The ADEM was the lead agency for completion of this Plan; both the ASSWCC and the AFC were contracted to provide assistance in preparing agricultural and silvicultural portions of the Plan. The AFC was assisted by the Alabama Forestry Association (AFA), the Alabama Wildlife Federation, and the USDA-FS in preparing the silvicultural component. Section 5.C of the Plan describes the silvicultural component of the Alabama NPS Management Program. This section describes the key pollutants causing silvicultural NPS problems (sediment, nutrients, organics, temperature, pesticides and herbicides). It also briefly reviews existing BMPs and state programs to control NPS pollution from silvicultural activities, outlines future alternatives for improved silvicultural NPS control, describes needed NPS control

program enhancements including BMP revisions, and presents an implementation schedule for future program components.

The bulk of the silvicultural section is devoted to description of three alternatives for the silvicultural NPS Management Program. Alternative 1 represents the current program; Alternatives 2 and 3 represent program enhancements contingent on increased federal funding under Section 319. Alternative 3, which would require an additional $318,900, is the recommended Program. Each alternative is based on different levels and rates of implementation of 17 specific tasks to increase public, landowner, and operator knowledge of and training in importance and proper use of BMPs: use of existing slide/tape program and film; public service and paid radio/TV announcements; demonstration forests for BMPs in each physiographic area of the state; use of Forest Incentive Program and Agricultural Conservation Program Plans requiring BMP implementation; on-the-ground one-on-one training; professional BMP displays at public gatherings; informational booklets; speeches and TV appearances; TREASURE forests for multiple use management/BMP use and demonstration; promotion of logging contract clauses specifying BMP utilization; BMP monitoring; assessment of BMP use; in-stream sampling to determine extent of NPS pollution and BMP effectiveness; and stream classification approaches.

The Plan also summarizes several enhancements needed in the silvicultural NPS Control Program. Needed enhancements include reviewing and assessing existing BMPs for adequacy in protecting water quality standards; updating (in cooperation with USDA-FS and AFA) BMPs and BMP manuals regarding logging roads, logging decks, and skid trail construction and maintenance (of concern in relation to sediment production); adopting "avoidance" as a BMP for practices that impair water quality; improving (in cooperation with AFA) the consistency of BMP implementation, especially on small private holdings; improving statewide monitoring of BMP implementation based on random sampling; monitoring water quality (ADEM); and encouraging (with the assistance of the Alabama Forest Owners Association) the use of contracts which specify the use of BMPs. A specific schedule for implementing these program enhancements, contingent on future increases in program funding, is presented.

The importance of these future silvicultural NPS Control Program enhancements to the continuation of a voluntary NPS control program is emphasized by the following statement contained in the silvicultural section of the Management Program Plan (23, p. 115): "Should reasonable educational techniques be insufficient to effect BMP implementation, ADEM's enforcement authorities under the Alabama Water Pollution Control Act and the Environmental Management Act will be implemented."

E. Forestry BMP Manual(s)

Forestry BMPs were initially developed in Alabama in the early 1970's and have undergone several revisions in the intervening period. The AFC currently has two separate BMP manuals, one for normal silvicultural activities on upland sites and a second one for operations in wetlands. In addition, a process to revise and improve existing BMPs was initiated in 1989/1990. A draft of a revised BMP manual was prepared in 1992 and is undergoing review by a variety of groups.

The existing BMP manual for silviculture was published in 1989 by the AFC, with the assistance of the AFA BMP Subcommittee of the Forest Practices Committee, the USDA-FS, and the Alabama Wildlife Federation (29). The manual contains an introduction to Alabama forestry and the concept of BMPs, as well as a section discussing the main pollutants from silvicultural operations that can impair water quality. It discusses the concept, importance to water quality protection, and design of Streamside Management Zones in a separate section and then summarizes recommended BMPs for forest operations. Specific BMPs are presented under the headings of Access (Location and Construction of Permanent Roads, Water Crossings, Maintenance of Permanent Roads, and Trails); Harvesting (Temporary Access Roads and Landings, Felling, Skidding, and Miscellaneous); Site Preparation; Surface Water Management; Forest Chemicals; Prescribed Fire; Wildfire Control; and Stabilization of High Erosion-Hazard Areas. Recommended practices are fairly general and lacking in specific numerical criteria. The manual also contains a Glossary of key terms, a Seeding Guide containing fairly specific information, a listing of additional Sources of Information, and a Bibliography of useful references.

The wetlands BMP manual was also published in 1989 by the AFC with assistance from the same organizations listed above (30). This manual is organized in a similar manner to the general silvicultural BMP manual and presents recommended practices at a similar level of detail. It contains an Introduction, which provides a useful overview of forested wetland types found in Alabama; a discussion of silvicultural systems appropriate for wetlands; and a short discussion of potential impacts of forestry operations in wetlands. The discussion of Streamside Management Zones is repeated here, and recommended BMPs are presented under the headings of Forest Road Construction (Access, Construction and Maintenance of Permanent Roads, and Maintenance and Construction of Temporary Access Roads and Landings); Harvesting (Scheduling, Felling, Skidding, and Harvesting Systems); and Wetlands Wildlife Habitat (Harvest Areas, Streamside Management Zones, Roads and Logging Areas, and General Guidelines for Protecting Sensitive Resources). An Appendix summarizes fairly specific information on recommended procedures for Stabilizing Roads, Landings, and Rights of Way (i.e., a seeding guide), and a Glossary defines important terms.

The ongoing revision of BMPs was initiated in 1989 in response to the State NPS Management Plan which called for revisions of existing BMPs for both upland and wetland sites. The ADEM specifically requested the AFC, with assistance from USDA-FS, ADEM, AFA, and other organizations, and extensive public input, to strengthen streamside management zone, stream crossing, and road sections of BMPs. The process followed in the rather intensive revision of Alabama's forestry BMPs is described by Burdette (31; see also 32). The AFC hired an Environmental Forester (Don Burdette) to handle environmental issues that affect forestry, and to assemble an ad hoc committee to assist the BMP revision process. In 1992 a new (Draft) BMP Manual was written and circulated for review (33). The Draft Manual is considerably more detailed than existing versions and contains more specific recommendations including numerous figures, drawings, and tables with numerical recommendations. The Manual contains a Forward that summarizes the mission of AFC and its role in developing BMPs, the purpose of BMPs, and a summary of who is responsible for maintaining water quality standards during forestry operations. It summarizes BMPs under the headings of Streamside Management Zones, Stream Crossings, Forest Roads, Timber Harvesting, Reforestation/Stand Management, Wetlands (a lengthy section including useful background information on relevant federal statutes and Corps of Engineers permitting requirements), and Revegetation/Restoration. Appendices provide an extensive Glossary of relevant terms, References to useful reports and publications, and a comprehensive list of other Sources of Technical Information. The manual is in a more pleasing and useful format than existing versions.

F. State Forest Practices Rules

Alabama has not established specific forest practice rules. However, introduction of a Forest Practices Act in the next session of the Alabama legislature has been rumored (34).

G. Special Rules -- Wetlands, Cumulative Effects, or Groundwater

Besides the statutes cited earlier and the voluntary BMPs for both uplands and wetlands, Alabama has no special rules for protection of wetlands, cumulative effects, or groundwater.

H. Program Changes Since 1980

Major changes have occurred in the Alabama silvicultural NPS control program since 1980. In its last review (19), NCASI identified Alabama as having an active program that was fairly unique in the completeness of its initial program assessments. Subsequently, the program declined somewhat due to funding constraints, but is now clearly improving (5), partly as a result of implementation of the Section 319 process and subsequent developments. In 1990 the AFC staffed a new Environmental

Forester position with responsibility for coordinating environmental aspects of forestry operations within the state including revision of BMPs, establishing BMP demonstrations, enhancing education and training regarding BMPs and NPS control programs, producing a video on proper BMP implementation, and participating in the EPA Gulf of Mexico Initiative. Clearly there has been an increase in program activities since that time -- an active BMP revision process is well underway, public training and education have increased, monitoring and analysis of BMP compliance have increased (including use of Landsat imagery to identify active logging sites for compliance checks), and a positive working relationship with ADEM is evident.

I. Educational and Training Programs to Promote Compliance

The AFC maintains an active and expanding program of public outreach, education, and training to inform landowners, forestry practitioners, and the public regarding the importance of NPS control programs and proper techniques of implementing forestry BMPs (5, 23). Training and education activities, conducted in association with AFA, include use of an existing slide/tape program and film, development and use of a video program, a formal BMP training course (35), public service articles in newspapers and TV/radio programs, speeches, brochures and booklets, and on-the-ground training associated with complaints/problems and program evaluations. AFC maintains 34 demonstration forests in all physiographic regions of the state, where proper BMP techniques are demonstrated, and recognizes good stewardship of forest resources including water quality protection through its TREASURE Forest Program (which requires proper implementation of BMPs). In designated counties in the state, the Forestry Incentives Program (FIP) is available for cost-share assistance to owners of eligible tracts less than 500 acres in size for timber production; FIP plans require use of BMPs. Finally, the AFC is promoting use of BMP clauses in forestry contracts through the Alabama Forest Farmers Federation. Publicity surrounding the BMP revision process has resulted in large increases in information dissemination over the past two years (e.g., over 60 requests for public presentations; 34).

J. Compliance Survey Methods and Results

The AFC has a specific program in place to monitor success in BMP implementation (24). A minimum of six compliance checks are required in each county per year (ca. 400 sites checked statewide each year), using a standardized form (Form FC-54, BMP Monitoring Report) that allows very specific questions to be addressed regarding the overall success of the operation in relation to the proper use of relevant BMPs. Checks are made approximately bi-monthly beginning in October/November and reflect seasonal differences as well as differences in site conditions and operators. Inspection sites are determined by

Landsat imagery and by following a logging truck from a woodyard or processing plant back to the harvest area. Following each inspection, a copy of the completed Report, containing pertinent explanations and recommendations, is provided to those involved in the operation and to the AFC county/district files and the Environmental Forester at state headquarters. Records are maintained for three years and can be summarized by landowner, contractor, timber buyer, county, district, or statewide.

Table 1 presents a summary of compliance survey results for 396 sites statewide conducted from October 1991 through September 1992 (36). While these summary results show generally good overall compliance with BMPs, they also show areas of needed improvement. Moreover, in the words of one involved with the survey, "they do not adequately portray that some operations are conducted with exceptional sensitivity to water quality while others fail miserably to protect water quality and soil productivity during forestry activities" (36). Appropriately, achieving greater uniformity in BMP compliance and water quality protection was one goal identified for the Alabama Silvicultural NPS Control Program in the Section 319 Management Plan.

K. Research on BMP Effectiveness

Research on BMP effectiveness in coordination with the AFC has only recently been initiated within Alabama. These studies are being coordinated with the Auburn University School of Forestry. Drs. Richard Brinkard and Graeme Lockaby were listed as contact persons for these studies (34). The USDA-FS Southern Forest Experiment Station has conducted numerous research studies of forest management practices related to chemical and other methods of vegetation control through its Research Work Unit located at Auburn ("Control of undesirable vegetation in southern pine forests"). The AFC is currently considering changes in its BMP monitoring procedures and the BMP Monitoring Report to survey both implementation and effectiveness of existing BMPs for forestry (34).

L. Special Problems or Issues

Issues such as the TVA chip mill debate in the neighboring state of Tennessee and concerns over implementation of the Coastal Zone Management Act (CZMA), together with the ongoing BMP revision process, have stimulated intense debates within the state regarding the merits of voluntary versus mandatory BMPs. Although sentiments favoring landowner rights and non-regulatory NPS control approaches are currently strong in Alabama, public support of mandatory BMPs is also growing. Plausible rumors of possible future county regulations to protect sensitive watersheds and the possible introduction of a formal Forest Practices Act in the next session of the state legislature have been common within the Alabama forestry community (34).

TABLE 1 SUMMARY OF ALABAMA BMP COMPLIANCE MONITORING RESULTS OF 396 SITES DURING OCTOBER 1991 THROUGH SEPTEMBER, 1992

Questions	Questions Phrased to Elicit Positive Response	Response
1	Had heard of BMPs?	78.9%
4	Used a written contract?	69.9%
4a	Contract contained BMP stipulations?	60.1%
5	Operation contained a stream?	68.7%
6	SMZ was adequate?	77.1%
10	Located roads outside of SMZs?	90.1%
9	Stream crossings were adequate?	80.1%
22	Did not use stream channel as skid trail?	95.8%
23	Did not use intermittent channels as skid trails?	93.0%
21	Did not operate equipment in SMZ?	73.2%
19	Did not leave tops/branches/slash in stream?	76.7%
14	Road sediment kept out of stream?	84.8%
2	Planned roads in advance?	80.5%
8	Avoided sensitive areas with roads?	90.5%
7	Roads adequately stabilized?	86.6%
11	Diversion structure adequate?	77.8%
12	Outfall protection adequate?	83.2%
13	Can close roads in wet weather?	85.4%
24	Harvest sediment kept out of stream?	81.9%
18	Landings properly located?	94.5%
3	Skid trails planned in advance?	51.6%
16	Located skid trails properly?	83.6%
17	Landings adequately stabilized?	91.3%
15	Skid trails adequately stabilized?	78.9%
20	Oil and trash properly disposed of?	83.3%

IV STATE REPORT FOR ARKANSAS

A. Program Overview

The Arkansas Department of Pollution Control and Ecology (ADPCE) has been designated as the lead agency responsible for assessing and controlling NPS pollution within the state and for meeting the state's responsibilities under relevant federal water quality legislation including Section 319 of the Clean Water Act of 1987. The Department prepares the state's NPS Assessment Reports and updates. By letter of agreement between ADPCE and the Arkansas Soil and Water Conservation Commission (ASWCC), ASWCC is responsible for preparing and implementing the state's NPS Management Plan and updates, including the implementation of BMPs. According to a Memorandum of Agreement, ADPCE and ASWCC share responsibility for selecting and evaluating BMPs for each NPS category identified as a source of water quality degradation (37). The ASWCC also maintains responsibility for the agricultural NPS control program. Responsibility for controlling NPS pollution resulting from forest management operations has been delegated to the Arkansas Forestry Commission (AFC), with the assistance of ASWCC, local Soil and Water Conservation Districts, and the State Plant Board.

The ADPCE manages NPS pollution problems which result from silvicultural and other sources pursuant to the Arkansas Water and Air Pollution Control Act. In the case of silviculture, the Department manages a limited regulatory program; it manages (with ASWCC) and coordinates the overall program and is authorized to investigate and regulate NPS pollution problems from silvicultural operations on a complaint basis. It may initiate civil actions and levy fines of up to $10,000 per day. Although such regulatory actions are authorized, they have not yet been directed against forest management operations (38, 39).

The AFC has developed a voluntary program of BMP formulation and promotion for the control of NPS pollution from forest management operations (39, 40). The program, initiated in 1981, was developed as part of the Section 208 Arkansas Water Quality Management Plan and is guided by an overall Implementation Plan (40). The AFC works with others in the state, including the Arkansas Forestry Association (AFA) Forest Practices Committee, USDA-SCS and -FS, forest industries, and University of Arkansas at Monticello Forestry School, to develop, disseminate, evaluate, and revise forestry BMPs. The AFC also maintains an active training and education program, including public education in forestry NPS pollution control; water quality management training for AFC and other agency personnel, consulting and industry foresters, forest landowners, loggers, contractors, forest managers, and pulpwood haulers; and use of BMP demonstrations, meetings, and workshops. AFC provides technical assistance to

forest landowners in preparation of forest management plans that specify water quality protection measures, and on-the-ground assistance in BMP implementation and to solve water quality problems. The AFC also follows up on water quality complaints associated with forestry operations, and provides guidance on proper management measures to correct such problems. The Commission maintains an active program for monitoring forestry operations for BMP implementation and effectiveness, recommends the incorporation of BMPs in timber sale contracts, and has developed approaches for evaluating the success of the overall NPS program as well as of specific BMPs. The ASWCC, together with local Soil and Water Conservation Districts, assists AFC in the implementation of BMPs to control forestry NPS pollution, as spelled out in Memoranda of Understanding between AFC and all county Districts (41). Finally, the AFC administers the Forest Stewardship Program, works with landowners to develop Forest Stewardship Plans that include BMPs, and promotes the use of BMPs in all of its forest management activities in the state. AFC has recently developed a plan to review and evaluate its entire NPS control program and to modify the program as needed (42).

Thus, Arkansas has a non-regulatory program for silvicultural NPS control, backed up by authority (which is not currently invoked) for a limited regulatory program for violators, and the authority to make the entire program regulatory if current voluntary approaches are not effective in protecting water quality.

B. Water Quality and NPS Control Statutes and Regulations Relevant to Forest Management

The primary statute pertaining to control of NPS pollution is the Arkansas Water and Air Pollution Control Act (7, 9, 43). The Act establishes the ADPCE, acting under authority of the Arkansas Pollution Control Commission, as the lead administrative agency for NPS control within the state. One member of the Pollution Control Commission is the State Forester, and another is the Executive Director of the ASWCC. The Department is given broad authority to issue permits and orders, and to promulgate rules and standards, in regards to prohibited pollutants. ADPCE can initiate civil actions and levy fines up to $10,000 per day to enforce compliance with its orders and standards. The Act defines pollution broadly enough to include nonpoint sources, and it specifically lists decayed wood, sawdust, shavings, bark, and sand as prohibited pollutants. While this Act is sufficiently broad to give ADPCE power over NPS pollution, the Act has not yet been used to regulate silvicultural operations (10, 38).

The Arkansas Stream Obstruction Statutes (9, 44) prohibit obstructing any improved drainage project or natural drain with trees, tree tops, or limbs.

The Arkansas Tree Removal in Riparian Areas Law (9, 45) prohibits the removal of trees growing below the normal high water mark of any navigable river or stream.

C. State 319 Assessment Report

The Arkansas Nonpoint Source (Section 319) Assessment Report was completed and submitted to EPA in August 1988; an update was prepared and submitted in August 1991 with specific reference to NPS pollution resulting from agriculture, silviculture, and resource extraction (37). These are the only categories of NPS pollution identified to date by ADPCE as causing impairment of waterbodies in the state. Primary work on the Assessment report was conducted by the ADPCE, with input and assistance from other agencies including the ASWCC. Data and information for this updated Assessment were taken from the ADPCE ambient water quality network and from water quality assessment documents (305(b) reports), fishery surveys, Clean Lakes programs and reports (314 reports), Basin Survey Reports, local health departments, USDA-SCS and -FS, and other sources including best professional judgment of state agency staff. Of the 11,310 river miles within the state's current river reach system, only 4,713 miles (42%) could be directly assessed based on available data and information.

Of the 11,310 river miles in the state, approximately 2,828 miles were assessed as being impaired. Agriculture accounted for 2,668 impaired miles (24% of all river miles, 94% of impaired river miles); silviculture, for 235 impaired miles (2%, 8%); and resource extraction, for 192 impaired miles (2%, 7%). A large number of additional river segments were listed as being threatened by agriculture, particularly animal waste resulting from poultry operations, hog farms, and dairy farms. Of the 77 significant, publicly owned lakes in Arkansas, only one was listed as impaired and three as threatened by agricultural NPS pollution. The most severe impact to wetlands in the state was identified as physical destruction resulting from clearing and draining for agricultural production. Sufficient data were not available to permit a detailed statewide assessment of groundwater. For nearly all the river miles listed as impaired due to silviculture, silt was the main cause of impairment and fish and wildlife was the use impaired.

D. State 319 Management Plan

The Arkansas Nonpoint Source (Section 319) Management Program Plan was also completed and submitted to EPA in August 1988; a revised Plan was completed and submitted in late 1992 (39). Primary work on this Plan was performed by the ASWCC, with input and assistance form other state agencies including AFC for silvicultural components. Both this Management Plan and the associated Assessment Report Update were intended to become part

of the Arkansas Water Quality Management Plan completed in May 1979 during the Section 208 planning process. The Plan designated the ADPCE as the lead state agency for water pollution control and assessment and the ASWCC as the lead agency for preparing and implementing the Management Program. The AFC was similarly designated as the lead agency for silvicultural NPS control, with assistance from the ASWCC, local Conservation Districts, and the State Plant Board.

The silvicultural section of the Management Program reviews AFC's statutory authority for NPS control, and summarizes information on sources of state and federal assistance to the silvicultural NPS Management Program (e.g., from USDA-FS, USDA-SCS, and USDA-ASCS; AFC; and ASWCC). It also discusses the potential relation of forest management operations to NPS pollution and lists (in the main text by heading only, and in Appendix A in greater detail) the currently recommended forestry BMPs under the headings of Timber Harvesting (Planning, Design, Felling and Bucking, Skidding, and Disposal of Debris and Litter); Road Construction and Maintenance (Road Location, Construction, Drainage, Water Crossing, and Maintenance); Mechanical Site Preparation (General and Equipment Operations); Silvicultural Chemicals (Maintenance of Equipment, Mixing, Aerial Application, Ground Application, Limits on Application, Container Handling and Disposal, Equipment Cleanup, and Records). The balance of this section summarizes the AFC program for NPS control, as well as associated milestones for FY 1993 through 1996, as follows:

1) Arkansas Forest Fire Law -- enforce the law to prevent uncontrolled fires and associated soil erosion.

2) Technical Assistance to Landowners, Loggers, Contractors, and Agency Personnel -- provide technical services that encourage protection of water quality, including assistance in preparing forest management and forest stewardship plans and in properly implementing established BMPs.

3) Water Quality Awareness -- hire a Forest Hydrologist to direct the Water Quality Management Program for Silviculture; to conduct educational and training programs for landowners, loggers, contractors, and agency personnel; and to promote proper use of BMPs in all silvicultural activities.

4) Nonpoint Source Education -- conduct public education programs on forestry NPS pollution control through presentations to youth and civic groups, video tape releases, radio and television programs, training manuals, and fact sheets. Success in this component will be measured by increased public awareness of

forestry NPS problems and control programs based on surveys.

5) Water Quality Management Training -- prepare and implement training sessions, primarily one-on-one, to demonstrate to agency personnel, forest landowners, loggers, contractors, and forest managers proper application of BMPs for water quality protection. As part of such sessions, distribute to attendees information pertinent to BMPs, sound forest management, and water quality protection.

6) Forestry NPS Pollution Library -- acquire, catalog, and make available to others (technical agencies, institutions, landowner and environmental groups, and clubs) pertinent material on control of forestry NPS pollution, including slide sets, videos, books, workbooks, software, and pamphlets.

7) BMP Demonstrations to Targeted Groups -- in cooperation with the Forestry School, University of Arkansas at Monticello and other agencies, conduct demonstrations of BMPs at various sites in the state, and schedule field days and tours at preset times or on demand.

E. Forestry BMP Manual(s)

Forestry BMPs -- which are referred to by AFC as BMP Guidelines to emphasize that they are voluntary -- were developed in the early 1980's by AFC with the AFA Forest Practices Committee. They are currently contained in a single BMP manual published and distributed by AFC (46). The manual contains an introductory discussion of the role and importance of BMPs in NPS control from forestry operations. Recommended BMP Guidelines are presented under the headings of Planning (General and Planning Design); Road Construction and Maintenance (Road Location, Construction, Drainage, Water Crossing, and Maintenance); Harvesting (Harvest Design, Felling and Bucking, Skidding, and Disposal of Debris and Litter); Mechanical Site Preparation (General and Equipment Operations); Silvicultural Chemicals (Maintenance of Equipment, Mixing, Aerial Application, Ground Application, Limitations on Application, Container Handling and Disposal, Equipment Clean Up, and Records); and Proviso. The manual reviews the responsibilities of several state agencies in the silvicultural NPS control program and reprints three sections from the Arkansas Water Quality Management Plan dealing with Streamside Management Zones (SMZ), Canopy and Vegetation Criteria (i.e., within SMZs), and Monitoring and Sampling Needs. The manual concludes with a Glossary of key terms, and a listing of additional Sources of Information. BMPs are presented in a fairly general manner, and the manual contains no supporting tables, figures, or illustrations with specific numerical

criteria. The AFC has also published two small guide booklets, which can be taken to the field, that summarize the recommended BMP Guidelines (47, 48).

The AFC has developed a plan to review and revise its Voluntary BMP Guidelines (42). Additional BMPs are proposed in the areas of Prescribed Burning, Drum Chopping, Wildfire Control and Reclamation, and Salvage and Sanitation in SMZ's. Additionally, the AFC intends to develop separate Wetlands BMP Guidelines in the following areas: Pre-harvest Planning, Truck Haul Roads, Skid Trails, Log Decks, Harvesting, SMZ's, Cross Drainage, and Regeneration (42). No specific time frame for these enhancements was specified.

F. State Forest Practice Rules

Arkansas has not established formal forest practice rules. Because of the tremendous attention that forest management practices have received within the state, particularly from the environmental community, there is interest in developing such rules, particularly on the part of AFA and forest industries, in the form of formal Forest Practice Laws (38).

G. Special Rules -- Wetlands, Cumulative Effects, or Groundwater

Besides the statutes cited earlier and the voluntary BMP Guidelines for Silviculture, Arkansas has no special rules for protection of wetlands, cumulative effects, or groundwater.

H. Program Changes Since 1980

The AFC silvicultural NPS control program was initiated in 1981 (38, 40). In its last survey of NPS control programs in the southern U.S., NCASI (18) noted that the Arkansas program emphasized education to encourage the voluntary use of BMPs. Forestry BMPs had been developed, and several projects were underway to evaluate their effectiveness. AFC was training its field personnel in BMP application and providing training to industry and other groups. Some forest products companies were also conducting training sessions for their foresters and contractors. NCASI reported a good rate of BMP implementation, as well as a recent improvement. The AFC program was listed as one of the five most active in the South in terms of resources and staffing (11).

Although the entire program developed since 1980, it effectively has not changed since its inception in 1981 (38). If anything, there has been a marked increase in NPS control programs and training by forest industries and products companies, while the intensity of the AFC program has fallen off a bit. AFC has now developed a plan to review all elements of its forestry NPS control program -- training, education,

supervision of others, monitoring, BMPs -- and to initiate revisions as needed (42). It has also proposed (39) to hire a Forest Hydrologist to manage the forestry NPS control program and to expand the educational and training components of the program once it does so.

I. Educational and Training Programs to Promote Compliance

The AFC has maintained an active education and training program since the inception of the silvicultural NPS control program, with strong support from forest industries (5, 38, 39, 40). The Commission estimates that it has provided training for over 12,000 individuals in over 2,500 training sessions through the end of 1990 (49). Many of the forest industries and products companies are also actively engaged in training, with assistance provided by AFC. Company foresters and contractors must be trained in and follow company BMPs which are frequently more stringent than state BMPs.

The AFC provides BMP training for all its staff, and mandatory in-depth training at the District level for its foresters and rangers in BMP application, water quality protection, and monitoring including use of the modified Universal Soil Loss Equation (USLE). BMP and water quality protection training sessions, workshops, and meetings are provided for industry and consulting foresters, loggers, contractors, forest landowners and managers, and pulpwood haulers; many of these are one-on-one training sessions held on the ground with loggers and pulpwood haulers. AFC attempts to hold at least four training sessions per county per month. It also encourages NPS control through public education efforts involving group presentations, video and slide-tape programs, radio and TV programs, pamphlets, brochures, fact sheets, and manuals. In cooperation with the University of Arkansas at Monticello, AFC conducts BMP demonstrations at various sites in the state, including the Poison Springs State Forest, and holds field days and tours at preset times or on request. The Commission is also seeking to develop and make available to others a "forestry NPS pollution library" including slide sets, videos, books, pamphlets, and other materials.

J. Compliance Survey Methods and Results

Since 1982 the AFC has also conducted an active program to monitor sites of logging operations for BMP implementation and effectiveness (38, 39, 49). The Commission estimates that it has monitored over 3,800 individual sites and over 290,000 acres through the end of 1990. Inspections (about two per county per month) are conducted by District foresters, distributed between industrial and small private operators. Sites are selected in the field by county foresters on a "drive-by" basis.

The AFC has two broad purposes in this monitoring and inspection program: 1) to evaluate and improve the effectiveness of BMPs and 2) to develop a database concerning on-site and water quality impacts of forestry operations. The inspection is conducted following completion of a silvicultural operation and requires the inspecting forester to complete a form (now in its 10th version) designed for this purpose (50). Information on the site, operation, implementation and effectiveness of BMPs, and overall success in preventing erosion and protecting water quality is recorded on the form. The modified USLE is used as the basis for evaluating effectiveness; it assesses the potential for erosion and water quality degradation as a result of the operation. Some sites have been monitored successively over time, at the completion of harvest, planting, and site preparation, or after successive growing seasons.

Although the monitoring and inspection program has maintained good continuity, the resulting 10+ years of data have not been analyzed or summarized in any meaningful way. Thus, no statistics relating to overall compliance rates or effectiveness can be provided. AFC staff believe that rates of BMP compliance are good, especially on industry lands, and that not serious impacts to water quality are resulting from forestry operations, but cannot document this assertion until the underlying monitoring data are analyzed and summarized. It is likely that the University of Arkansas at Monticello Forestry School will be asked to compile and analyze the data under a cooperative agreement with AFC (38).

K. Research on BMP Effectiveness

The monitoring and inspection program conducted by the AFC has provided some information on BMP effectiveness in preventing erosion and protecting water quality, but this information has yet to be analyzed in detail. AFC has cooperated in BMP effectiveness research with other organizations, including USDA-FS Southern Forest Experiment Station, Weyerhaeuser Company, Oklahoma State University, and University of Arkansas at Monticello. Most of this work has involved watershed and water quality research conducted in the Ouachitas, Ozarks, and Coastal Plain; Drs. Ed Lawson, Ed Miller, and Scott Beasley are pertinent contacts. This research parallels similar studies conducted in Oklahoma. This body of research includes watershed monitoring studies; studies of sediment yield from watersheds and forest access roads; watershed research on impacts of forest management practices on streamflow, sediment yield, and stream chemistry; and studies of pesticide impacts on water quality. Additional research is in progress on water quality impacts of management

practices through the USDA-FS New Perspectives/Ecosystem Management Program on the USDA-FS Ouachita National Forest; Drs. Pat Fowler and Ed Lawson are the contacts.

Additional research described in the state reports for Louisiana, Mississippi, and Oklahoma apply to portions of Arkansas as well.

L. Special Problems or Issues

Forest management practices have come under intense scrutiny within the state over the past several years, particularly from the environmental community over the issue of clearcutting and other forms of even-aged management. One consequence of the ensuing public debate has been an interest, particularly on the part of AFA and forest industries, in the development of a formal Forest Practice Law for Arkansas. For the future, wetlands and endangered species appear to be critical issues that could have a large impact on approaches to forest management and to NPS control within the state (38).

V STATE REPORT FOR FLORIDA

A. Program Overview

The Florida Department of Environmental Regulation (FDER) has been designated as the lead agency responsible for assessing and managing NPS pollution within the state and for meeting the state's responsibilities under relevant federal water quality legislation including Section 319 of the Clean Water Act of 1987. Responsibility for controlling NPS pollution resulting from forest management operations has in turn been delegated to the Florida Department of Forestry (FDOF). Additional responsibilities for silvicultural NPS pollution control rest with the five Florida Water Management Districts (WMDs) and with Florida's counties.

The FDER manages NPS pollution resulting from silvicultural and other sources pursuant to the Florida Air and Water Pollution Control Act. Most of the state's NPS control programs, including that for silviculture, have grown out of those initially developed during the areawide water quality planning (Section 208) process in the late 1970's. The FDER is responsible for ensuring protection of and adherence to state water quality standards, for overseeing and coordinating program components delegated to other state agencies such as the FDOF, and for periodically evaluating program compliance. In the case of silviculture, the FDER manages what it terms a non-regulatory program with a regulatory backstop (51); it is frequently described by others (e.g., 13, 52) as a quasi-regulatory program.

Violations of relevant statues can result in civil or criminal penalties which may be substantial, up to $10,000 per violation per day. Several recent violations have resulted in penalties of this magnitude (11).

The FDOF is the lead agency for the non-regulatory NPS control program for silviculture, with responsibility for overall program management and coordination, and it has developed a voluntary program of BMP implementation and promotion for the control of NPS pollution from forest management operations (51, 52). FDOF is responsible for assisting FDER with silvicultural portions of state water quality assessments and management plans; for working with other organizations in the state to develop, maintain, and improve forestry BMPs; and for disseminating information through public education and training programs to the forestry community regarding the silvicultural NPS control program, landowner and operator responsibilities under this program, and proper techniques for using BMPs. FDOF also provides technical assistance to forest landowners, forestry practitioners, consulting foresters, logging contractors, and others to prevent or abate water quality problems; incorporates BMPs into forest management advice given to forest landowners; employs BMPs in the management of state lands; and recommends language specifying BMPs for inclusion in forest management contracts (53). Since 1981, the agency has maintained an active program for surveying compliance with BMP implementation throughout the state, with biennial reports to FDER.

Florida's five WMDs have specific responsibilities for aspects of silvicultural NPS control under provisions of the Warren Henderson Wetlands Protection Act (8, 10, 11, 51, 52). The two southernmost WMDs are less active in this regard, but the three northernmost WMDs are very active and have adopted special rules and regulations for forestry operations in wetlands and Waters of the State (54). The Wetlands Protection Act granted specific pollution control authority to the WMDs, as well as authority to regulate dredge and fill activities in wetlands and Waters of the State. Under this authority, the WMDs require mandatory use of BMPs near streams and wetlands, and they issue permits for silvicultural activities. Normal activities such as harvesting, site preparation, and planting are interpreted to be exempt from permitting, but activities that impound, divert, or obstruct surface waters (construction of roads, ditches, or culverts) require permits. Permits require application of BMPs along with other performance standards and require that water quality standards be maintained. Currently, forestry permits are mailed in to the WMDs, have no fee, and are basically instruments of notification. Only one WMD requires a waiting period. The WMDs typically inspect forestry operations for compliance with all applicable rules including BMPs, have the authority to enforce BMPs under their silviculture rules, and have levied fines or initiated restorative actions for non-compliance. The

WMDs also distribute the silvicultural BMP manual and conduct educational workshops and seminars on BMP importance and application.

Florida's counties also maintain programs and regulations impacting silvicultural NPS control under provisions of Florida's Growth Management Act. As required by this Act, all counties where silviculture is a significant land use have developed comprehensive plans including "Conservation Elements" requiring implementation of BMPs for silvicultural operations. This has effectively added another layer of regulation to forest management activities, and in some sense has made the entire NPS control program regulatory in these counties (52). Some counties require permits and others only notification of silvicultural activities, but all enforce compliance with established forestry BMPs.

Among southern states, Florida's program for silvicultural NPS control is among the most rigorous. Florida was the first southern state to require mandatory use of BMPs in certain instances and the first with an active program of BMP enforcement. Florida's silvicultural NPS control program may be described as quasi-regulatory -- i.e., non-regulatory with a regulatory backstop -- and with authority to make the entire program regulatory if current approaches are not effective in protecting water quality.

In spring 1993, a major environmental reorganization bill was enacted by the Florida Legislature that could have important effects on forestry NPS control programs within the state (55). Florida House Bill 1751 was enacted by the state legislature on April 2, 1993 and took effect on July 1, 1993. The bill, which apparently resulted from a push to streamline environmental permitting and related decision-making processes in the state, provides for the merger of the Florida Department of Natural Resources and the FDER into the new Florida Department of Environmental Protection (FDEP), and consolidates certain permitting responsibilities with the five WMDs. In particular, the bill transfers protection of wetlands and permitting of wetland impacts from the Warren S. Henderson Wetlands Protection Act of 1984 to Chapter 373 of the Florida Statutes (F.S.). Under the new regulations, all permits for dredge and fill, management and storage of surface waters, and alteration of mangroves are to be consolidated under a single "environmental resource permit." Such permits will now be required for all activities in wetlands or surface waters, as delineated in s. 372.421 (1), F.S., as amended. Activities requiring permits are identified in the bill. The Florida Environmental Regulation Commission is ordered to develop unified, statewide methods for delineating wetlands, which must be ratified by the Legislature before they become effective. The FDEP and WMDs are required to participate in and encourage establishment of regional wetland mitigation areas and

banks. The bill further provides permitting criteria for activities in wetlands and surface waters, and the FDEP/WMDs are instructed to develop rules governing the use of mitigation banks by January 1, 1994. The full impact of this new reorganization bill on state NPS control programs for silviculture is not yet clear. As a consequence, no attempt has been made to modify subsequent sections of this chapter based on this new development.

B. Water Quality and NPS Control Statutes and Regulations Relevant to Forest Management

Florida maintains some of the most stringent water quality legislation in the southern U.S. and has enacted many rules and regulations to protect water quality and quantity (8, 10, 11). Four statutes and rules provide the basis for existing silvicultural NPS control activities in the state. The primary statute is the Florida Air and Water Pollution Control Act, as amended (7, 9, 56). Under this Act, which does not mention forest management activities directly, the FDER is given broad powers to develop water pollution control and abatement programs, including those associated with NPS pollution. The Act gives FDER authority to issue orders, seek injunctive relief against violators, and make the entire NPS control program including silvicultural components regulatory.

The Warren Henderson Wetlands Protection Act of 1984 grants pollution control authority to the state's five WMDs, including authority to regulate dredge and fill activities resulting from silviculture and other land management activities in wetlands and Waters of the State (8, 9, 57). Through this Act, administered cooperatively by the FDER and WMDs, the WMDs can regulate and require permits for activities that impound, divert, or obstruct the normal flow of surface waters (construction of roads, ditches, and culverts) during forest management operations.

Under provisions of the Growth Management Act, enacted by the Florida legislature in 1985, all local units of government (primarily counties) are required to prepare and periodically update comprehensive plans, including specific "Conservation Elements," to address impacts of land uses such as silviculture (58).

Finally, the state Stormwater Rule, passed by the Florida Environmental Regulation Commission in 1982, requires that BMPs be employed to treat all stormwater discharges within the state prior to their discharge into state waters (59). Silvicultural activities are exempted from permitting requirements of this Rule only so long as they comply with existing BMPs (51).

C. State 319 Assessment Report

The Florida Nonpoint Source (Section 319) Assessment Report was completed and submitted to EPA in August 1988 (60). The report was prepared by the Nonpoint Source Management Section of the FDER, with input and assistance from over 150 organizations and individuals within the state including all of Florida's Water Management, Water Control, Soil and Water Conservation, and FDER Districts, and all counties; the Florida Game and Freshwater Fish Commission; the Florida Department of Agriculture and Consumer Services/FDOF; the USDA-SCS; and the USDA-FS. Although some monitoring data were available for analysis, the Assessment was largely based on evaluated data ("qualitative evaluations") submitted by assessment participants, including water quality observations, local knowledge of land use activities and pollution sources, and best professional judgment. Frequently, such evaluated data are not supported by site-specific data. Thus, the Assessment Report was considered to be a "baseline" requiring future refinement and update, some of which was to be provided by Section 305 (b) Reports. Many waters in the state were not assessed, while others were only partially assessed. Additionally, follow-up activities were recommended to ground truth evaluated data and to clarify identification of particular nonpoint sources contributing to water quality degradation in specific watersheds.

The 319 Assessment was focused on Florida's watersheds. Under the Section 208 areawide water quality planning program, the FDER and the USGS-WRD defined 1,645 watersheds within the state grouped within 65 major hydrologic basins. Of these watersheds, 986 (60%) were at least partially assessed for NPS pollution of surface waters during the 319 process. Among these 986 watersheds, 43% were assessed as containing surface waters threatened by NPS pollution; 41%, as suspected; 26%, as moderately impaired; and 10%, as severely impaired. Sixteen percent of assessed watersheds contain surface waters reported to be in good condition. Turbidity (70%) was the prevalent NPS symptom reported in Florida surface waters, followed by declining fisheries (47%), excessive aquatic vegetation (46%), algae growth (44%), low DO (40%), fish kills (30%), odor problems (17%), and impacts to swimming and shellfishing (<10%). Primary pollutants affecting surface waters in the state were nutrients (78%) and sediment (76%); hydromodification, bacteria, debris, oil/grease, and pesticides and other chemicals affect waters in 37-45% of assessed watersheds; metals and salinity intrusion/pH alteration were factors in 14% and 8% of watersheds, respectively.

Urbanization (54%) and agriculture (51%) were the predominant NPS categories affecting state surface waters, followed by septic tanks (40%), hydromodification (33%), construction (29%), and other sources (26%). Mining and silviculture each were found to impact surface waters in 14% of

assessed watersheds. Both activities were not as wide ranging within the state as more highly ranked impacts, but could be predominant NPS sources within localized areas (e.g., 100% of surface waters in the Perdido River Basin, within which agriculture and silviculture are predominant land use activities, were assessed as being threatened by silviculture). Landfills were found to impact 11% of assessed watersheds. This ranking of primary NPS sources in Florida was similar across all impairment classes (i.e., threatened, severely impacted, etc.). However, mining occurred at a higher frequency among moderately impaired watersheds, while agriculture was a more prevalent impact among severely impacted watersheds. Silviculture was rarely found to be a factor in watersheds containing severely impacted surface waters.

In addition to these statewide summary statistics for surface waters, the Assessment Report also summarized results on NPS impacts by river basin and watershed.

D. State 319 Management Plan

A Draft of the Florida Nonpoint Source (Section 319) Management Plan was completed in August 1988; the Revised Final Plan was submitted to EPA in May 1989 (51). The Florida NPS Management Program was designed to meet the requirements of the federal Clean Water Act of 1987 and to preserve, protect, and restore the water quality of Florida's surface and ground water resources. Unlike many other states, Florida built upon its Section 208 water quality management plans and implemented a wide variety of management programs designed to address NPS impacts resulting from the state's rapid growth. Florida views the renewed federal NPS emphasis as an opportunity to enhance the state's NPS control programs and to continue Florida's leadership role in this arena. The FDER Nonpoint Source Management Section was the lead agency for completion of this Plan; silvicultural and agricultural components were prepared with assistance from the Florida Department of Agriculture and Consumer Services, the FDOF, the USDA-SCS, the USDA-FS, and the Florida Forestry Association. The Plan presents an overview of Section 319 Management Program requirements, describes the state's BMPs to control NPS pollutants, and provides an overview of Florida's existing NPS control programs along with measures proposed to enhance the effectiveness of these programs.

The section on BMPs defines the term in relation to NPS control and discusses the relative advantages of prevention, treatment, and control approaches to the abatement of NPS pollution. It outlines steps followed in the initial development of state BMPs, including those for silviculture (initially published in 1979) and forested wetlands (initially published in 1987). BMPs were developed with input from specialized Technical Advisory Committees and Citizen Advisory Committees and are still

undergoing development and refinement based on new information regarding their use and environmental benefits. The section on Silviculture BMPs differentiates between extensive and intensive forest management systems, briefly lists harvest systems employed in Florida, and presents information on the purpose of and procedures employed for site preparation and planting in Florida. It also discusses forest road and ancillary construction activities and the potential relations between forestry operations and water quality degradation, and it describes the process leading to the initial formulation of silviculture BMPs in Florida. Eight specific BMPs included in the current silviculture BMP manual and the existence of a separate manual providing management guidelines for forested wetlands are briefly mentioned. These are discussed in greater detail in Section V, E below.

The section on NPS Management Programs provides an overview description of Florida's existing programs, which were initially developed as part of the state's areawide water quality management planning program (Section 208 program) in the late 1970's and early 1980's. The program currently involves a network of participants in federal, state, and local agencies; is multi-faceted; and includes regulatory and non-regulatory elements, technical and financial assistance, education, training, technology transfer, and research. As the lead agency for implementing this program, the FDER is responsible for establishing minimum treatment standards to ensure that NPS discharges do not cause or contribute to water quality standards violations and for overseeing and coordinating implementation of NPS management programs delegated to other agencies. The silviculture NPS Control Program was established in 1979 as part of the Section 208 program. The Management Plan briefly describes the major features of the program and the responsibilities of the cooperating agencies in the program (FDER, FDOF, and the WMDs), and enumerates the four main elements of the program: BMPs identification, educational programs, technical assistance programs, and compliance inspections (see other portions of this state report for thorough discussion of these elements).

The NPS Management Plan concludes with an outline of program goals and milestones for the coming four years, focused on activities to enhance the effectiveness of the existing program. The program will be focused on a set of identified NPS priority watersheds ("targeting"), where specific management goals for pollutant reduction will be identified and watershed management plans will be developed. Specific implementation milestones and activities to reduce NPS pollution are enumerated. Although a number of these could impact the silvicultural NPS control program, silvicultural activities and forestry BMPs are not mentioned specifically in any of the milestones or activities.

E. Forestry BMP Manual(s)

Forestry BMPs were initially developed in Florida in the mid-1970's as part of the areawide water quality planning (Section 208) process, and have undergone several revisions in the intervening period. The FDOF currently has two separate BMP manuals, one for normal silvicultural operations on upland sites and a second for operations in wetlands. Additionally, in November 1991 the FDOF initiated a process to comprehensively review and revise existing forestry BMPs. The process will result in a new BMP manual and possibly significant restructuring of forestry regulations (52).

The Florida BMP manual for silviculture was initially published in 1979 by FDOF, with input and assistance from Florida's forest industries, USDA-SCS, USDA-FS, the University of Florida School of Forest Resources and Conservation, and the Florida Forestry Association. The current revised manual was published in 1990 with assistance from these same organizations plus the Florida Association of Consulting Foresters (53). A Forward to the BMP manual briefly reviews the basis for silvicultural NPS control and BMP implementation, describes technical assistance available from FDOF and the purpose of the manual, and emphasizes that the silvicultural NPS control program will remain non-regulatory only if forestry practitioners abide by and cooperate in implementing established BMPs. A short chapter discusses forestry-water quality relationships, focusing on the potential water quality impacts of timber harvesting, site preparation techniques, and road construction and drainage techniques.

A detailed chapter provides guidance on the definition of a Discretionary Zone (DZ) and its allocation among Primary and Secondary Streamside Management Zones (SMZs). The Discretionary Zone, the area within 300 feet of a watercourse, is considered to be the area most influential to surface water quality. The relative allocation of the DZ to Primary and Secondary SMZs and the specific application of BMPs contained in the manual are a function of the Site Sensitivity Classification (SSC), which is in turn determined by soil erodibility (K-factor) and slope (%). For perennial streams and lakes ten acres or larger, the Primary SMZ is the initial 35 feet of the DZ on either side of the watercourse; the width of the Secondary SMZ is a function of the SSC. Only a Secondary SMZ is defined for intermittent streams and wet weather ponds. Selective logging and limitations on the volume of timber harvested are specified for the Primary SMZ; no such restrictions apply to the Secondary SMZ. Specific BMPs are recommended in a separate chapter in the manual under twelve broad headings for application within the DZ, but may be applied on other sites as well: Site Sensitivity Classification, Streamside Management Zone (Water Quality Protection, SMZ Subdivisions, and Silvicultural Limitations); Primary SMZ

(Intermittent Streams and Silvicultural Recommendations) and Secondary SMZ (Silvicultural Recommendations and Maximum Bare Ground Exposure); Access Road Drainage (Culverts, Cross Ditches, Water Turnouts, Broad Base Dips, and Water Bars); Access Planning and Considerations (Planning temporary or permanent roads, When crossing a stream, When constructing a road, and When maintaining a road); Timber Harvesting Sites (Skid Trails); Site Preparation and Planting (When site preparing and regenerating a forest); Using Prescribed Fire; Pesticides (When applying pesticides); Site Fertilization; and BMPs During Emergencies (Wildfire and Insect or Disease Epidemics).

Two additional chapters provide guidance on BMP implementation. The first provides guidance on Applying BMPs, including discussions of materials needed, determination of where BMPs should be recommended, procedures for determining site sensitivity, both on the ground and from maps/photos, and procedures for completing the BMP Prescription Form. The second chapter discusses the Role of Landowners in Applying BMPs, on both public and private lands; recommends that whenever the site is located within 300 feet of a watercourse BMPs be included in the management plan (and contains recommended contract language); outlines the responsibility of FDOF in conducting compliance surveys; and notes the availability of FDOF personnel for technical assistance.

Several Appendices to the manual contain additional detailed guidance on the application of the recommended BMPs. Information and guidance are included on SMZ widths as a function of SSC, tree stocking and bare ground exposure, determination/estimation of soil erodibility categories and K-factors for Florida soils, slope category estimation, recommended spacing for drainages, vegetative site stabilization, design of various water control structures (culverts, ditches, turnouts, dips, etc.), and completion of the BMP Prescription Form. A detailed set of tables specifies allowed and prohibited practices for each SSC category. Addresses and phone numbers of all FDOF Field Unit Locations are listed, and a Glossary defines pertinent terms. Among BMP manuals for the southern U.S., Florida's is clearly one of the most detailed and complete. It provides specific and detailed recommendations on allowed and prohibited practices, and contains numerous figures, drawings, and tables with detailed numerical recommendations.

The companion manual of management guidelines for Florida's forested wetlands (61) was published in 1987 by the FDOF and the Florida Forestry Association, with assistance and input from the USDA-FS, Florida Game and Freshwater Fish Commission, U.S. Army Corps of Engineers, North Carolina State University School of Forest Resources and Industry Hardwood Research Cooperative, and University of Florida School of Forest Resources and Conservation. The management guidelines contained in this manual

are somewhat less detailed and lacking in specific numerical recommendations than the BMPs contained in the normal BMP manual and are intended to supplement the BMP manual, including considerations beyond water quality.

An introductory section discusses the purpose of the manual and presents a system for categorizing/classifying Florida wetlands into eight discrete types based on hydrologic and soil conditions. For each of these types, management guidelines are presented under the following broad headings: Natural Regeneration (General Concepts, When to Regenerate, and Regeneration Systems); Regeneration Recommendations by Site Type (Regeneration Cut Implementation and Regeneration Assessment); Harvesting (Plan, Select Harvesting Systems, Schedule and Supervision); Access Systems (General Access Guidelines); SMZs (Stream Channel Protection, Temperature and Sunlight Control, Erosion/Sediment Potential, Wildlife Aspects, Applying SMZs, Specific Guidelines within SMZs, and Relationship to Existing BMPs); Wildlife Habitat (Harvesting, SMZs, and Roads and Logging Areas); and Miscellaneous Options (Thinning, Exotics, Fire, and Timber Stand Improvement). Guidelines for SMZs in the wetlands manual differ from those in the regular BMP manual. There is no distinction in wetlands between Primary and Secondary SMZs. The manual recommends a SMZ extending 75 feet from perennial streams with bank-to-bank widths of 30 feet or larger, and 35 feet for intermittent streams, perennial streams less than 30 feet wide, and lakes 10 acres or larger. Selective logging and restrictions on the amount of canopy removed and certain other practices are recommended in the SMZ.

Several appendices contain supporting information, including detailed descriptions (physical description, forest vegetation-productivity, and hydrology and soils) of the eight forested wetland types considered in the manual, definitions of relevant terms, and useful references. A final table summarizes recommended management measures for each of the eight forested wetland types.

F. State Forest Practice Rules

Florida has not established formal forest practice rules.

G. Special Rules -- Wetlands, Cumulative Effects, or Groundwater

Florida's five Water Management Districts issue special rules and regulations (54) for forest management operations in and adjacent to wetlands and Waters of the State under authority of the Warren Henderson Wetlands Protection Act of 1984; these are described above in Section V, A and B. No other special rules for protection of wetlands, cumulative effects, or groundwater have been issued.

H. Program Changes Since 1980

In its last review (18), NCASI identified Florida as maintaining a successful non-regulatory silvicultural NPS control program with detailed BMPs, strong educational elements, and well-developed program assessment and compliance monitoring components. Since 1980, the program has undergone major changes (5, 52), becoming even more stringent and rigorous with a strong regulatory component. These changes have occurred largely in response to public concerns with environmental issues in a state with rapid growth and to subsequent legislative developments, primarily passage of the Warren Henderson Wetlands Protection Act of 1984 and the Growth Management Act of 1985. Both Acts resulted in new layers of regulation of silvicultural activities (summarized above), administered by the five WMDs and Florida's counties, respectively. Thus, the entire program is now quasi-regulatory -- i.e., non-regulatory with a regulatory backstop -- and requires mandatory use of BMPs in certain instances, permits for forest management operations that alter normal flow of surface waters, and active BMP enforcement.

During this period the BMP manual was revised, with the current version published in 1990, and a separate manual for forested wetlands was developed. Another comprehensive revision of BMPs was initiated in 1991, which could result in a significant restructuring of forestry regulations (52). During this period also, NPS/BMP educational and training efforts have increased, a BMP demonstration center was established on private lands (51), and compliance monitoring activities were expanded and continued. Continued changes in the silvicultural NPS control program are anticipated in the future, with an increasing move toward a regulatory program.

I. Educational and Training Programs to Promote Compliance

Based on an analysis of personnel and budgets (11), as well as on results of compliance surveys, Florida maintains among the most active educational and training programs for promoting compliance with BMPs and forestry NPS control. Even more resources were allocated by the WMDs to education and training than by the FDOF.

The FDOF conducts a variety of educational and training programs designed to inform the forestry community regarding the silvicultural NPS control program, landowner and operator responsibilities under this program, and proper application of BMPs. Components of these programs include various types of literature (brochures and booklets); media programs (e.g., slide programs with scripts for use by county foresters); and development of a BMP demonstration center on private lands to provide hands-on experience with forestry BMPs. The FDOF also provides technical assistance to forest landowners, forestry

practitioners, consulting foresters, logging operators, and other members of the forestry community, and it conducts BMP workshops routinely throughout the state for landowners, foresters, and loggers (51, 52). In 1990, 22 workshops were held with approximately 850 attendees. In the first eight months of 1992, eight workshops were held with about 400 attendees. Some workshops include field work and all have classroom sessions with slides and question/answer periods. These workshops have been considered to be very effective and a major reason for the high rate of compliance with BMPs throughout the state (52).

Education also occurs during on-site assessments of BMP compliance, which involve a post-operation visit and evaluation by the County Forester. The landowner and operator are contacted and encouraged to participate in the site evaluation. In the case of a non-compliance site, the landowner receives BMP information and is encouraged to meet with the County Forester to discuss problems and solutions (52).

J. Compliance Survey Methods and Results

The FDOF has been actively conducting statewide surveys of BMP compliance since 1981. The sixth biennial Compliance Survey was conducted in 1991, marking over a decade of BMP monitoring within the state (62). Since 1981, over 800 sites have been surveyed (5). In 1991, 150 total sites were surveyed, 128 in 1989, and 136 in 1987. These biennial Compliance Surveys are conducted in the northern-most 37 counties, where the vast majority of commercial forestry operations within the state occur. Survey sites are located on private industry lands, private non-industrial lands, and public lands, where timber harvesting, site preparation, tree planting, or some combination of these activities have occurred in the previous two years. Sites selected must be within 300 feet of a perennial or intermittent stream or lake 10 acres in size or larger (based on the definition of the Discretionary Zone in the BMP manual, the area where BMPs are recommended to be applied for greatest water quality protection). In each Survey, each participating county is assigned a predetermined number of survey sites, based on the level of timber removal reported by the USDA-FS (62).

Specific sites for compliance surveys are selected by FDOF County Foresters from aerial reconnaissance using fixed-wing aircraft. A flight pattern is determined for each county to reduce bias in site selection and to provide a representative cross section of site ownerships and physiographic conditions. County Foresters randomly select sites along the flight pattern meeting criteria listed above until locating the assigned number of sites for that county. Once a site is selected, a trained professional forester visits the site and evaluates the operation for compliance with BMPs. The evaluation involves a detailed field inspection and completion of a comprehensive questionnaire

focusing on road construction, SMZs, and site preparation practices. At the conclusion of the field inspection, each site is rated as pass/fail in respect to overall BMP compliance (62).

In 1991, 141 of 150 sites evaluated were rated as complying with BMPs, a compliance rate of 94% (62). The long-term average rate of compliance has been 90%, the range is 84-94%, and the rates of compliance for the previous two surveys (1987, 1989) were 89% and 94%, respectively (5, 52, 62). These results indicate a high rate of compliance with silvicultural BMPs within the state and reflect the stress placed on BMP/NPS educational and training programs by the FDOF and the WMDs.

K. Research on BMP Effectiveness

Research studies on BMP effectiveness have not been specifically initiated or sponsored by the FDOF within Florida. The state contact did provide a summary of select literature on water quality impacts of silvicultural activities, including some work outside the state, that the FDOF uses in relation to assessing BMP effectiveness (63). Nonetheless, considerable research has been conducted within the state on water quality and related impacts of forest management practices. Much of this research has been conducted by the University of Florida School of Forest Resources and Conservation, and by the USDA Forest Service IMPAC Research Work Unit located at Gainesville. Drs. Hans Riekerk and Dan Neary are relevant contacts for this work. Additionally, NCASI is sponsoring work on BMP effectiveness within the state through its office in Gainesville; Dr. Jim Shepherd is the relevant contact.

L. Special Problems or Issues

There are a number of special issues within the state of Florida that are likely to influence future forestry BMPs, regulations, and NPS control programs (52). These issues include the Coastal Zone Management Act (the entire state is effectively a coastal zone), the Endangered Species Act, pending reauthorization of the Clean Water Act (Section 404 in particular), and possible reissuance/modification of the federal wetlands delineation manual. The task in progress of revising existing silvicultural BMPs was initiated primarily due to concerns over BMP effectiveness. Although serious questions exist regarding possible impacts on water quality and quantity, the key issues driving this process are related to wetlands and wildlife. Revised BMPs are expected to include new provisions for protecting additional wetland values and "older growth" wildlife habitat.

Wetlands and wildlife are expected to remain key issues driving future changes in forestry BMPs and regulations. Concern over threatened and endangered species, both plant and animal, is

increasing rapidly within the state, and appears likely to be the next major environmental issue on private timberlands within the state.

VI STATE REPORT FOR GEORGIA

A. Program Overview

The Georgia Department of Natural Resources-Environmental Protection Division (GDNR-EPD) has been designated as the lead agency responsible for assessing and managing NPS pollution within the state and for meeting the state's responsibilities under relevant federal water quality legislation including Section 319 of the Clean Water Act of 1987. Responsibility for controlling NPS pollution resulting from forest management operations has in turn been delegated to the Georgia Forestry Commission (GFC). Additional responsibilities for protection of water quality in select sensitive areas rest with Georgia's counties.

The GDNR-EPD manages NPS pollution problems which result from silvicultural and other sources pursuant to the Georgia Water Quality Control Act. In the case of silviculture, the EPD regulates and investigates NPS pollution and water quality problems on a complaint basis. Guidelines have been developed which specify the steps and procedures GFC is to follow in handling commercial forestry complaints and problems within the state (64, 65). If reported problems cannot be resolved successfully, then GFC consults with EPD to determine further actions, which may include requests or warnings from EPD, water quality investigations to document NPS impacts, and formal enforcement actions by EPD. If enforcement is warranted, relevant statutes specify penalties for continued violation, which may be substantial -- i.e., up to $25,000 per violation per day (7,9).

The GFC has developed a voluntary program of BMP formulation, demonstration, and implementation to control and minimize NPS pollution resulting from forest management operations (65, 66). The GFC has a statewide Water Quality Coordinator for the silvicultural NPS control program, and has appointed and trained a forester in each of its 13 districts to act as District Coordinator for its program. Among the responsibilities of these District Coordinators are education, training, and demonstrations to promote BMPs, assistance in conducting surveys, preparation of reports, investigation/ mediation of forestry complaints, and regional assessments of BMP implementation and effectiveness. The GFC is responsible for assisting GDNR-EPD with silvicultural portions of state water quality assessments and management plans, for working with other

organizations in the state to develop, maintain, and improve BMPs, and for disseminating information through formal and informal education and training sessions on BMPs and proper application for state agency personnel, industry personnel and private loggers, site preparation vendors, and landowners. The GFC also provides technical advice to landowners on forest management and harvesting, and has instituted a policy that forest water quality protection be addressed in all forest management plans prepared for private non-industrial forest landowners. GFC employs BMPs in the management of state lands, and recommends contract language specifying BMPs for inclusion in forest sale agreements for private landowners (67). The agency also responds to reported water quality complaints and problems resulting from commercial forestry activities, including site investigations and assessments, evaluations of compliance with BMPs, consultations with loggers, contractors, and landowners regarding corrective actions, and other attempts to resolve problems. In the absence of problem resolution, complaints are referred to GDNR-EPD for consultation including possible formal enforcement action. Since 1990, the GFC has conducted surveys of BMP compliance within the state, with periodic reports to the EPD.

Georgia counties also maintain rules and regulations that impact silvicultural NPS control programs. Under provisions of the Comprehensive Georgia Planning Act of 1989, the GDNR must develop minimum standards and procedures to protect sensitive areas and resources in the state; criteria of relevance to silvicultural NPS control programs have been established to date for protecting water supply watersheds, wetlands, river corridors, and mountains (68). Counties are required to adopt these minimum standards in developing local comprehensive plans. Forest management operations are allowed in these sensitive areas only if they employ BMPs established by the GFC. This essentially makes the NPS control program regulatory in these areas. In addition, most Georgia counties maintain various other forms of logging regulation (69). All counties require forestry activities to conform to existing regulations and employ combinations of permits, notification, and bonds, fees, or deposits to regulate logging operations.

Thus, Georgia has a non-regulatory program for silvicultural NPS control in much of the state, a regulatory program in select sensitive areas, a regulatory backstop for violators, and the authority to make the entire program regulatory if current approaches are not effective in protecting water quality.

B. Water Quality and NPS Control Statutes and Regulations Relevant to Forest Management

The primary statute pertaining to control of NPS pollution is the Georgia Water Quality Control Act, as amended (7, 9, 70),

which gives the GDNR-EPD (under authority of the Georgia Water Control Board) broad authority to promulgate rules and regulations to control water pollution within the state. This Act is unique for the South (10), in that it specifically empowers the EPD to control and issue permits for both point and nonpoint source discharges. Under authority of this Act, the Division could require permits for any activities, including forest management operations, recognized as a potential source of NPS pollution. Although this provision has not yet been invoked in respect to forestry operations, it clearly gives the GDNR authority to make the entire silvicultural NPS control program regulatory if current voluntary approaches do not protect water quality conditions.

A second statute that influences NPS control programs within the state is the Comprehensive Georgia Planning Act of 1989, as amended (71), adopted in response to recommendations of the Governor's Growth Strategy Commission (66). This Act requires local (i.e., municipal and county) governments to develop coordinated and comprehensive plans which take into consideration natural resources, environments, and vital areas within their jurisdiction. The Act also authorizes the GDNR to develop minimum planning standards and procedures for protection of sensitive areas and resources within the state, and requires local governments to use these minimum standards in developing and implementing local comprehensive plans. These minimum standards must be adopted by counties not later than September 1995. Special planning criteria have been formulated by GDNR for protection of water supply watersheds, wetlands, river corridors, and mountains (see Section VI, G).

C. State 319 Assessment Report

The Georgia Nonpoint Source (Section 319) Assessment Report was completed and submitted to EPA in December 1989 (72). Primary work on the Report was completed by the GDNR-EPD (Water Protection Branch), with assistance from the GFC and the Georgia Soil and Water Conservation Commission for silvicultural and agricultural components of the assessment. The Assessment was based on available information developed pursuant to Sections 208, 303(e), 304(f), 305(b), and 320 of the federal Clean Water Act, as well as on a variety of specific sources of information resulting from state water quality assessments and evaluations conducted during 1984-1987. For many waterbodies in the state, evaluations in the 319 Assessment Report were based on current (no more than five years old) site-specific water quality data, including trend monitoring, intensive surveys, biological monitoring, toxic substance monitoring, and aquatic biomonitoring tests. For other state waters, evaluations were based on information other than current site-specific monitoring data, including predictive modeling, fisheries studies, citizen complaints, stream locations, and best professional judgment.

Georgia's surface water resources include: approximately 20,000 miles of streams, 417,730 acres of publicly owned lakes, 100 miles of coastline, and 594 square miles of estuaries. Of these resources, 97% of stream miles were assessed as meeting designated beneficial uses; 2%, as partially supporting uses; and 1%, as not supporting uses. Municipal point sources were the primary cause of stream impairment (i.e., less than full support of designated uses) in 59% of stream miles, while nonpoint sources were the primary cause in 35%. For lakes and reservoirs, 1.3% partially support uses, and 0.01% do not support designated uses. Nonpoint sources were the primary cause of impairment in 63% of the acreage, while municipal point sources were the cause in 33%. In the case of estuaries, 1% each of the total square miles were assessed as partially supporting and as not supporting designated uses. Primary causes of impairment were industrial (91%) and municipal (9%) point sources. State groundwater resources showed no evidence of widespread pollution, with most existing contamination resulting from naturally occurring mineral salts and radioactive minerals. Similarly, there was no evidence that NPS pollution has impacted wetlands in the state.

Data summaries and analyses in the Assessment Report did not allow a clear ranking of major causes and symptoms of NPS pollution by percentages. However, monitored streams and lakes/reservoirs not fully supporting designated uses were listed, along with symptoms and causes of impairment. Primary stream symptoms were fecal coliforms and low DO; the primary NPS causes were urban effects and combined sewer overflow; and the uses impacted were fishing and recreation. For monitored lakes and reservoirs, the major NPS symptoms were accelerated eutrophication due primarily to phosphorus loading, excess nutrients, excess algal productivity, reduced water clarity, hypolimnetic DO depletion, and excess rooted macrophytes. Among monitored waters, no waterbodies could be identified as having been specifically impaired by forest management operations.

In the case of evaluated waterbodies within the state, the Assessment Report listed a series of urban streams, watersheds, and agricultural streams that were felt to be potentially threatened in the future by urban effects (various sources including storm water runoff and combined sewer overflows), construction, agriculture (crop production, pasture lands, feedlots), and silviculture. These were waterbodies in which the specific categories of NPS generating activity had the potential to impair designated beneficial uses in the future, but for which no current chemical or biological water quality data existed to confirm whether or not water quality problems were occurring. For potential impacts of silvicultural activities, GFC staff members identified 15 watersheds in different counties in the state where commercial activities were planned in the coming two-year period. The Report noted that other water bodies could also be potentially impacted as "silviculture activities occur."

D. State 319 Management Plan

The Georgia Nonpoint Source (Section 319) Management Plan was completed and submitted to EPA in December 1989 (66). An Update to the Plan was submitted in April 1991 (64). The GDNR-EPD was the lead agency for preparation of the Plan and 1991 Update; silvicultural sections were prepared with assistance of the GFC. The Plan proposed a four-year program for managing categories of NPS pollution identified in the companion Assessment Report. The NPS Management Plan was recognized as one element of the state's Clean Water Strategy, a rational continuing process to ensure that goals and requirements of the federal Clean Water Act were integrated with current water pollution control efforts as well as the long-range mission and goals of GDNR-EPD. Much of the Program Plan was based on targeting pollution prevention and control activities on those waterbodies identified in the continuing, biennial assessment process as being impaired or threatened by NPS pollution. The broad objective of the Management Plan was to develop a plan of action, within the context of both the Georgia Clean Water Strategy and available resources, that would abate categories of NPS pollution identified in the 319 Assessment Report.

The bulk of the 319 Management Plan identified and discussed existing and proposed BMPs and NPS management programs for the specific categories of NPS pollution identified in the Assessment Report, including silviculture. Discussions for each NPS category included an overview of the strategy for that category, state waters targeted for improvement, applicable NPS control programs and BMPs to reduce NPS loadings, and a listing and description of continued and proposed implementation programs and activities over the coming four-year period. A general NPS management strategy, applicable to all categories of NPS pollution, was also included in the Plan. This strategy was derived from a paper (73) prepared for the Governor's Growth Strategy Commission Task Force on Natural Resources Protection, which included the following broad statement:

> Problems associated with nonpoint source pollution are site specific and related to topography and land use practices. The major nonpoint source pollution problems in Georgia are from urban sources.... Impacts from agriculture and forestry vary from river basin to river basin. Major impacts, when Best Management Practices are not in place, are elevated solids, turbidity and higher fecal coliform bacteria concentrations.... Nonpoint source pollution from nutrients and pesticides is not a significant problem in Georgia at this time.
>
> Following from this statement, the overall strategy for the NPS Management Plan was to focus on 1) identification and

control of NPS pollution of streams in medium and large urban areas; 2) management of effects of construction in rapidly growing metropolitan areas and the mountains; 3) voluntary BMPs in agricultural areas, procedures to restore/maintain streamside vegetation, and assessment of streams impacted by agricultural activities; 4) voluntary programs of, and expanded assessment of the application rate and effectiveness of, BMPs for commercial forestry activities; and 5) protection of the Chattahoochee River.

The silviculture section of the 319 Management Plan states that the major impact of commercial forestry within the state occurs on streams where BMPs are not properly employed, resulting in increases in sedimentation which alters or destroys habitat for aquatic organisms and fish. The overall goal of the silvicultural NPS control program is to "promote the voluntary use of appropriate BMPs to protect water quality from commercial forestry activities." Efforts are to be targeted on those streams listed as threatened by commercial forestry activities in the 319 Assessment Report, as well as on the Georgia mountains and Piedmont, areas with highly erodible soils meriting special attention. The section also provides brief overview of the GFC program, and summarizes recent program accomplishments related to education, training, and assessment of program effectiveness. Current forestry BMPs are briefly listed, and ongoing processes to develop comparable BMPs for forested wetlands and a program to monitor BMP implementation and effectiveness are mentioned. The section concludes by listing four specific implementation activities for the coming four-year period: 1) continue the voluntary NPS management program, including education and training to encourage use of BMPs, especially directed to small independent loggers and landowners; 2) develop a compliance surveillance program, to determine frequency of use and effectiveness of BMPs, with reports of findings to GDNR-EPD; 3) complaint response, to assess and take appropriate corrective actions in response to reported water quality problems resulting from commercial forestry operations, including enforcement actions when warranted; and 4) conduct seminars for GDNR personnel, to train DNR staff in areas with significant silvicultural activities to allow them to determine whether BMPs have been employed, to identify potential water quality problems caused by harvesting, and to convey such information to the appropriate authority. An implementation schedule for these activities is included in the fifth section of the Management Plan.

In April 1991 the GDNR-EPD prepared and submitted to EPA an Update to its Nonpoint Source Management Plan, containing new and expanded elements for its urban, agricultural, and silvicultural NPS control programs.

One new and one enhanced element were included in the silvicultural section of this Update: 1) trout stream protection, an enhancement of the BMP education initiative (the first implementation activity listed above), targeting protection of trout streams through development and use of a brochure explaining the importance of trout streams and BMPs specifically applicable to their protection; and 2) long-term BMP assessment, a new element involving GFC monitoring water quality (dissolved solids and turbidity) upstream and downstream of forestry sites to assess BMP effectiveness. The Update also includes a Memorandum of Understanding between GFC and USDA-FS identifying responsibilities of each agency in conducting NPS control programs for activities on National Forest System lands, and a copy of guidelines jointly developed by GFC and GDNR for addressing water quality complaints from commercial forestry operations.

E. Forestry BMP Manual(s)

Forestry BMPs were initially identified in 1978 as part of the Section 208 planning process and published in 1981 (18). The GFC currently has two separate BMP manuals, one for normal silvicultural activities on upland sites and a second one for operations in wetlands.

The existing BMP manual for silviculture was published in 1985 by the GFC, based on the BMPs initially developed in 1978, which have not been revised (74). These BMPs were developed by a Forestry Non-Point Source Technical Task Force created by the state as part of the Section 208 planning process to assess the extent of pollution resulting from forestry activities and to recommend practices which would eliminate or reduce the amount of pollution. Because soil characteristics and slope vary greatly within the state, BMPs were designed for each of Georgia's four major regions: Lower Coastal Plain, Upper Coastal Plain, Piedmont, and Mountains. A Foreword to the BMP manual summarizes the purpose of the manual and the recommended practices contained therein; the Introduction summarizes the process leading to the development of BMPs, and presents a map of the four major regions of the state. Specific BMPs are listed in nine main sections: 1) Streamside Management Zones (Primary SMZ and Secondary SMZ); 2) Stream Crossings; 3) Access Roads and Their Construction; 4) Timber Harvesting; 5) Site Preparation; 6) Reforestation; 7) Forest Protection (Prescribed Burning, Fire Lines, and Chemical Fire Retardants); 8) Chemical Treatment (Pesticide and Herbicide); and 9) Fertilization. Each section lists recommended practices as well as practices to be avoided. A concluding Appendix contains a Glossary of key terms, and additional guidance regarding diameters of metal culverts; techniques for seeding, mulching, and fertilizing roads, skid trails, and disturbed areas; stabilizing roadbanks; and road cross-sections for side slopes of varying degrees. Locations,

addresses, and phone numbers for each of the 13 GFC District offices are also included.

A number of the recommended practices vary across the four main regions of the state. For example, recommended widths of Primary and Secondary SMZs vary from 20-80 feet and 0-80 feet, respectively, depending on the region. Some practices are recommended for the secondary SMZ but not the Primary (e.g., fire, clearcutting in the mountains), while other practices are recommended for avoidance in either area (e.g., roads, leaving trees or tops in water). Although some sections of the manual are quite general, others (e.g., SMZs, Access Roads) are quite detailed and contain numerous drawings, figures, and tables with specific numerical recommendations. The overall manual is attractively produced and easy to use.

The forested wetlands BMP manual was published in 1990 (75) by the Georgia Forestry Association's Wetlands Committee, with assistance from the GFC, other southern state forestry commissions and forestry associations, the U.S. Army Corps of Engineers, U.S. EPA, GDNR-EPD, University of Georgia School of Forest Resources, The Georgia Conservancy, NCASI, Georgia Farm Bureau Federation, Georgia Soil and Water Conservation Commission, and others. The manual contains an Introduction that outlines the purpose and background for BMPs and the forested wetlands BMP manual, and summarizes the existing technical criteria for definition of jurisdictional wetlands. The second section provides an identification and classification of major wetland types found in Georgia, by physiographic class, and summarizes information on hydrology, soils, and vegetation for each forested wetland type. There is also a section which provides multiple use guidelines for the management of forested wetlands relative to the multiple functions and values associated with wetland ecosystems. Throughout these introductory sections are numerous statements encouraging proper application of BMPs in conducting forest management operations within wetlands, as well as compliance with all existing regulations and water quality standards.

BMPs for forested wetlands are presented in four major sections: SMZs (Introduction, Definition of Wetland SMZs, Purpose of the SMZ, Determination of SMZ Width, and Specific Recommendations within the Wetland SMZ -- Timber Harvest, Access, Timber Stand Improvement, Wildlife, Fire, Chemicals, Site Preparation, and Reforestation); Wetland Access Systems (Forested Wetlands Access Guidelines -- Permanent Roads, Temporary Roads, and Recommended BMPs); Harvesting Wetland Sites (Planning the Harvest, Harvesting Constraints, Harvest Supervision, and Recommended BMPs); and Regenerating Wetland Forests (Concepts of Natural Regeneration, Concepts of Artificial Regeneration, and Recommended Regeneration Practices by Wetland Groups). The manual also contains a Summary of Recommended BMPs for Forested

Wetlands, an Appendix with definitions of key terms, References to useful publications and reports, and a listing of GFC District offices. Recommended SMZ widths and practices vary by region within the state, and are similar to those in the regular BMP manual; most other practices vary by wetland type rather than region within the state. The manual is attractively produced, contains considerable detail, and is intended to supplement the regular BMP manual.

F. State Forest Practice Rules

Georgia has not established formal forest practice rules.

G. Special Rules -- Wetlands, Cumulative Effects, or Groundwater

Under provisions of the Comprehensive Georgia Planning Act of 1989, the GDNR-EPD has formulated a series of special Rules for Environmental Planning Criteria (68). These rules are intended to be minimum planning standards and procedures for protection of sensitive areas and resources in the state, which are to be adopted by local governments in developing and implementing local comprehensive plans. To date four specific criteria have been formulated by GDNR for protection of water supply watersheds, wetlands, river corridors, and mountains. Each of these impacts the silvicultural NPS control program differently, as summarized below. A fifth set of criteria for protection of groundwater recharge areas (Chapter 391-3-16.02) does not specifically impact NPS control programs for forest management operations.

The Criteria for Water Supply Watersheds (Chapter 391-3-16.01) were developed to protect water supply watersheds from contamination of surface drinking water supplies to the point where they cannot be treated to meet drinking water standards. This protection is accomplished by establishing buffer zones and setback requirements around reservoirs and streams, acceptable management practices, and allowable densities of impervious surfaces within watersheds. Different criteria are established based on watershed size and distance from reservoir boundary or water supply intake. Local governments are required to prepare water supply watershed protection plans and submit them to the GDNR for approval. Local governments may exempt forest management operations from the stream corridor buffer and setback area provisions of these plans only if they employ BMPs established by the GFC and if they do not impair the quality of the drinking water stream.

The Criteria for Wetlands Protection (Chapter 391-3-16.03) require local governments to acknowledge the importance of wetlands for the public good, and the GDNR to establish a freshwater wetlands data base. Freshwater wetlands are defined by the criteria; five specific categories of wetlands are also

identified, including forested wetlands, and are to be identified and mapped by the state. Specific considerations which must be addressed in the development of land-use plans for the wetland classes identified in the state database are listed. Among the considerations which must be included in land-use plans are uses of wetlands which do not impair the long term function of wetlands, including timber production and harvesting. Presumably, such operations and practices must employ BMPs established for forested wetlands.

The Criteria for River Corridor Protection (Chapter 391-3-16.04) define river corridors ("strips of land that flank major rivers") in relation to the preservation of specific qualities of rivers (wildlife habitat, recreation, clean drinking water, erosion control, flood protection). These criteria require development of river corridor protection plans in order to maintain the integrity of a natural vegetative buffer area bordering each protected river. These plans shall provide for specific acceptable uses of river corridors, provided that such uses do not impair the long-term functions of the protected river or river corridor. Timber production and harvest are listed among the acceptable uses, provided that BMPs established by the GFC are employed and that forestry activities do not impair the drinking water quality of the river water as defined by the federal Clean Water Act.

The Criteria for Mountain Protection (Chapter 391-3-16.05) discuss the significance of land-disturbing activities in the Georgia mountains, and define the need for special mountain protection. The criteria require development of specific mountain protection plans by appropriate local governments. Forestry may be permitted on protected mountains provided that BMPs established by the GFC are employed, and that forest management operations are consistent with all state and federal laws.

H. Program Changes Since 1980

Georgia's silvicultural NPS control program was initiated in 1981 by a Memorandum of Understanding between GDNR and GFC (18). BMPs were established and water quality coordinators were assigned in each of the 13 GFC Districts to provide local expertise in BMPs, foster on-site training in proper application of established BMPs, and monitor regional compliance with BMP implementation. The program included assessments of program effectiveness from its inception.

Since the program was initiated, major changes and program improvements have occurred. A second BMP manual for forested wetlands was developed and published. Education and training programs designed to promote compliance have been significantly enhanced, and specifically targeted at small operators and landowners and for the protection of trout streams. New Rules

for Environmental Planning Criteria developed by the GDNR-EPD in response to the Comprehensive Georgia Planning Act of 1989 have added new regulatory components to the silviculture NPS control program, in select sensitive areas including water supply watersheds, wetlands, river corridors, and mountains. The GFC initiated a statewide program for monitoring BMP compliance and effectiveness, with periodic reports to the EPD; established formal guidelines for handling potential water quality problems and complaints resulting from commercial forestry activities; entered into a Memorandum of Understanding with the USDA-FS regarding responsibilities for conducting NPS control programs on National Forest System lands; and initiated a new program of water quality monitoring above and below forestry operations to assess the long-term effectiveness of BMPs.

I. Educational and Training Programs to Promote Compliance

According to Cubbage et al. (11), Georgia maintains one of the four most active educational and training programs among all southern states. The GFC conducts a wide variety of educational and training programs to inform and educate the public and the forestry community regarding its NPS control program and proper implementation of BMPs (65, 66, 72). The GFC conducts formal and informal training programs for other state agencies, industry personnel and private loggers, site preparation vendors, and landowners; has distributed over 9,000 copies of the BMP manuals; made numerous special presentations to groups; prepared BMP sign boards and table top displays containing pictures of proper BMPs and rotated them among points of logger concentration; produced, distributed to Districts, and extensively shown a film illustrating the need for BMPs; included BMPs in forest management plans prepared for private non-industrial forest landowners; and recommended contract language specifying BMPs for inclusion in forest sale agreements. Consultations conducted during complaint investigations have led to increased recognition and application of BMPs, especially among major corporations (65). Workshops have been conducted by both GFC and GFA for consulting, land management, and procurement foresters; for forest operators and landowners; for timber companies and contract loggers; and for state agencies (e.g., State Fish and Game Commission Rangers and Wildlife Biologists) regarding their roles in protecting water quality (76).

A 1981 survey of commercial forestry sites statewide by GFC District Coordinators revealed that awareness and usage of BMPs had increased significantly within forest industries, particularly among the larger industries. A 1986 survey revealed the need to continue and re-focus education and training efforts targeted at small loggers, contractors, and landowners since these groups seem to be the "least educated and convinced of the need to incorporate established common sense soil and water quality practices into their everyday operation" (66). As a

consequence, GFC placed new emphasis on educational programs directed to small independent loggers and landowners to improve the use of BMPs in small logging operations.

J. Compliance Survey Methods and Results

BMP compliance surveys were initiated by the GFC in 1991 (77). The approach followed in Georgia was modified from that developed and implemented by Florida, based on technical input and assistance from the USDA-FS, University of Georgia School of Forest Resources, the GFA, and the EPD. Objectives of GFC's compliance survey are to determine BMP compliance and damage to streambanks or streamflow, determine BMP effectiveness, recommend improvements in BMPs, and target groups with poor records of compliance for further training.

The goal of the 1991 survey was to sample about 10% of the estimated 3,000 annual logging operations in the state, with selected sites distributed among counties and ownership categories (forest industry, private non-industrial, public) based on state and USDA-FS data on volume of timber harvested by county and acres disturbed silviculturally by ownership class. A total of 345 sites where forestry operations had occurred within the past six months were checked for impacts resulting from non-implemented or ineffective BMPs during October 1990 to February 1991. Each site evaluation by a trained forester involved a field inspection and completion of a detailed compliance survey form developed by GFC. The form requires a rating for each individual BMP/forestry practice, as well as an overall rating of all practices applied to the site and an overall damage assessment to streams within the site.

Detailed results of this first statewide compliance survey were presented by practice and overall, by ownership class, and by region (Mountain, Piedmont, Coastal Plain); results may be briefly summarized as follows:

1) Forest Road Construction -- overall compliance 69%, average streambank damage 4.1%; compliance higher (damage lower) for public and forest industry owners, compliance lowest in Mountains and highest in Coastal Plain.

2) Timber Harvesting -- overall compliance 83%, average streambank damage 4.9%; compliance highest (damage lowest) on forest industry lands, compliance lowest in Mountains and highest in Coastal Plain.

3) Site Preparation -- overall compliance 94%, average streambank damage 2.2%; little real difference in compliance or damage among ownerships or regions (though best on public lands).

4) Reforestation -- overall compliance 96%, average streambank damage 1.7%; little real difference in compliance or damage among ownerships or regions.

5) Forest Fire Protection -- overall compliance 85%, average streambank damage 3.1%; lowest compliance (highest damage) on private industry lands, no real regional differences.

6) Overall Compliance -- overall compliance 86%, average streambank damage 4.8%; highest compliance (lowest damage) on private industry lands, compliance highest in Coastal Plain and lowest in Mountains (except on public lands where compliance lowest/damage highest in Piedmont).

Detailed observations were included in the Survey Report which supplement the broad conclusions above. Additionally, specific recommendations were included for improving compliance, including: targeting Mountains for improvement, especially regarding road construction and timber harvesting on private and industry lands; and targeting small private landowners and independent loggers for extensive BMP training and education.

Overall, the report concluded that Georgia's voluntary program of NPS control and BMP implementation is working, though there is room for improvement. In regards to BMP effectiveness, the report concluded that most current BMPs appear to be sufficient to protect water quality when implemented. However, modifications in some BMPs were recommended, BMPs need to be made more site specific (e.g., SMZ width in relation to slope, soil type, erodibility, and rainfall), and changes in equipment and technology need to be addressed (e.g., feller buncher use in SMZs). Future surveys will be conducted in 1992 and then biennially.

K. Research on BMP Effectiveness

The GFC is not currently sponsoring or cooperating in any research within the state on BMP effectiveness. However, initial establishment of BMPs in Georgia was based upon research conducted by Dr. John Hewlett and colleagues at the University of Georgia School of Forest Resources on watershed responses to specific forest practices (18). Some initial work on BMP effectiveness was also conducted by the GDNR-EPD during the Georgia Nonpoint Source Impact Assessment Study (78). In addition, extensive research conducted by the USDA-FS Coweeta Hydrologic Laboratory (Otto, NC) and the IMPAC project (Gainesville, FL) apply to specific portions of the state, supplementing the research noted above.

L. Special Problems or Issues

Special issues facing forestry BMPs, regulations, and NPS control programs within Georgia derive from public concerns with the environment (79). An increasing number of environmental groups within the state are becoming aware of BMPs and recommending they become law. New county ordinances, public concerns with wetlands and highly erodible lands, new SCS requirements of landowners, and recently passed "growth strategies legislation" which established the state's new Rules for Environmental Planning Criteria (68) have all heightened environmental awareness and expectations within the state, and increased public support for regulatory approaches to silvicultural NPS control programs (11).

VII STATE REPORT FOR LOUISIANA

A. Program Overview

The Louisiana Department of Environmental Quality (LDEQ) has been designated as the lead agency responsible for assessing and managing NPS pollution within the state and for meeting the state's responsibilities under relevant federal water quality legislation including Section 319 of the Clean Water Act of 1987. Responsibility for controlling NPS pollution resulting from agriculture and silviculture has in turn been delegated to the Louisiana Department of Agriculture and Forestry (LAF); the LAF's Office of Forestry manages the silviculture NPS control program designed to reduce NPS pollution from forest management operations.

The LDEQ manages NPS pollution problems which result from silviculture and other sources pursuant to the Louisiana Water Control Law. In the case of silviculture, the LDEQ manages a limited regulatory program: it manages and coordinates the overall program, and is authorized to investigate and regulate NPS pollution problems from silvicultural operations on a complaint basis. It may initiate enforcement actions and levy civil penalties of up to $25,000 per day. However, although such regulatory actions are authorized, they have not yet been directed against forestry, and silvicultural operations are specifically exempted from any permitting requirements (9, 11, 80).

The LAF has recently developed and currently manages a voluntary program of BMP formulation and promotion for the control of NPS pollution from forest management operations (80, 81, 82). The entire program is focused on improving the rate and success of BMP implementation throughout the state. The LAF works with others in the state, including the Louisiana Forestry

Association (LFA), Louisiana Association of Consulting Foresters, USDA-SCS, and USDA-FS to develop, disseminate, evaluate, and revise forestry BMPs. The LAF also maintains an active education and training program involving publication and distribution of the BMP manual, production of videos on BMP implementation and importance, and BMP training sessions. The LAF provides technical assistance to members of the forestry community, recommends incorporating logging performance standards into silvicultural contracts (11), and has designed a biennial BMP implementation survey program and completed its first survey. The forestry NPS control program includes a forestry demonstration project component, with the initial project being a research study of the effectiveness of SMZs in reducing NPS pollution following forest harvest. The LAF and LDEQ will jointly evaluate program success and accomplishments and implement needed program enhancements.

Thus, Louisiana has a non-regulatory program for silvicultural NPS control, backed up by authority (which is not currently invoked) for a limited regulatory program for violators, and the authority to make the entire program regulatory if current voluntary approaches are not effective in protecting water quality.

B. Water Quality and NPS Control Statutes and Regulations Relevant to Forest Management

The primary statute pertaining to control of NPS pollution is the Louisiana Water Control Law (7, 9, 83). This Law establishes the LDEQ, and the Office of Water Resources, as the lead agency for controlling NPS pollution problems within the state. The Office of Water Resources is empowered to develop general water protection plans for the state and to regulate and restrain the discharge of pollutants. The LDEQ is authorized to develop a NPS management program, to establish water quality standards and guidelines, to promulgate rules and regulations, to issue permits to control water pollution, to initiate civil liability actions, and to levy civil penalties of up to $25,000 per day (or up to $50,000 per day for failure to take action after issuance of a compliance order). The Law also includes a mandatory provision prohibiting those engaged in logging operations from leaving trees or tops in navigable waters of the state. The Law is broad enough to cover NPS pollution, including that resulting from forest management operations, at the discretion of the Department. However, the administrative requirements and regulations associated with the statute specifically exempt silviculture from the pollution permitting requirements, and the Law has not yet been directed against forestry (9, 11).

The Louisiana State and Local Coastal Resource Management Act (7, 9, 84) states that permits are not required for silvicultural activities in coastal areas so long as conventional practices are employed.

The Louisiana Natural and Scenic River System Act (7, 9, 80, 85) permits only selective cutting within 100 feet of the ordinary low water mark of scenic rivers. The only exceptions are cutting to control insect and disease problems and for the personal, non-commercial use of timber by the landowner. In any case, the LAF must be notified of the operation and the owner/operator must remove tree tops from the scenic river.

C. State 319 Assessment Report

The Louisiana Nonpoint Source (Section 319) Assessment Report was completed and submitted to EPA in August 1992 (86). Primary work on the Report was completed by the LDEQ, with assistance from a large number of other agencies and organizations including the LAF and USDA-FS for silviculture components. The Assessment was based on both evaluative studies and monitoring studies designed for NPS pollution. The latter came largely from the Louisiana surface water quality monitoring network, which has been in place since the 1950's. The former was provided by LDEQ Water Pollution Control Division field staff in each of the regional offices, based on best professional judgment, working knowledge of the waterbodies in their assigned division, complaint and fish kill investigations, facility inspections, short-term intensive surveys, ambient data collection, and special knowledge of point and nonpoint sources, land use patterns, studies of other agencies, and "fishing success stories."

Results of this Assessment were summarized by twelve major river basins within the state. No summary, statewide statistics ranking NPS impacts by designated uses impacted, primary causes of impact, or key categories of NPS impact (including silviculture) were provided, nor was it possible to calculate such statistics from the data and information provided in the Assessment Report. Thus, it is not possible to compare silviculture with other categories of NPS impact in terms of relative importance. In each of the river basin summaries, the Report did list all waterbodies impaired by NPS pollution, along with suspected cause and source of NPS pollution. Careful inspection of the tables revealed that, although silviculture was listed as a source of NPS impairment in nine of the twelve river basins in the state, the frequency with which it was listed was substantially less than for a number of other sources (e.g., agriculture, industrial, urban runoff, spills, petroleum activities, hydromodification, saltwater intrusion, wastewater). Thus, although it can be stated qualitatively that silvicultural activities are a relatively minor cause of NPS impacts to surface

waters in Louisiana, an exact quantitative comparison of silviculture with other NPS categories cannot be provided based on the Assessment Report.

The 1992 Water Quality Inventory [305(b)] Report estimated that silviculture impaired water quality in 9% of the state's river miles, 9% of the lake acreage, 0% of estuaries, and 2% of wetland acres (82). Major categories of river impairment were agriculture (31%), resource extraction (16%), hydromodification (12%), urban run-off (11%), and construction (3%). Comparable values for lakes were agriculture (27%), resource extraction (21%), hydromodification (11%), urban run-off (10%), and construction (1%); for estuaries, resource extraction (39%), agriculture (14%), urban run-off and hydromodification (13% each), and construction (1%); and for wetlands, agriculture (35%), hydromodification (25%), resource extraction (19%), and construction (10%). Thus, silviculture ranked fifth, fifth, sixth, and fifth out of six NPS categories in terms of impairment of rivers, lakes, estuaries, and wetlands, respectively.

D. State 319 Management Plan

The Louisiana Nonpoint Source (Section 319) Management Program Plan was also completed and submitted to EPA in August 1992 (82). The LDEQ was the lead agency for preparation of this Program, with assistance from a number of other state and federal agencies including LAF and USDA-FS for silviculture components. The Nonpoint Source Management Program is one component of the state's Water Quality Management Plan; its purpose is to describe the strategy the state has taken for implementing the Program. The state's Management Program is based on a comprehensive, integrated approach involving coordination of implementation activities of the various state and federal agencies participating in the program through the actions of a NPS Interagency Committee managed through the LDEQ. The Program Plan contains a detailed Memorandum of Understanding (MOU) specifying the roles and responsibilities of each of the agencies cooperating in the Program, and describing the specific programs they will implement under the NPS Program.

The Forestry Section of the NPS Management Program discusses the importance of forests and forestry to the state, and reviews information on the potential contributions of forestry operations to NPS pollution. The silviculture NPS control program is based on cooperation among the LDEQ, LAF, and LFA. The NPS control program combines long-term educational programs and demonstration projects (directed at improving implementation of BMPs on forest lands and designed to provide information to forest landowners and forest operators on the water quality problems that result from silvicultural activities) and the recommended management practices for reducing and correcting identified problems. A Forestry BMP Committee was established to set the direction for

the silvicultural NPS control program, with members drawn from LAF, LDEQ, LFA, USDA-SCS, USDA-FS, Louisiana Association of Consulting Foresters, and forest industries. This section of the NPS Program lists the recommended forestry BMPs under the headings of Streamside Management Zone (SMZ), Permanent Access Roads and their Construction, Timber Harvesting, Reforestation, Fire Line Construction, and Forest Chemicals, and outlines the purposes, goals, and milestones of the recommended forestry demonstration project and forestry educational program.

The purpose of the forestry demonstration project is to evaluate the effectiveness of BMPs, especially SMZ presence, in reducing NPS pollutants from forestry operations. The project is a cooperative venture among LDEQ, LAF, LFA, USDA-FS, and the School of Forestry, Wildlife, and Fisheries at Louisiana State University (see section VII, K). Traditional water quality variables, benthic invertebrates, and fish are being sampled above and below 40-acre sites harvested with a modified seed tree cut with and without 100-foot streamside buffer zones. The goal of this project is to gather quantitative data on the effectiveness of SMZs in reducing sediments, nutrients, organic matter, and other pollutants from forested lands. Results of the project will be incorporated into BMP revisions and forestry educational programs. The following tasks were specified for the demonstration project component of the silviculture NPS program for the period 1992-95: track and report results of initial demonstration project; work with USDA-FS, LAF, and LFA to incorporate BMPs into ongoing programs and activities; determine additional steps to be taken in demonstration projects, implementation projects, and educational programs to improve BMP implementation in areas of the state where water quality problems have been identified; and track progress in BMP implementation and accomplishments of the forestry NPS control program.

The purpose of the educational program component of the NPS Management Program is for the state and federal agencies (LDEQ, LAF, LFA, USDA-SCS, USDA-FS, and Louisiana Cooperative Extension Service) cooperating in the forestry NPS control program to work together toward implementation of forestry BMPs. The program is implemented through parish and district offices of the cooperating agencies, and is intended to focus activities in watersheds where silvicultural NPS problems have been identified. Two videos were produced which illustrate both proper implementation of each recommended BMP and the importance of industry taking the lead in BMP implementation if the overall program is to remain voluntary. A BMP manual was also published. These items have been used in statewide education and training sessions for landowners, commercial harvesters, loggers, and industry representatives. The LAF has also implemented a program to survey BMP implementation statewide. Results will be used to focus educational programs in areas that need to be targeted for improvements. The following tasks were specified for the

education component of the silviculture NPS program for the period 1992-95: develop an Interagency Agreement between LDEQ and LAF on specific tasks to be implemented; cooperate with LAF, LFA, and Cooperative Extension Service in educational programs; track the effectiveness of the educational program through the BMP implementation survey; report results of the implementation survey; and implement additional educational efforts as needed.

E. Forestry BMP Manual(s)

Forestry BMPs were established in Louisiana in 1988 during the 319 reporting process (81). The existing BMPs were developed by the LFA and published by the LAF with input and assistance from the Louisiana Association of Consulting Foresters, Louisiana Cooperative Extension Service, Louisiana Department of Wildlife and Fisheries, Louisiana Society of American Foresters, USDA-SCS, and USDA-FS. Presently only a single BMP manual is available and distributed by LAF (87).

The BMP manual contains a brief introduction focusing on the role of BMPs in controlling and reducing NPS pollution from forest-related activities. It presents recommended BMPs under the headings of Streamside Management Zones (SMZs), Permanent Access Roads and Their Construction, Timber Harvesting, Reforestation, Fire Line Construction, and Forest Chemicals. The manual concludes with a Glossary defining key terms. The manual also contains a number of helpful illustrations of recommended practices. Descriptions of recommended practices are fairly general, and the manual provides no tables or figures containing specific numerical criteria.

F. State Forest Practice Rules

Louisiana has not established formal forest practice rules.

G. Special Rules -- Wetlands, Cumulative Effects, or Groundwater

Beside the statutes cited earlier and the voluntary BMPs for forestry, Louisiana has no special rules for protection of wetlands, cumulative effects, or groundwater.

H. Program Changes Since 1980

The last NCASI review of silvicultural NPS control programs in the southern U.S. (18) revealed that, because existing 208 funding had been directed to other higher priority pollution control needs within the state, no progress had been made in establishing a silvicultural NPS control program in Louisiana. In his 1989 review of southern programs, Siegel noted that a NPS program had been initiated, but that BMPs had not been established and the program was constrained by severe budget and personnel limitations (10). Effectively, Louisiana's

silvicultural NPS control program as described in this section was initiated in 1988 during the 319 assessment and reporting process (81). Thus, the entire program summarized here has been developed since 1980.

I. Educational and Training Programs to Promote Compliance

Louisiana's new silvicultural NPS control program includes an active educational program which seeks to improve BMP implementation in the state by providing information and training on NPS pollution problems associated with forest management practices and recommended practices for correcting these problems (81, 82, 88). The program is a cooperative effort among LAF, LFA, LDEQ, USDA-SCS, USDA-FS, Louisiana Cooperative Extension Service, and Louisiana Department of Wildlife and Fisheries, implemented through their parish and district offices. The program is focused on those areas of the state where NPS problems have been identified. A BMP manual has been published and two videos have been produced, emphasizing both proper techniques for implementing established BMPs and the critical importance of forest industry taking the lead in BMP implementation if the program is to remain voluntary. These materials are used in free one-day training seminars held throughout the state for loggers, foresters, landowners and managers, commercial harvesters, and industry representatives. Success of these educational efforts will be evaluated based on results of the BMP implementation survey; additional programs will be implemented as needed, and targeted at areas where NPS problems exist and BMP implementation is low.

J. Compliance Survey Methods and Results

The LAF recently initiated a statewide procedure for evaluating BMP compliance, and completed its first compliance survey (81, 82, 89). This initial survey was completed through funding provided to Louisiana State University. Results and data from this survey are under analysis and a report is being prepared. In the future the survey will be repeated every two years. The objectives of LAF's compliance survey program are to: determine the percent implementation of BMPs in the state, determine BMP educational needs based on problems revealed by the survey, and determine the areas of the state where water quality is being adversely impacted by silvicultural practices.

For this first survey, sampling sites (i.e., sites where individual forestry operations were recently conducted) were selected by parish in a stratified random manner based on the reported 1990 pine sawtimber harvest levels. From 2-11 sites were selected per parish. The universe of possible sampling sites was initially identified from aerial observations; specific sites were selected to provide a cross-section of ownerships, forest types, and physiographic regions. The final selection of

sites within a parish was random. A total of 144 sites were surveyed in 1991.

Each site was visited on the ground and evaluated for BMP implementation based on a detailed field inspection and completion of a survey form designed for this purpose. The evaluation focused on numerous BMPs and specific practices related to SMZs, roads, timber harvest, site preparation, reforestation, fireline construction, stream crossings, skid trails, and surface water management. Additional data and information were recorded for each site based on topography, ownership class, presence of technical forestry assistance, operation type and size, and site type.

Data are still under analysis and detailed conclusions cannot be summarized. The overall rate of compliance revealed in this survey was about 51%. Although this figure is low in comparison with results of surveys in other southern states, it apparently reflects a substantial improvement compared with an earlier (1985) USDA-SCS survey which revealed <10% implementation of BMPs. The long-term goal of LAF based on their established education and training program is to achieve a compliance rate of 90% or better. Other information compiled by LAF suggests that forest landowners have responded well to increased emphases on NPS control in terms of improved compliance, but that loggers have not, and are thus a target of current education emphases. Most forest industries require BMP compliance on their lands; peer pressure among firms has apparently played an important role in establishing this situation (81).

K. Research on BMP Effectiveness

The LAF is currently cooperating in and sponsoring a major research study of BMP effectiveness, in collaboration with the LDEQ, EPA, and USDA-FS (5, 81, 82). The research is being conducted on the Kisatchie National Forest by Louisiana State University, Department of Fisheries and Wildlife; Dr. Fred Bryan is the relevant contact. Funding for the research is being provided by the USDA-FS (both Kisatchie National Forest and Southern Forest Experiment Station) and by the LDEQ through a Section 319 Grant from EPA. This research effort was specifically identified as a Demonstration Project under the silvicultural portion of the Nonpoint Source Management Program. The research is focused on evaluating the effectiveness of BMPs, especially SMZ presence, on water quality and aquatic organisms and communities. Sampling of stream water quality, fish, and benthic invertebrates is being conducted above and below harvest areas that do and do not contain an established SMZ.

No additional research on BMP effectiveness has been conducted or is in progress within the state. However, additional research on water quality impacts of forestry

practices as summarized in the state reports for Arkansas, Mississippi, and Texas also apply to portions of Louisiana.

L. Special Problems or Issues

Issues pertinent to implementation of the CZMA and wetlands have been prominent in discussions of silviculture NPS control within Louisiana (81). It is unlikely that any such issues will force a change from a voluntary to a regulatory program of NPS control for forest management operations. They are likely, however, to lead to further enhancements of education and training efforts within the state.

VIII STATE REPORT FOR MISSISSIPPI

A. Program Overview

The Mississippi Department of Environmental Quality (MDEQ), Bureau of Pollution Control, has been designated as the lead agency responsible for assessing and managing NPS pollution within the state and for meeting the state's responsibilities under relevant federal water quality legislation including Section 319 of the Clean Water Act of 1987. Responsibility for controlling NPS pollution from silviculture has in turn been delegated to the Mississippi Forestry Commission (MFC).

The MDEQ manages NPS pollution problems which result from silvicultural and other sources pursuant to the Mississippi Air and Water Pollution Control Act. In the case of silviculture, the Department manages a limited regulatory program -- it manages and coordinates the overall program and is authorized to investigate and regulate NPS pollution problems from silvicultural operations on a complaint basis. It may issue cease-and-desist orders and levy fines up to $25,000 per day. However, although such regulatory actions are authorized, they have not yet been invoked for silviculture (9, 90).

The MFC has recently developed and oversees a voluntary program of BMP formulation and promotion for the control of NPS pollution from forest management operations (91, 92). The MFC works with others in the state, including the Mississippi Forestry Association (MFA) and forest industry, to develop, evaluate, and disseminate forestry BMPs. The MFC maintains an active education and training program involving radio and TV presentations, newspaper and magazine articles, publication and distribution of BMP manuals and brochures, and BMP training sessions at workshops and meetings. The Commission also provides training to its own foresters, as well as technical assistance to landowners, loggers, and foresters in designing logging and forest management plans. The MFC provides technical and cost-

share assistance through the federal Forestry Incentive Program, Agriculture Conservation Program, Reforestation of Timberlands Act, and Cooperative Forest Management Program, and recommends incorporation of BMPs into logging contracts. In addition, the MFC is developing a program to monitor and evaluate rates of compliance with recommended BMPs.

Thus, Mississippi has a non-regulatory program for silvicultural NPS control, backed up by authority (which is not currently invoked) for a limited regulatory program for violators and the authority to make the entire program regulatory if current voluntary approaches are not effective in protecting water quality.

B. Water Quality and NPS Control Statutes and Regulations Relevant to Forest Management

The primary statute pertaining to control of NPS pollution is the Mississippi Air and Water Pollution Control Act (7, 9, 93). The Act establishes the MDEQ, Water Quality Management Section, Bureau of Pollution Control, as the lead agency for controlling NPS pollution problems within the state. The Act empowers the MDEQ to develop standards and programs to prevent, abate, and control water pollution. A separate permit board is authorized to issue permits for contaminated discharges. The MDEQ may issue cease-and-desist orders during emergencies, and levy fines up to $25,000 per day. The MDEQ's powers under this Act are broad enough to be applied to NPS pollution, including that resulting from silviculture, but the Act has not yet been directed against forestry operations.

A second relevant statute is the Mississippi Stream Obstruction Law (7, 9, 94). This Law prohibits felling trees or leaving logs greater than six inches in diameter or tree tops in any running stream.

C. State 319 Assessment Report

The Mississippi Nonpoint Source Pollution (Section 319) Assessment Report was completed and submitted to EPA in May 1989 (91). Primary work on the Report was performed by the Mississippi Department of Natural Resources (as MDEQ was then termed), Bureau of Pollution Control, with assistance from a number of other state and federal agencies including the USDA-FS and MFC for silviculture components. The Assessment of all waterbodies in the state was based on either monitoring data -- fixed station physical/chemical data, biological assessments, and analyses of fish tissue -- or evaluations of other factors such as land use, locations of pollution sources, or citizen complaints. Information was also solicited from a large number of state and federal agencies, interested groups, and citizens. Finally, water quality information gathered by the Bureau of

Pollution Control for the Section 305(b) Water Quality Report also contributed to this Assessment.

Results of the Assessment revealed that water quality conditions in Mississippi are generally good. Most waterbodies either meet all applicable water quality standards or fully support designated uses. Of the state's approximately 15,600 miles of rivers and streams, about 90% were found to fully support designated uses. The 10% of streams not fully supporting uses were impacted primarily by nutrients and siltation, and to a lesser degree by pesticides, priority organics, metals, chlorine, organic enrichment/DO depletion, and salinity. The primary source of these impacts was agriculture. Over 96% of the state's approximately 500,000 acres of lakes fully support designated uses, with the remainder partially supporting. The primary source of impacts was again found to be agriculture. Similarly, about 95% of the 133 miles of estuaries, 49% of the 81 miles of water adjacent to the coastline, and 68% of the tidal rivers were found to fully support designated uses. Little data were available to assess NPS impacts to groundwater and wetlands.

No summary, statewide statistics ranking NPS impacts by designated uses impacted, primary causes of impact, or key categories of NPS impact (including silviculture) were provided, nor was it apparent how to calculate such statistics from the data and information provided in the Assessment Report. Thus, it is not possible to compare silviculture with other categories of NPS impact in terms of relative importance. The Assessment Report did present detailed summaries of findings by river basin, including tables listing all waterbodies impaired by NPS pollution. Careful inspection of the tables revealed only a small number of waterbodies for which silviculture was listed as a category of impairment. Also, silviculture was identified as a potential impact in only four of the ten river basins analyzed. Thus, although it can be stated qualitatively that silvicultural activities are a relatively minor cause of NPS impacts to surface waters in Mississippi, an exact quantitative comparison of silviculture with other NPS categories cannot be provided based on the Assessment Report.

A companion "Silvicultural Water Quality Assessment 1989," prepared by the MFC, provides additional data on the relative NPS impacts associated with silviculture (95). This report was prepared in order to evaluate effects of silvicultural practices on water quality in Mississippi lakes and streams. The report provided an overview of current forestry practices in the state and their potential impacts on soil disturbance, erosion, and water quality; of current land use practices in Mississippi; and of the major soil resource areas in the state. The report also presents a detailed analysis and evaluation of erosion caused by silvicultural practices in Mississippi. Total soil loss from forestry activities was estimated as approximately 1.18M tons of

soil per year; this represents only about 1.6% of total soil loss from all NPS sources in the state. Soil loss estimates varied substantially by forestry practice, being highest associated with forest roads, skid trails, and disking operations. Similarly, soil loss varied greatly across the different physiographic regions of the state, being highest on loessial soils and in the upper and lower Coastal Plains. Although forestry operations represent only a small fraction of all NPS soil loss in the state, they can be locally significant and improvements in practices based on full implementation of BMPs are possible. The most severe practices relative to soil loss noted in this report were improper use of logging roads, logging decks, and skid trails.

D. State 319 Management Plan

The Mississippi Nonpoint Source Pollution (Section 319) Management Report was also completed and submitted to EPA in May 1989 (92). Primary work on the Management Report was performed by the Mississippi Department of Natural Resources (as MDEQ was then termed), Bureau of Pollution Control, with assistance from a number of other state and federal agencies including the USDA-FS and MFC for silviculture components. Mississippi's NPS Management Program presented in this Report is based on the state's identified Water Pollution Control Policy: "to conserve the waters of the state and protect, maintain and improve the quality thereof for public water supplies, for the propagation of wildlife, fish and aquatic life and for domestic, agricultural, industrial, recreational, and other legitimate beneficial uses, and to provide for the prevention, abatement and control of new or existing water pollution; and to cooperate with other agencies of the State, agencies of other States and the Federal Government in carrying out these objectives." The Report identified the MDEQ (then MDNR), Bureau of Pollution Control as the lead agency responsible for managing the state's NPS Control Program, and discussed the process for prioritizing waterbodies and program elements.

The silvicultural section of the Management Report summarized the results of the MFC's evaluation (95) of forestry soil loss as compared with total NPS soil loss -- i.e., 1.6% of the total -- and then listed the recommended forestry BMPs, developed by the MFC in cooperation with the MFA, under the headings of Streamside Management Zones (SMZs); Permanent Access Roads; Temporary Access Roads, Landings, Felling & Skidding; Reforestation; and Forest Chemicals. The Report noted that the silvicultural NPS control program was to be based on the dissemination of these BMPs to, and their voluntary implementation by, all entities involved in forestry activities in the state. The Report noted that MDEQ and MFC would be responsible for evaluating the effectiveness of BMPs (approach yet to be developed) and for implementing the proposed

silvicultural NPS plan. The Management Report also listed 41 streams believed to be impacted by silvicultural practices, and outlined a four-year action plan for controlling NPS pollution from silviculture. The overall goal of the plan was to "protect surface water and ground water quality from silviculture NPS pollution"; program components included:

1) Publish BMPs and distribute them to practicing foresters, loggers, and wood producers;

2) Train MFC foresters how to use BMPs in making forest management prescriptions, and in designing logging plans;

3) Develop and publish water quality articles in newspapers, magazines, radio, and TV;

4) Promote voluntary use of BMPs in forestry operations through meetings and workshops; and

5) With MDEQ, evaluate improvements and accomplishments by assessing use of BMPs and water quality change through a survey.

E. Forestry BMP Manual(s)

Forestry BMPs were not developed in Mississippi until 1989 as part of the 319 assessment and reporting process. BMPs were developed and published by the MFC in cooperation with the Environmental Affairs Committee of the MFA, the USDA-FS, and forest industry. BMPs are currently contained in three separate handbooks -- a shorter booklet of Silvicultural BMPs for Mississippi, a more detailed BMPs Handbook, and a manual of BMPs for Wetlands.

The booklet of Silvicultural BMPs for Mississippi was published by the MFC in 1989 following BMP development by MFA and approval by EPA and MDEQ (96). The booklet presents a short overview of NPS provisions in the Clean Water Act, of forestry in Mississippi, of the role of BMPs in NPS control, and of the potential impacts of silvicultural practices on water quality (sediment, organics, temperature, nutrients, and pesticides). Recommended BMPs are presented under the headings of Streamside Management Zones (SMZs); Permanent Access Roads; Temporary Access Roads, Landings, Felling & Skidding; Reforestation; and Pesticides. The booklet concludes with a discussion of silvicultural contributions to NPS soil loss in Mississippi and with a Glossary defining key terms. This information was abstracted and published from similar material contained in the "Silvicultural Water Quality Assessment 1989" (95). The booklet is fairly general and brief and contains no tables or figures with specific numerical criteria.

The more detailed BMP Handbook (97) was also published by MFC in 1989 following BMP development by the MFA Environmental Affairs Committee. The Handbook provides an overview of the Clean Water Act, NPS pollution, and the role of BMPs; of forestry and land resource areas in Mississippi; and of six general methods for controlling silvicultural NPS pollution (e.g., don't allow surface runoff directly into a waterbody, maintain the integrity of streambeds and banks, and do not leave debris in streambeds). Detailed Specifications for Individual BMPs are presented in seven main sections in the Handbook: Woodland Access Roads and Trails (Filter strips, Broad based drainage ditch, Water Bars, Culverts and bridges, Pipe Culverts, Fords, Outsloping, and Haul Road Construction Specifications and Use Recommendations); Site Preparation (Prescribed Burning, Mechanical, Chemical Treatments, and Surface Water Management); Tree Planting; Forest Harvesting (Access Roads and Trails, Regeneration, Filter Strips, Logging Debris, Machinery Maintenance, Landings and Concentration Yards, and Portable Sawmills and Sawdust); Revegetation of Critical Forest Areas (Site Preparation, Lime and Fertilizer Establishment Rates, Seedbed Preparation, Selection of Species, Seeding, Mulching, Management, and Maintenance); SCS Guidelines for Grass or Small Grain Cover for Disturbed Areas (Seedbed Preparation, Lime and Fertilizer, Planting, Mulching, and How to Calculate Seed and Fertilizer Needs for Roads and Disturbed Areas); and Filter Strips (Strip Width, Establishment, Type of Vegetation, and Management). The Handbook concludes with recommendations concerning the suitability of perennial grasses and legumes for revegetation, and mixtures and seeding rates for temporary and permanent seedings; and with a discussion of the development of NPS Management Plan Guidelines and forest management plans and of the cost of implementing BMPs. Overall this Handbook is quite detailed and presents numerous tables, figures, and illustrations containing specific numerical criteria and recommendations. The BMPs contained herein are also summarized in an attractive brochure prepared by the MFC (98).

The BMP manual for operations in wetlands (99) was published by the MFC in 1991 based on input and recommendations from the MFA Environmental Affairs Committee - Wetlands Task Force, USDA-FS, and private industry. The wetland BMPs contained in this manual are intended to supplement those contained in the general BMP Handbook, and to meet or exceed the requirements set forth in Section 404 of the Clean Water Act. The manual contains an introduction to the functions and values of wetland forests and to the concerns that exist with regard to their management. It also presents a detailed discussion of the various approaches taken by EPA, the Corps of Engineers, and the Fish & Wildlife Service to define wetlands relative to pertinent federal legislation and discusses the hydrology of wetland forests focused on Alluvial Rivers, Blackwater Rivers, and Bogs and Bog-Fed Streams. Silvicultural Techniques for Wetlands Regeneration

are presented in a lengthy section containing specific recommendation for Natural Regeneration of Bottomland Hardwoods (When to Regenerate and Regeneration Systems - Clearcut, Shelterwood, Two-Age Stand Regeneration, Group Selection, Single-Tree Selection, Regeneration Methods by Site Type, BMPs for Regeneration Cut, and Regeneration Assessment); Artificial Regeneration of Bottomland (Site Evaluation Considerations - Water, pH, Site Preparation, Planting Stock, Trees/Acre, Species Mix, and Post Planting Weed Control; Acorn Direct Seeding; Site Selection; Seed Collection and Storage; Time of Seeding; Depth of Seeding; Method of Sowing; and Spacing); and Regeneration of Other Desirable Wetland Species (Site Preparation). Recommended BMPs are presented under the headings of Harvesting (Planning Operations, Selecting the Harvesting System, Scheduling Harvest, Supervision of Harvest Operations, and Recommended Practices for Harvesting Operations); Logging/Access Roads (Recommended Practices for Road Construction); and SMZs (Wildlife Aspects of SMZs and Determining SMZs). A series of Miscellaneous Management Options for wetland forests are presented in a separate section, including Precommercial Thinning (Hardwoods), Thinning (Hardwoods), Single Tree Selection, Fire, Timber Stand Improvement, and Wildlife Enhancement for Other Desirable Wetland Species. The final two sections discuss Wildlife Habitat in wetland forests (Harvesting with Specific Wildlife Objectives, Snags, SMZs for Specific Wildlife Needs, Roads and Logging Areas for Wildlife, and Protecting Sensitive Wildlife Resources), and the descriptions of forested wetland types employed in this manual under several broad site classes (Flowing Water and Mineral Soil, Flowing Water with Organic Soil, and Still Water with Mineral Soils). The manual concludes with a listing of References and Suggested Readings. Mississippi's wetland BMP manual is written in considerable detail and contains many attractive illustrations, but contains fewer specific numerical criteria and recommendations than the general BMP Handbook.

F. State Forest Practice Rules

Mississippi has not established formal forest practice rules.

G. Special Rules -- Wetlands, Cumulative Effects, or Groundwater

Beside the statutes cited earlier and the voluntary BMPs for both uplands and wetlands, Mississippi has no special rules for protection of wetlands, cumulative effects, or groundwater.

H. Program Changes Since 1980

The last NCASI review of silvicultural NPS control programs in the southern U.S. (18) revealed that existing forestry practices were considered to be adequate to meet water quality goals within the state, and that no funds were available to establish a silvicultural NPS control program. As late as 1987

Siegel reported that no NPS program was in place and that no BMP manual had been published (11). Mississippi's silvicultural NPS control program was not established and initiated until after approval of the state's Nonpoint Source Pollution Management Program by EPA in 1989 (92). Thus, the entire program summarized in this section has been developed since 1980.

I. Educational and Training Programs to Promote Compliance

The MFC has developed an active program of public outreach, education, and training to inform landowners, members of the forestry community, and the public regarding the importance of NPS control and the proper use of BMPs (5, 92). The main components of their education and training efforts include publication of BMP guidelines and their distribution to practicing foresters, loggers, and wood producers; training MFC foresters in implementing and monitoring BMPs so they can provide technical assistance to members of the forestry community; development and publication of articles on water quality and NPS control for newspapers, magazines, radio, and TV; and promoting the use of BMPs in training workshops and meetings.

J. Compliance Survey Methods and Results

Mississippi has not yet completed a detailed statewide survey of compliance with forestry BMPs.

K. Research on BMP Effectiveness

The MFC is not currently cooperating in or sponsoring any research within the state on BMP effectiveness (90). However, considerable research has been conducted within the state on water quality and related impacts of forest management practices. Extensive research relevant to control of silvicultural NPS pollution has been conducted by the USDA-FS Forest Hydrology Laboratory (Oxford, MS). Some additional water quality-related research has been conducted by the Mississippi State University School of Forest Resources. In addition, research conducted by Auburn University and by the USDA-FS Research Work Unit at Auburn ("Control of undesirable vegetation in southern pine forests") also applies to forestry operations in Mississippi.

L. Special Problems or Issues

Discussions related to implementation of the CZMA and to the Chip Mill Permit issue in the neighboring state of Tennessee have stimulated interest in Mississippi. However, it is likely to be changes in legislation at the national level -- e.g., related to reauthorization of the Clean Water Act -- that have an impact on future changes in silvicultural NPS control programs in Mississippi rather than specific issues or environmental concerns within the state itself (90).

IX STATE REPORT FOR NORTH CAROLINA

A. Program Overview

The North Carolina Department of Environment, Health, and Natural Resources (NCDEHNR), Division of Environmental Management (NCDEM), has been designated as the lead agency responsible for assessing and managing NPS pollution within the state and for meeting the state's responsibilities under relevant federal water quality legislation including Section 319 of the Clean Water Act of 1987. Responsibility for controlling NPS pollution resulting from forest management operations has in turn been delegated to the NCDEHNR Division of Forest Resources (NCDFR). Responsibilities of each agency, and of the Division of Land Resources (NCDLR), in protecting surface waters of the state from degradation resulting from forestry operations and in meeting water quality standards according to designated uses as established by the Environmental Management Commission (EMC, 100), are spelled out in two Memoranda of Agreement (101, 102) and in a clarifying memorandum between DFR and DLR (103).

The NCDEM manages NPS pollution problems which result from silvicultural and other sources pursuant to the North Carolina Water and Air Resources Acts and the Sediment Pollution Control Act. In the case of silviculture, the NCDEM manages a regulatory program -- to retain the silvicultural exemption from the state's Sediment Pollution Control Act, forest owners and operators are required to follow BMPs or other acceptable practices in order to meet the performance standards (104) for water quality protection specified in the Forest Practices Guidelines (FPGs) Related to Water Quality (105). Failure to adhere to these performance standards (i.e., if BMPs are not in place and properly functioning to protect water quality on land at least one acre in size disturbed by forestry operations) will subject forest owners and operators to the full weight of the Sediment Pollution Control Act -- they must prepare, have approved, and adhere to an erosion and sedimentation control plan for their site. The NCDEM provides technical guidance to NCDFR related to the rules of the EMC and to the development of a NPS pollution control educational program, notifies DFR when potential violations of the FPGs are observed or reported, and investigates and takes appropriate regulatory action in those cases where DFR's mitigative actions have not been successful or are not possible (102). The DLR has primary responsibility for enforcing violations of the Sediment Pollution Control Act; it handles fines, stop work orders, and other legal aspects. The DEM is responsible for enforcement of problems pertaining to chemicals, oil, or turbidity, while the state Department of Agriculture, Board of Pesticides handles pesticide problems (106). Only violations of the water quality standards established by the EMC are reported to and investigated by the DEM. If warranted, NCDEM implements corrective actions

through formal enforcement actions. Penalties in such cases may be substantial -- i.e., up to $15,000 per day per violation (7, 9).

The NCDFR has primary responsibility for managing the regulatory program of silvicultural NPS control (102, 106). DFR is responsible for educating and training members of the forestry and logging communities and the general public regarding forestry BMPs and performance standards required for water quality protection as established in the Forest Practices Guidelines Related to Water Quality and explained in the BMP manual. DFR also inspects and evaluates sites for FPG performance standard compliance when preparing tree planting plans for private landowners; evaluates forestry operations believed to be in non-compliance with FPG performance standards based on DEM notification, citizen complaint, or employee observation; provides BMP guidance to responsible parties in such situations, and encourages them to perform mitigative and corrective actions; sends written notification to DEM when recommended mitigative and corrective actions have not been accomplished by the responsible parties; provides technical assistance to DEM during investigations of such violations; and provides testimony and statements if required during enforcement actions. The NCDFR also includes water quality protection practices in the professional management assistance and management plans it provides to forest landowners under its Landowner Assistance Program focused on small, private, non-industrial owners; incorporates water quality protection practices in the custom services offered to all landowners on a fee basis; promotes inclusion of BMPs in forest management plans prepared under its Forest Development Program; includes BMPs in management plans prepared for all state forest and related lands; establishes voluntary cooperative agreements with both industrial sector and private consulting foresters who agree to protect the timber base, and soil and water resources, by applying BMPs; and offers cost-share assistance and incentives for BMP implementation (i.e., approved plans require use of BMPs) through the Forestry Cost Share (Watershed Protection) Program and the ASCS Forestry Incentive Program (107).

Thus, North Carolina has a regulatory program for silvicultural NPS control, and the authority to make regulations even more stringent if current approaches are not effective in protecting water quality.

B. Water Quality and NPS Control Statutes and Regulations Relevant to Forest Management

The primary statute pertaining to control of NPS pollution is the North Carolina Water and Air Resources Acts, as amended (7, 9, 108). These Acts give broad powers to the NCDEM, working under authority of the Environmental Management Commission, over control of water pollution within the state, and authorizes DEM

to issue permits for pollutant discharges as well as orders directed at violators following a hearing. Although forest management operations are not specifically addressed in these Acts, sawdust and wood shavings are listed as potential pollutants. Nonpoint source pollutants are covered indirectly under the statute's definition of water pollution, which includes "alterations resulting from the concentration or increase of natural pollutants caused by man-related activities" (7,9). These Acts provide the basis for regulating NPS pollution resulting from silviculture.

A second key statute is the North Carolina Sediment Pollution Control Act (109), particularly as amended by "An Act to Limit the Forestry Exemption" (5, 106, 110). The original Act provided a blanket exemption to forestry from the provisions of this Act. The amendment, which was passed by the state legislature in 1989 and became effective in January 1990, established Forest Practices Guidelines Related to Water Quality (105) as performance standards for the protection of water quality during silvicultural operations, transformed North Carolina's program for controlling silvicultural NPS pollution from a voluntary to a regulatory program, and included forest land disturbing activities among the practices covered by the Act. No permit system or prior approval is required for forestry operations. But, if forestry BMPs or other appropriate practices are not in place on disturbed land and functioning properly to protect water quality, owners and operators are required to file and follow an approved sedimentation control plan if one acre or more of bare ground is exposed. The Act specifies heavy fines for violators.

Also relevant are the North Carolina Stream Obstruction Statutes (7, 9, 111). These statutes prohibit the felling of any tree, or the leaving of slash, stumpage, sawdust, or shavings, in such a way as to impede stream navigation or drainage.

C. State 319 Assessment Report

The North Carolina Nonpoint Source (Section 319) Assessment Report was completed and submitted to EPA in April 1989; a revised Report was prepared in December 1989 (112). Primary work on the Report was performed by the NCDEM (Water Quality Section, Water Quality Planning Group); assistance and input were obtained from a wide variety of groups within the state, including the NCDFR for silviculture components. The Assessment was based on site-specific monitoring data, both biological and chemical; evaluations based on other than current site-specific data including citizen complaints, best professional judgment, and input at 14 regional workshops conducted during the 319 process; and previous state water quality assessments conducted during 1985-87. Use of evaluated data allowed a much broader but less precise analysis of NPS pollution to be conducted. All data used

for this Assessment were entered into a spreadsheet data base according to the existing state Stream Classification System. This database will be continually updated with new data, modified data, and improved assessment methods. Gaps in the present assessment will be filled through ongoing state water quality programs.

Of the approximately 37,000 miles of streams and rivers in North Carolina, 11,069 miles (29.9%) were assessed as not supporting or only partially supporting designated uses. About 11.5% of these miles were impacted by point sources and 93.4% by nonpoint sources. Major sources of stream degradation were agriculture (67.1%), unknown (15.1%), urban runoff (14.7%), construction (11.9%), hydrologic modification (4.5%), land disposal (4.2%), forestry (2.7%), other (2.3%), and mining (2.1%). Major causes of degradation were sediment (56.9%), undifferentiated (24.4%), and multiple causes (13.5%).

Of the total of 305,367 acres of significant, publicly accessible lakes within the state, 11,897 acres (3.9%) were assessed as not supporting or only partially supporting designated uses. Point and nonpoint sources impact 97.3% and 95.6% of these degraded acres, respectively. Major sources of lake degradation were undifferentiated (22.0%), agriculture (17.3%), urban runoff (17.3%), construction (17.2%), landfills (16.0%), and forestry (3.8%). Major causes of degradation were aquatic macrophytes (41.9%), sediment (32.7%), and nutrients (23.7%). An additional 50,330 acres (16.5%) of lakes were rated as threatened.

Of over 2.0M acres of estuaries and sounds in North Carolina, 108,654 acres (5.4%) were assessed as not supporting or partially supporting designated uses. Forestry was not listed as a source of any of this degradation. About 27.8% of degraded systems were impacted by point sources, and about 72.2% by nonpoint sources. Major sources of degradation were agriculture (60.8%), septic tanks (4.7%), and urban runoff (4.4%). Major causes were chlorophyll a (46.7%), multiple (especially sediment and chlorophyll a) (34.9%), and fecal coliforms (15.4%).

The report also presented detailed summaries of NPS pollution by region (e.g., forestry was a slightly more significant cause of degradation in Mountains and Piedmont than in Coastal Plain) and by river basin.

D. State 319 Management Plan

The North Carolina Nonpoint Source (Section 319) Management Program Plan was also completed and submitted to EPA in April 1989; a revised Plan was prepared in December 1989 (107). The Program Plan was prepared by the NCDEM, with assistance from many other agencies and organizations in the state (e.g., NCDFR for

the silviculture component). This Program emphasizes management strategies and programs designed to address NPS problems identified in the companion NPS Assessment Report. Both land-use control and BMPs were presented as tools for controlling specific categories of NPS pollution and for protecting designated uses of waterbodies. The specific goals of the NPS Control Program included: 1) continue to build and improve existing programs; 2) develop new programs that control NPS pollution not addressed by existing programs; 3) target specific geographic areas and waterbodies for protection; 4) integrate the NPS Management Program with other state programs; and 5) monitor the effectiveness of BMPs and management strategies for both surface and groundwater quality. The Program was intended to balance two related priorities: statewide implementation of the overall NPS control program, including regulations, technical and financial assistance, and educational efforts, with targeting individual watersheds, both to improve degraded water quality and to minimize NPS impacts to high quality waters. The Program Plan listed the designated state NPS management agencies (e.g., NCDEM for overall water quality, NCDFR for forestry), and noted the establishment of a permanently staffed NPS Planning Group to coordinate Program planning and the work of the cooperating state agencies, to evaluate the overall effectiveness of the Program, to prepare annual reports documenting water quality progress, and to make mid-course corrections to the Program.

The forestry section of the NPS Management Plan provided an overview of the economic importance of forestry to the state, and listed the potential water pollutants which may result from forestry activities (sediment, organic debris, thermal effects, forest chemicals). It also reviewed the data on forestry NPS impacts from the Assessment Report, suggested that forestry activities can have severe localized impacts on stream water quality, especially in the North Carolina mountains, and noted that the estimates of forestry impacts (which were among the lowest of all categories included) may not be valid due to the limited amount of data available and to difficulties in distinguishing between agricultural and silvicultural activities in topographic map interpretations. The bulk of the section was devoted to describing the major components of the silvicultural NPS Management Program and enhancements needed in these components, which may be summarized as follows:

1) Forestry Cost-Share Program (Watershed Protection Program) -- program administered by NCDFR to protect the quality of soil and water resources in state-defined Nutrient Sensitive Waters (three specific watersheds in 16 counties with severe eutrophication problems) through use of accepted forestry BMPs. This Program will pay up to 75% of the costs of implementing BMPs, up to $3,000 per year per applicant. Needed enhancements in this Program component include

expanding the program statewide for all private, non-industrial forest owners; increased staffing and funding; and increased numbers of BMP training sessions and demonstrations for forest owners, contractors, and managers.

2) Cooperative Agreements -- established voluntarily with members of the forestry community, who indicate their willingness to protect the timber base and soil and water resources by encouraging and applying forestry BMPs. The Cooperating Forest Industry Agreement, which had been signed by 100% of large firms and 50% of mid-size firms, indicates that the industry acknowledges the need to reforest cut-over lands and protect soil and water resources by implementing BMPs. The Cooperating Consulting Forester Agreement, signed by about 65% of consulting foresters, encourages these individuals to adhere by plan, contract, and inspection to approved BMPs. The identified need is to expand the use of such Agreements.

3) Forest Operator Certification Program -- the NCDFR identified the need to develop, sponsor, and conduct a voluntary training program for forest operators and non-industrial forest owners and to recognize those operators that adhere to environmentally sound management practices.

4) North Carolina Stream Obstruction Act -- the Plan identified the need for stronger enforcement of this Act, which prohibits felling of trees and depositing of debris in streams where such actions would impede natural drainage. NCDFR personnel currently enforce this Act and take corrective actions in response to citizen complaints and when violations are observed during routine work with landowners and operators.

5) Forest Development Program -- through participation in the planning stages of this program, designed to provide cost-sharing incentives for commercial timber growth, the NCDFR promotes the inclusion of BMPs in required forest management plans.

6) Custom Forestry Services -- the NCDFR incorporates water quality protection practices into the custom services it offers to forest landowners on a fee basis.

7) Landowner Assistance Program -- the NCDFR includes water quality protection measures in the professional forest management assistance and written management plans it provides without charge to all forest landowners under this program, which is especially

tailored to the needs of small, private, non-industrial owners.

8) Forestry Education Program -- information and educational assistance is offered to the forestry community both through the state forestry extension service and by the NCDFR, including on-site demonstrations, group meetings, brochures, limited individual assistance, and mass media approaches.

9) Management of State-Owned Forest Land -- the NCDFR directs silvicultural operations on forest lands under its control and on lands controlled by certain other state agencies. Management plans prepared by professional foresters specify practices including BMPs which must be followed during forestry operations on these lands.

10) Forestry Incentive Program -- this ASCS program provides cost sharing assistance to private owners of eligible tracts of land for timber production. Assistance requires approved forest management plans, including BMPs and certain other conservation measures.

The forestry section of the Management Plan concluded by enumerating the newly identified "Forest Practices Guidelines Related to Water Quality," and by summarizing a four-year action plan designed to reduce and improve control of NPS pollution from silviculture in North Carolina. Full implementation of the ten tasks listed in the action plan was recognized as being contingent on additional funds being made available for the program. The specific tasks included in this plan, and the lead agency for each, are as follows: document the water quality benefits of the Forestry Cost Share (Watershed Protection) Program through monitoring targeted watersheds (NCDEM); expand the Cost Share Program statewide for private, non-industrial forest owners (NCDFR); seek funding to increase staff for Cost Share Program expansion (NCDFR); increase participation in Cooperative Agreements with both industrial sector and private consulting foresters (NCDFR); establish the Forest Operators Certification Program (NCDFR); conduct water quality workshops during the Certification Program (NCDFR, NCDEM); develop BMPs for forested wetlands (NCDFR); develop a list of alternative chemicals that are as effective as currently used forest chemicals but environmentally safer (NCDFR, NCDEM); develop protection strategies for environmentally sensitive waters (NCDEM, NCDFR); and assist forest owners, install BMPs, and improve forest acres based on resources actually available to the program (NCDFR). Periodic evaluations of these ten program components (if fully funded) would provide a basis for assessing progress in reducing silvicultural NPS pollution, and for revising future program priorities based on progress to date.

E. Forestry BMP Manual(s)

Forestry BMPs were originally developed in North Carolina in the late 1970's as part of the state's Water Quality Management Plan (113). These BMPs were originally published as "Forest Practices Guidelines Related to Water Quality" under the direction of the North Carolina Forestry Council (114). The NCDFR currently maintains two BMP manuals, one for normal silvicultural activities on upland sites and a second one for operations in wetlands. Both manuals are viewed as containing specifications for a variety of management practices which may be used to meet the specific performance standards (104) set forth in the revised "Forest Practices Guidelines Related to Water Quality" (105). Forest owners, managers, and operators are required to adhere to these performance standards in order to retain the forestry exemption under the Sedimentation Pollution Control Act of 1973, as amended (109, 110). The Forest Practices Guidelines enumerate nine specific performance standards for forest management practices within North Carolina: 1) streamside management zone, to be established along intermittent and perennial streams and perennial waterbodies and of sufficient width to confine within the SMZ visible sediment resulting from accelerated erosion; 2) prohibition of debris entering streams and waterbodies, which may result in stream obstruction, flow impediment, or water quality degradation; 3) access road and skid trail stream crossings; 4) access road entrances; 5) prohibition of waste entering streams, waterbodies and groundwater, which would result in violations of water quality standards adopted by the Environmental Management Commission (100); 6) pesticide application; 7) fertilizer application; 8) stream temperature; and 9) rehabilitation of the project site, within 30 days of cessation of operations, to prevent stream water quality damage and to permanently stabilize SMZ areas and other areas that may directly contribute visible sediment to streams.

The existing BMP manual for silviculture was published in 1989 by the NCDFR, with assistance from the NCDEHNR Division of Land Resources, North Carolina State University Extension Forest Resources, USDA Forest Service, and an appointed Technical Advisory Committee (115). The manual contains an introduction to silvicultural NPS pollution in North Carolina, and to the purpose of BMPs relative to the state's Forest Practices Guidelines, as well as sections discussing the general impacts of forestry operations on water quality (sediment, temperature, chemical use, organic matter additions/oxygen depletion) and the relationships between runoff and erosion as influenced by key soil physical properties (e.g., soil texture, structure, porosity, and bulk density). This section concludes with a listing of factors that can be controlled during forestry operations in order to minimize erosion and sedimentation.

Recommended BMPs for forest management operations are presented in four broad areas within the BMP manual: Accessing and Harvesting Forest Products (Pre-Harvest Planning; Streamside Management Zone; Access Roads; Water Turnouts; Log Decks, Landings, and Portable Sawmill Locations; Skid Trails; Stream Crossings; Cross Road Drainage; Broad Based Drainage Dip; Rolling Dip; and Water Bars); Site Preparation and Reforestation (Reforestation/Regeneration Plan, Prescribed Burning, Drum Chopping, Disking, Bulldozing, Bedding, Furrowing and Scalping, Hand Tools and Equipment, Machine Planting, Pesticides, and Forest Fertilization); Revegetating Disturbed Areas (Seedbed Preparation, Lime and Fertilizer, Permanent Seeding, Mulching, Anchoring Organic Mulch, Maintenance, Permanent Seeding Mixtures, Temporary Seeding and Seeding Mixtures, and How to Calculate Seed and Fertilizer Needs for Roads and Disturbed Areas); and Wildfire Protection. Each individual BMP listed above is discussed in detail in four subsections: Definition and Purpose, Conditions Where Applies, Specifications, and Maintenance. The manual is in a pleasing and easy to use format, and contains numerous tables, drawings, and illustrations that present specific numerical criteria. For example, SMZ widths are presented as a function of stream or waterbody type and percent slope. Considerable detail is presented on revegetation and seeding methods, with different recommendations for the different physiographic regions of the state (Mountains, Piedmont, Coastal Plain) and soil types. The manual concludes with a Glossary of key terms.

The wetlands BMP manual was published by the NCDEHNR-NCDFR with assistance from a wide variety of other organizations -- North Carolina Forestry Association, North Carolina Wildlife Resource Commission, North Carolina State University School of Forest Resources, USDA Forest Service, US Army Corps of Engineers, North Carolina Society of Consulting Foresters, The Nature Conservancy, and North Carolina Division of Soil and Water Conservation. The manual contains an introduction to the environmental values and functions of forested wetlands, and to the distinction between the general term, forested wetlands, and jurisdictional wetlands as defined under the Clean Water Act. A detailed classification of forested wetlands is also included in the manual, along with a description of the ten major forest wetland types identified for North Carolina in two broad groupings (Alluvial and Non-Alluvial), and a discussion of "exceptional wetland sites" within the state. Recommended BMPs for forested wetlands are presented under the headings of Road Construction and Maintenance (Types of Roads); Construction Guidelines (Permanent Roads, Temporary Roads, and Fill Roads); Stream Crossings and Other Erosion Prevention Measures; Harvesting and Logging Systems (General Recommendations, Harvest Regime, and Logging System; the latter two are broken out by forested wetland type); Regeneration/Reforestation, which presents Recommended Regeneration Practices (Natural, Artificial) by Wetland Type; Wetland Forestry and Wildlife Management, again

by wetland type; Streamside Management Zones, defined by minimum width of SMZ adjacent to perennial streams as a function of stream width and percent slope, and with Specific Operating Guidelines Within the SMZ; and Water Management. The BMPs recommended in this manual are much more general than in the primary BMP manual, and the manual itself contains almost no tables, figures, or specific numerical criteria. An Appendix to the manual contains Detailed Descriptions of Forested Wetlands in the state (Landscape Position, Hydrology, Vegetation, Soils, Examples, and Comments); definitions of quality management practices for forested wetlands (i.e., practices which protect site hydrologic function and productivity); specific Operating Guidelines for Water Management Systems (New Installation and Retrofit and Maintenance); and a Glossary of key terms. The manual concludes with a matrix comparing the several wetland classification systems for forested wetlands in use in five southern states (AL, FL, SC, NC, and VA).

F. State Forest Practice Rules

North Carolina has not established formal forest practice rules. However, establishment of a Forest Practices Act in the future is a possibility (106). Members of the state legislature are currently studying such an action, which is being encouraged by conservation and environmental groups across the state.

G. Special Rules -- Wetlands, Cumulative Effects, or Groundwater

Besides the statutes cited earlier, the BMPs for both uplands and wetlands, and the Forest Practices Guidelines Related to Water Quality, North Carolina does not have any special rules for the protection of wetlands, cumulative effects, or groundwater.

H. Program Changes Since 1980

Fundamental changes have occurred in North Carolina's silvicultural NPS control program since 1980. The entire program changed from a voluntary to a regulatory program associated with passage of the 1989 amendment to the state's Sedimentation Pollution Control Act (110), and its implementation in January 1990. Prior to 1989, forestry operations enjoyed blanket exemption from this Act, and the existing voluntary program focused on development and promotion of BMPs (e.g., 18). Currently, forest owners and operators must employ BMPs or other appropriate practices on their lands and comply with the performance standards established by the Forest Practices Guidelines Related to Water Quality in order to retain the forestry exemption. Failure to do so subjects owners and operators to the full weight of the amended Act. This has placed additional responsibilities on NCDFR in regards to conducting on-site inspections to ensure compliance with FPG performance

standards and to recommend appropriate corrective and mitigative measures when situations of non-compliance are discovered, and legal and enforcement requirements of DEM and DLR when mitigative measures are not effective or possible. During the first half of 1992, for example, 12% of sites evaluated by DFR required application of mitigative measures, and 1% were referred to DEM or DLR for formal enforcement actions (117). The change from a voluntary to a regulatory program has also resulted in greater emphasis being placed on education and training programs related to BMPs and water quality protection (5, 106). A revised BMP manual was published in 1989, and a new wetlands BMP manual in 1990. During 1993, DFR was scheduled to initiate a statewide survey of BMP implementation and effectiveness, contingent on receipt of Section 319 funding from EPA (106).

I. Educational and Training Programs to Promote Compliance

In their survey of silvicultural NPS control programs published in 1989, Cubbage et al. (11) identified North Carolina as maintaining one of the four most active education and training programs in the South. Since passage of the amendment to the state's Sedimentation Pollution Control Act in 1989, which transformed North Carolina's forestry NPS control program to a regulatory one, education and training in BMPs and water quality protection have received even greater stress and have become key program emphases (5, 106). Education and training programs are conducted by DFR and North Carolina State University Extension Forest Resources, individually and together. Current efforts include use of videos, brochures, a slide-tape program, on-site demonstrations of BMPs and water quality protection measures, group meetings, mass media education approaches, and limited individual assistance to specific forest landowners and operators (106, 107). The NCDFR also encourages inclusion of logging performance standards in silvicultural contracts (11).

J. Compliance Survey Methods and Results

North Carolina has not yet instituted a regular, recurring program to survey compliance in BMP implementation. A comprehensive survey of BMP implementation and effectiveness is scheduled for 1993, contingent on funds provided by EPA (106). In 1980 the NCDFR did conduct a baseline survey of forestry practices in order to determine the level of BMP use and to establish a baseline against which program success could be measured; a second survey was conducted in 1982 (18). About 5% of the sites initially surveyed were judged to have potential water quality problems. Staff of the NCDFR currently feel that (106) substantial forest protection measures have been established since 1990 by forest operators, especially major forest industries, but presently lack hard data to support this contention.

Currently, when evaluating sites for preparation of tree planting plans for private forest owners, the NCDFR also evaluates sites for compliance with North Carolina Forest Practices Guidelines (FPG). A summary of data for such compliance evaluations was available for 1990 through the first half of 1992 (117). During this period 1,880 sites were evaluated for FPG compliance; 1,442 of these sites were evaluated in the first two quarters of 1992. For these total sites, 514 notices (27.3%) of non-compliance were issued. As might be expected, since the current regulatory program was implemented at the start of 1990, rates of non-compliance were much higher for 1990-91 (78.1%) than for the first half of 1992 (11.9%). During the first half of 1992, 11.9% of sites evaluated required mitigative measures, and 0.97% were referred for formal enforcement action. All of the sites referred for enforcement action had problems with soil resulting from accelerated erosion entering streams. Although these figures are representative of the degree of compliance (and non-compliance) within the state, they cannot be taken as a true estimate of compliance rates. The sites were not selected based on any established or randomization procedure, and some fraction of the sites were evaluated specifically because of a citizen complaint.

K. Research on BMP Effectiveness

The NCDFR is not currently cooperating in or sponsoring any research within the state on BMP effectiveness. However, considerable research has been conducted within the state on water quality and related impacts of forest management practices. Extensive research conducted by the USDA-FS Coweeta Hydrologic Laboratory applies to both the Mountains and Piedmont of North Carolina. Drs. Wayne Swank and Lloyd Swift are appropriate contacts. Additional research has been conducted by both the North Carolina State University School of Forest Resources and the Duke University School of Forestry and Environment. This latter research applies to Piedmont and coastal regions, and includes research on both upland and wetland sites. The NCDFR will conduct an effectiveness survey in 1993.

L. Special Problems or Issues

Special issues driving future changes in forestry BMPs, regulations, and NPS control programs derive from strong public concerns with environmental issues (106). The state is involved with concerns over implementation of the Coastal Zone Management Act. However, it is general environmental concerns, especially focusing on wetland issues, mountain trout streams, water supply watersheds, and impacts of forest clearcutting on erosion and stream sedimentation and damage, that will drive future changes in forestry NPS control programs. Such concerns have already led to a change from a voluntary to a regulatory program, and are providing support for introduction of a Forest Practices Act in

the state legislature (106) and greater forestry regulation in the future (11).

X STATE REPORT FOR OKLAHOMA

A. Program Overview

The Oklahoma Department of Pollution Control (ODPC) has been designated as the lead agency responsible for assessing and managing NPS pollution within the state and for meeting the state's responsibilities under relevant federal water quality legislation including Section 319 of the Clean Water Act of 1987. Responsibility for controlling NPS pollution resulting from forest management operations has in turn been delegated to the Oklahoma Department of Agriculture, Forestry Services (ODAFS).

The ODPC manages NPS pollution problems which result from silvicultural and other sources pursuant to the Oklahoma Pollution Control Coordinating Act and the Pollution Remedies Law. In the case of silviculture, the Department manages a limited regulatory program: it manages and coordinates the overall program, and is authorized to investigate and regulate NPS pollution problems from silvicultural operations on a complaint basis, so long as those problems affect the property or water of another landowner. It may initiate civil actions and levy penalties of up to $10,000 (7, 9). Although such regulatory actions are authorized, they have not yet been applied to forestry (10). However, the underlying statutes are undergoing revision, and it is not clear at present whether ODPC will begin to impose regulatory controls on forest operators subsequent to findings of water quality standards violations (118).

The ODAFS has developed and currently manages a voluntary program of BMP formulation and promotion for the control of NPS pollution from forest management operations; the program was initiated in 1976 (118, 119, 120). The ODAFS works with others in the state, including the Oklahoma Forestry Association (OFA), Oklahoma State University Cooperative Extension Service and Department of Forestry, USDA-FS, and forest industry, to develop, evaluate, revise, and disseminate forestry BMPs. The ODAFS maintains an active education and training program, including training programs and information (videos, slide programs, fact sheets, field guides, workshops, and seminars) to inform members of the forestry community concerning effective management approaches for water quality protection; a public education effort designed to educate and inform the general public about forest water quality problems, issues, and management approaches; and field demonstrations of practices for water quality protection. The ODAFS also provides technical and cost-share assistance to landowners for properly implementing water quality

management practices through development of management plans that include BMP application. These services are delivered through the ODAFS's fifteen district offices, and are targeted differently at industrial and small non-industrial forest owners and operators. The ODAFS recommends inclusion of logging performance standards related to water quality protection in silvicultural contracts (11, 120), and administers the Forest Stewardship Program through which eligible landowners prepare Stewardship Forest Plans containing water quality protection measures. The ODAFS has developed a variety of approaches for evaluating the effectiveness of the NPS control program, including research and monitoring studies designed to evaluate the effectiveness of BMPs and management systems, a new program for monitoring BMP compliance (121), and other measures of program effectiveness. In addition, the Department has sponsored and cooperated in research and development projects designed to establish causes of and trends in forestry NPS pollution, to refine and evaluate BMP effectiveness, and to develop improved program evaluation criteria. Finally, the ODAFS coordinates the silvicultural NPS control program with other state and federal agencies and water quality programs, and integrates NPS control into its regular management practices and programs.

Thus, Oklahoma has a non-regulatory program for silvicultural NPS control, backed up by authority (which is not currently invoked, but which may be in the future) for a limited regulatory program for violators, and the authority to make the entire program regulatory if current voluntary approaches are not effective in protecting water quality.

B. Water Quality and NPS Control Statutes and Regulations Relevant to Forest Management

The primary statutes pertaining to control of NPS pollution are the Oklahoma Pollution Control Coordinating Act (7, 9, 122) and the Oklahoma Pollution Remedies Law (7, 9, 123). These statutes designate the Water Resources Board, acting under authority of the Pollution Control Coordinating Board, as the lead entity for administering water pollution control programs within the state. The ODPC is given executive authority over all state agencies administering pollution control programs. These statutes define pollution broadly, to include all substances potentially injurious to "aesthetic sensibilities." However, the statutes do not apply to waters entirely within one ownership unless pollution is found to affect another's property or water. While these statutes are broad enough to give the Department authority over NPS pollution, they have not yet been applied against forestry operations (10).

The relevant pollution control statutes for Oklahoma have recently undergone revision, and further revisions are underway (118). While authority to manage the silvicultural NPS control

program is still clearly delegated to ODAFS, this authority is subject to potential regulatory control by the ODPC and Pollution Control Coordinating Board. The degree to which ODPC will impose additional restrictions and regulatory controls on forest management operations subsequent to findings of water quality standards violations is not presently clear. Such actions seem especially likely in the Illinois River Basin in northeast Oklahoma (118) (see section X, L).

C. State 319 Assessment Report

The Oklahoma Nonpoint Source (Section 319) Assessment Report was completed and submitted to EPA in Fall 1988 (124). Primary work on the Report was performed by the ODPC, with input and assistance from 22 other state and federal agencies including ODAFS for the silvicultural component. Data and information for the Assessment were drawn from the Oklahoma Conservation Commission Statewide Highflow Monitoring Program, the Oklahoma State Health Department Ambient Trend Monitoring Program, other monitoring programs focused on lake water quality data, results from special studies and site-specific observations conducted by various agencies, other information provided by cooperating agencies (COE, Substate Planning Districts, Scenic River Commission), and best professional judgment. Data and information were available to assess about 50% of the river miles and lake acres in the state. The Report discussed current data gaps, provided additional information pertinent to groundwater and water-demanding threatened and endangered species, and presented the state's strategy for targeting waterbodies identified as impaired by the Assessment.

Assessment data and results were summarized by major hydrologic planning basins as defined in the Oklahoma Comprehensive Water Quality Management Plan. No statewide summary statistics ranking NPS impacts by designated uses impaired or primary causes of impact were presented. The Report did, however, provide a comparative ranking of major categories of NPS impact, based on number of waterbodies impaired rather than river miles or lake acres, as follows: agriculture (58%), urban (18%), miscellaneous (14%), rural roads (10%), refinery (8%), hydrostructures (5%), oilfield waste (5%), mining (5%), and silviculture (1%). Actual silvicultural impairments were noted in only a single watershed in the state; silviculture was listed as a NPS concern in only two of the state's seven hydrologic basins.

D. State 319 Management Plan

The main portion of the Oklahoma Nonpoint Source (Section 319) Management Plan, including the agricultural component, was completed and submitted to EPA in May 1990; the silvicultural component was submitted in April 1991 (119). Primary work on the

Plan was again performed by ODPC with assistance and input from 22 state and federal agencies including ODAFS for silviculture. The Plan provided the overall framework for the NPS Management Program, viewed as an extension of the state's Section 208 Comprehensive Water Quality Management Plan. It also identified the ODPC (the executive arm of the Pollution Control Coordinating Board) as the lead administrative agency for NPS management in the state, and the Oklahoma Conservation Commission as the lead technical contact for NPS problems. It also identified the ODAFS as the lead agency for all aspects of the silvicultural NPS control component (enforcement, technical assistance & control, training & education; but see section X, B regarding recent modifications in pertinent statutes).

The silvicultural component of the NPS Management Plan is an adaptation of the Oklahoma Section 208 Statewide Water Quality Management Strategy for Forestry produced by ODAFS in October 1984 and updated in July 1988; this Forestry Strategy was included in the state's Section 208 Comprehensive Water Quality Management Plan. The Forestry Strategy contains greater detail than the NPS Management Plan, and will continue to be used as the basic document for the overall NPS management program of ODAFS; future revisions of both documents will be coincident. The silvicultural NPS management plan clarifies terminology, discusses the overall framework and current emphases for the silvicultural plan, and designates the ODAFS as the lead agency for the forestry NPS management plan.

Part A of the Silvicultural Plan describes in considerable detail the current components of the forestry NPS program. Major program components include training and education programs that focus on training members of the forestry community on effective management approaches to water quality protection, public education related to water quality problems, issues, and management approaches, and demonstrations of water quality protection practices; landowner assistance in implementing effective water quality protection practices through management plans, technical assistance, and cost-share programs; evaluations of program effectiveness through water quality monitoring, studies of the effectiveness of water quality protection practices, and other measures of program effectiveness; research and development activities focused on BMPs, monitoring methods, and cost-share approaches to achieving program objectives; and coordination of program activities with other agencies and with other activities of the ODAFS.

Part B of the Silviculture Plan discusses proposed new or expanded activities in each of these program components:

1) training and education -- create new NPS management displays in state parks and forests, implement new demonstration sites/projects and associated

education/technology transfer activities, particularly focused on BMPs for gully control, streambank protection, application of poultry waste to forest land, industrial forest roads, and portable timber bridges;

2) landowner assistance -- incorporate NPS management advice in the state's new Forest Contractor Program, and survey firelines to evaluate the need for additional erosion control measures;

3) program effectiveness evaluation -- resume monitoring of headwater watersheds and BMPs and initiate survey of road practice needs;

4) research and development -- develop BMPs for forested wetlands, study streamside management practices, develop monitoring and evaluation system for BMP compliance monitoring program, and study public use of private forest roads; and

5) cooperative program activities -- reactivate the forestry NPS management advisory group, evaluate the feasibility of using forests to alleviate pollution in the Illinois River Basin and for application of animal (poultry) wastes, initiate Forest Stewardship Program, participate in state wetlands working group, and help organize regional workshops on BMP monitoring and effectiveness.

A proposed schedule and funding needs for the recommended program enhancements are also included.

Part C of the Plan provides additional details regarding water quality monitoring activities, while Part D presents detailed plans for proposed new forestry projects in targeted watersheds. Proposed watershed projects will include implementation of appropriate BMPs, road rehabilitation, and monitoring of water quality and practice effectiveness. A variety of other Supporting Elements are included in the Plan, including a brief discussion of existing BMPs (Item 5). BMPs are listed and discussed under the following headings: Management Systems and Management Unit Planning (Silvicultural Systems, Forest Management Compartment Planning, and Streamside Management); Forest Roads (Road Design and Location, Road Spacing, Construction, Road Drainage, Road Stream Crossings, Road Closure, and Road Maintenance); Timber Harvesting (Harvest Planning, Logging Practices, and Post-Harvest Practices); Forest Site Preparation (Chopping and Crushing, Disk-Harrowing, Bedding and Furrowing, Ripping, and Shearing and K-G Blading); Prescribed Burning (Burning Conditions and Firelines); Forest Chemicals (Mixing, Aerial Application, Ground Application, Limitations on

Application, Maintenance of Equipment, Container Disposal, and Equipment Clean-up); and Other Practices (Tree Planting, Deferred Grazing, Livestock Exclusion, Fencing, Fire-Line Practices, Check Dams, Brush Dams (Wattling), and Critical Area Tree Planting).

Several appendices provide additional supporting information pertinent to the Plan. Appendix A summarizes and synthesizes monitoring and research data pertinent to identification of NPS problems and measurement of NPS trends, with particular emphasis on transport of inorganic sediments and organic matter and inputs to surface waters. Appendix B presents the Southern Region State Forestry/Forest Service Action Plan for the Section 319 Plan, while Appendix C summarizes state programs pertinent to NPS control as excerpted from the State Forest Resource Plan. The silvicultural component of Oklahoma's NPS Management Plan is the most detailed and informative of all those reviewed in this project.

E. Forestry BMP Manual(s)

Forest water quality practice guidelines, or forestry BMPs, were initially developed in Oklahoma in 1976 (119, 120). Following a two-year evaluation program that included water quality monitoring studies, the voluntary guidelines were revised in 1982 and incorporated as a key section in the ODAFS Forest Manager's Guide for Water Quality Management in Oklahoma (120). This Field Guide was developed to present a stepwise procedure to assist forest managers in incorporating water quality considerations into forest management activities. The Guide itself was further revised in 1983 and 1985. This document provides background information on Oklahoma's Forest Water Quality Management Program, the relationship of forestry to NPS pollution, and the concept of BMPs. The five main sections in the Field Guide provide guidance to forest managers on determining landowner objectives, developing a site description, identifying alternative management systems and recommended practices, development and implementation of a management plan, and post-treatment evaluation of management practices.

The recommended forestry BMPs are included in the Guide as Appendix A, together with a Fire-Line Practices Supplement. These BMPs were designed to supplement technical BMPs on forest practices and road construction contained in the State Water Quality Management Plan. Following an initial discussion of the development and use of BMPs, recommended BMPs are presented under the headings of Streamside Management; Overall Management Compartment Planning; Forest Roads (Location, Spacing, Construction, Drainage, Water Crossings, and Maintenance); Harvesting (Landings, Cutting, Skidding Operations, and Disposal of Debris and Litter); Forest Site Preparation (Shearing and K-G Blading, Choppers and Brush Crushers, Disk-harrowing, Bedding and Furrowing, Ripping, and Site Drainage); and Forest Chemicals

(Maintenance of Equipment, Mixing, Aerial Application, Ground Application, Limitations on Application, Container Disposal, and Equipment Clean-Up). Two Appendices present Definitions of key terms and a discussion of Major Water Quality Influences of forestry operations (sediment, nutrients, organics, pesticides, and temperature). The BMPs are presented in a fairly general manner, without any tables, figures, or illustrations containing specific numerical criteria.

Additional appendices to the Field Guide contain detailed Technical Guidelines for small private forest roads, vegetation establishment on critical areas, and roadside erosion control with vegetation; sample forest management plans, including water quality management practices; a sample timber sale contract, including provisions for minimizing harvesting impacts on water quality; a summary of other references and educational resources; a discussion of technical assistance available from ODAFS; and a copy of Oklahoma's Statewide Water Quality Management Strategy for Forestry.

The ODAFS, in cooperation with Oklahoma State University Cooperative Extension Service, recently released a pocket guide to forestry BMPs in the state (125). The guide, printed in a useful pocket-sized format so it can be taken to the field, uses lists, tables, and figures to describe current BMPs for application during road construction and harvesting operations. The guide can also be used by landowners in the design of forest management plans and timber sales. Funding was provided by the Oklahoma Forest Stewardship Program, Renewable Resources Extension Act, Weyerhaeuser Foundation, and USDA Extension Service Water Quality Initiative.

Development of a separate BMP manual for operations in forested wetlands has been proposed (119).

F. State Forest Practice Rules

Oklahoma has not established formal forest practice rules.

G. Special Rules -- Wetlands, Cumulative Effects, or Groundwater

Beside the statutes cited earlier and the voluntary BMPs for forestry, Oklahoma has no special rules for protection of wetlands, cumulative effects, or groundwater.

H. Program Changes Since 1980

The last NCASI survey of silvicultural NPS control programs in the southern U.S. (18) revealed that ODAFS had a viable program in place (since 1976) based on the voluntary application of accepted management practices on a site-specific basis. This program was based on monitoring water quality in areas of

forestry activity; technical assistance regarding selection and application of effective water quality management practices; training programs for forest landowners, operators, and managers; use of water quality information and education materials for the general public; monitoring and evaluation of the effectiveness of water quality protection practices and the NPS control program; research and development; program coordination with other agencies and water quality activities; and training of ODAFS staff in water quality protection practices. Major program accomplishments were listed as expansion of the forestry water quality database, approval of revised BMPs, and cooperation from forest industry in monitoring, research, and BMP development and implementation. Field tests of road construction, harvesting, and regeneration practices were planned, along with monitoring of BMPs, the first since 1977.

Miller (118) reported that major changes since 1980 have largely involved changes in program emphasis, from the early emphasis on monitoring and studies to identify NPS problems and evaluate program and practice effectiveness, to a greater focus on BMP implementation and technology transfer. The ODAFS has enhanced its education and training program and developed a new video on logging and water quality, fact sheets, and expanded field demonstrations. A Field Guide for forest managers was developed and revised, including the current BMPs which were also revised. A new BMP compliance monitoring program has been designed and implemented, and the ODAFS has implemented the Forest Stewardship Program in the state.

I. Educational and Training Programs to Promote Compliance

The ODAFS maintains an active program of public outreach, education, and training to inform landowners, forestry practitioners, and the general public concerning the importance of NPS control programs and proper methods for implementing water quality protection practices or BMPs (119). Existing education and training efforts were recently enhanced as part of the 319 reporting process. ODAFS's program of education and training consists of three main components.

In the area of Water Quality Management Training, ODAFS prepares and implements training programs and related information to inform forest landowners, contractors, loggers, and forest managers on effective management practices for water quality protection. The existing program includes use of demonstration sites for training, two-day forestry water quality seminars for managers, BMP workshops for forest managers, workshops on application of the USLE, workshops on herbicide use, a slide program on BMPs, preparation and distribution of a Field Guide for forest managers on water quality protection (120), and development of a video on logging and water quality in cooperation with Oklahoma State University Cooperative Extension

Service. Proposed program enhancements in this area include improvement and revision of BMPs and the Field Guide, inclusion of educational and technology transfer activities in planned new demonstration sites, and expansion of the program to contact and educate landowners.

In the area of Public Education, ODAFS attempts to maintain an effective, comprehensive, statewide program to provide information to the general public on water quality problems, issues, and management approaches pertinent to forestry. This portion of the program includes slide programs and demonstrations for use with youth groups, and implementation of Project Learning Tree teacher training. New elements will include development of new educational aids for use by state agency personnel involved with water quality protection.

In the third program area, the ODAFS develops and operates Demonstration Areas to provide examples of water quality protection in forestry operations. Such Demonstration Areas have been established where possible on targeted watersheds and other available sites. New demonstrations are planned related to application of poultry waste to forest land, industrial forest road BMPs, use of portable bridges, use of trees in gully control and streambank stabilization, and rehabilitation of low-standard roads on small private ownerships. Such demonstrations will include both evaluations of practice effectiveness and educational and technology transfer with videos, fact sheets, and field demonstrations.

A final new educational effort will be associated with the newly initiated statewide BMP compliance monitoring program (121). Prior to identified logging operations, on both industrial and non-industrial sites, ODAFS/OFA foresters will conduct on-site educational sessions concerning proper use of BMPs tailored to the site to be harvested.

J. Compliance Survey Methods and Results

Although comprehensive statewide data are not presently available concerning compliance with established BMPs, some information has been gathered on rates of BMP compliance (118). Monitoring of Weyerhaeuser Company operations in 1976 revealed high rates of compliance in most settings. The ODAFS completed a pilot watershed implementation project in 1980-82, which revealed complete compliance with BMPs on forest industry lands, but lower compliance on non-industrial private forest lands. Additional, anecdotal evidence suggests that BMP compliance is good in the southeast part of the state, less so in the northeast where there is a greater preponderance of small operators. However, erosion and sediment loss rates tend to be less in the northeast due to thin soils and rapid infiltration rates. Only minor water quality impacts have been noted in that region, though localized

problems have been observed due to skidding in creek bottoms and poor road construction and drainage.

As a result of the 319 assessment and planning process, the ODAFS recently implemented rehabilitation of a 3-mile section of mountain road on non-industrial forest land, and a NPS project in a targeted watershed involving BMP implementation, road inventory, road use monitoring, and technology transfer with videos, workshops, and fact sheets (118). Also, in 1992 the ODAFS initiated a statewide compliance education and compliance monitoring program (5, 118, 119, 121). The program is a pilot, cooperative effort with the OFA to evaluate compliance of forest operators in applying current BMPs. Principal project tasks include: developing and maintaining lists of forestry operations (OFA); designing the compliance evaluation methods and forms (ODAFS, OFA); making educational contacts with operators or supervisors of selected logging operations (OFA); completing post-operation monitoring (OFA); and evaluating overall compliance and success of educational contacts (ODAFS).

Logging operations to be evaluated will be separated into two classes: forest industry and other operations. Forest industry operations will include those on lands of companies that also operate forest products plants and operations on other private lands that are conducted by company crews or contractors. Other operations will include logging operations on non-industrial private forest lands by sawmill operators, timber buyers, and others not meeting the forest industry definition. The OFA will develop lists of operators and make the initial educational contact and evaluation, using foresters having at least five years experience with BMP implementation. For forest industry operations, an OFA forester will meet with the company logging manager or contract supervisor to discuss BMPs with specific reference to the site to be logged. For other operations, an OFA forester will conduct an on-site tailgate discussion of BMPs with the operator. Following the logging operation, the OFA forester will examine the site and complete an evaluation report for the operation. The ODAFS will be responsible for selecting operations to be monitored, will participate in initial educational sessions and post-operation evaluations to ensure procedures and BMP requirements are clear, will resolve any problems in interpretation of BMP application and operation evaluation, and will perform independent monitoring on a sample of the operations evaluated.

K. Research on BMP Effectiveness

The ODAFS has over twelve years of history cooperating in and sponsoring research and monitoring studies on BMP effectiveness. Much of this research is summarized in the Silvicultural Component of the NPS Management Plan, particularly in Appendix A of that document (119). Additional effectiveness

studies and monitoring were proposed in the Plan. Much of this work, which complements similar research conducted in Arkansas, has been pursued cooperatively with the USDA-FS Southern Forest Experiment Station, Oklahoma State University, Weyerhaeuser Company, and University of Arkansas at Monticello. Drs. Ed Miller, Don Turton, and Ed Lawson are contacts for this work. This body of research includes headwater monitoring studies; studies of sediment yield from watersheds and forest access roads; watershed research on forest management impacts on streamflow, sedimentation, and stream temperature; research to establish basin sedimentation trends and for BMP development; and studies of pesticide use impacts on water quality.

Additional research described in the state reports for Arkansas, Louisiana, and Mississippi apply to portions of Oklahoma as well.

L. Special Problems or Issues

There are several issues currently receiving considerable public attention in the state that could lead to substantial future changes in silvicultural NPS control efforts, including increased emphasis on demonstration projects and education and training programs as well as perhaps even increased forest practices regulation and a switch to a regulatory program (118). Some of these issues grew out of recent changes in pollution control statutes, including the adoption of more stringent regulations for dealing with complaints and violations, and the Governor's planned emphasis on environmental regulation. Some are also associated with public perceptions concerning NPS problems associated with commercial forest areas in the state, environmental activists' concerns over water quality impacts associated with forest harvest, and concerns over increasing rates of hardwood utilization within parts of the state triggered in part by Georgia Pacific's recent installation of a new procurement operation for hardwoods near Sallisaw, OK.

The most visible issue in the state pertinent to silvicultural NPS control options is associated with public concerns over the Illinois River Basin (118). Over fifteen years of concern associated with water quality impacts of animal (poultry) waste and of municipal effluent has led to increased scrutiny of forestry operations in the basin, particularly associated with increasing rates of hardwood utilization. This public scrutiny resulted in 5-6 forestry complaints in 1992, including one on property adjacent to that of the Chair of the state Scenic Rivers Commission. This intense public concern for the Illinois River led ODAFS and OFA to establish a working group to deal with the issues involved, and to formulate a "forestry action agenda" pertinent to water quality management in the Illinois River Basin (126).

XI STATE REPORT FOR SOUTH CAROLINA

A. Program Overview

The South Carolina Department of Health and Environmental Control (SCDHEC) has been designated as the lead agency responsible for assessing and managing NPS pollution within the state and for meeting the state's responsibilities under relevant federal water quality legislation including Section 319 of the Clean Water Act of 1987. Responsibility for controlling NPS pollution resulting from forest management operations has in turn been delegated to the South Carolina Forestry Commission (SCFC).

The SCDHEC manages NPS pollution problems which result from silvicultural and other sources pursuant to the South Carolina Pollution Control Act. In the case of silviculture, the Department manages a limited regulatory program: it provides guidance and oversight for the overall program, and investigates NPS pollution problems from silviculture on a complaint basis. Report of a forestry NPS problem, by a private citizen or state agency staff member, triggers site inspection by DHEC technical staff. Relations between DHEC and SCFC are reported to be good, and site investigations of complaints are often conducted jointly (127). If warranted, corrective actions are implemented through formal enforcement actions. Relevant statutes specify penalties for continued violation, which may be substantial -- up to $25,000 per day per violation (7, 9). DHEC only began aggressively investigating complaints in the past 2-3 years, and did not take its first enforcement action against a forest operator until 1991 ($10,000 fine levied for tops left in stream; 127).

The SCFC has developed a voluntary program of BMP formulation and promotion, education and training, and monitoring to abate and control NPS pollution from forest management operations (127, 128). SCFC works with others in the state (especially Clemson University Extension Forest Resources, South Carolina Forestry Association - SCFA) to plan, develop, revise, and promote awareness and implementation of voluntary BMPs. The Commission disseminates information to forest landowners, industry and consulting foresters, loggers, contractors, and others on BMPs and NPS control programs through training and public education programs. SCFC provides professional technical advice and assistance to private non-industrial landowners, and provides technical assistance including recommendations for BMPs as part of the forestry cost-share program administered through the USDA-ASCS Forestry Incentive Program. SCFC also applies practices defined by the state Erosion, Sedimentation, and Stormwater Management Plan on state forest lands that it administers, and incorporates such practices in the professional advice it offers to other state agencies who own forest land.

The Commission has initiated an active program of BMP compliance monitoring, is planning new effectiveness monitoring efforts, and assists DHEC in investigating and resolving reports of silvicultural water quality violations.

Thus, South Carolina has a non-regulatory program for silvicultural NPS control, backed up by a limited regulatory program for violators, and the authority to make the entire program regulatory if current voluntary approaches are not effective in protecting water quality.

B. Water Quality and NPS Control Statutes and Regulations Relevant to Forest Management

The primary statute pertaining to control of NPS pollution in South Carolina is the Pollution Control Act, as amended (7, 9, 129). This statute establishes SCDHEC as the primary agency responsible for administering state programs under the Clean Water Act. Under this Act, DHEC has authority to control and prevent pollution, issue permits, promulgate rules and regulations, issue orders and initiate legal proceedings, and assess penalties and fines for violations. The Act defines pollution broadly, including (indirectly) nonpoint sources and any human alterations of the chemical, physical, biological, or radiological integrity of water. Although it does not mention silviculture specifically, it does list the following substances under the heading of "other wastes": sawdust, decayed wood, shavings, bark, and sand. Thus, the Act provides the basis for regulating NPS pollution resulting from forest management operations.

Three additional statutes are also relevant to silvicultural NPS control programs within the state. The South Carolina Stream Obstruction Statute (130) prohibits any damage to streambanks or obstruction of waterways due to felling of timber (7, 9). The South Carolina Scenic Rivers Act (131) defines three classes of eligible rivers in the state, and prohibits timber harvesting within designated distances of Class I streams on state controlled lands. Class I streams are defined as free-flowing rivers with shorelines which are essentially unaltered by man (7, 9). The South Carolina Stream Cleaning Act (132) requires landowners to clean out streams adjacent to their properties twice per year, and to keep them free of any obstructions which would interrupt the flow of sand and water (7, 9). Presumably this would include the removal of debris from logging operations.

C. State 319 Assessment Report

The South Carolina Nonpoint Source (Section 319) Assessment Report was completed and submitted to EPA in June 1988; a revised Report was submitted in April 1989 (133). Primary work on the Report was performed by the SCDHEC, with assistance from a

variety of other state and federal agencies including both SCFC and USDA-FS. Primary data for this Assessment came from the DHEC network of statewide ambient water quality monitoring stations. This was the only data source designated as "monitored" for this Assessment. Several other sources of "evaluated" data also contributed to the Assessment, including results from survey forms distributed to a wide variety of conservation groups, water recreation groups, local conservationists, wildlife officers, DHEC District Engineers, Soil and Water Conservation District Commissioners, and other interested individuals; results of the 1986-87 state Water Quality Assessment (305(b) Report); a 1985 ASIWPCA report ("America's Clean Water: the 1985 State Nonpoint Source Assessment, Appendix"); NOAA's "National Estuarine Inventory -National Coastal Pollution Discharge Inventory"; and results of a South Carolina Land Resources Conservation Commission computerized sediment yield model coupled to a geographic information system. In addition to identifying impaired water bodies in the state, the Assessment Report also summarized future NPS assessment procedures, identified key data gaps in the present analysis, enumerated high quality waters in the state, and discussed special concerns regarding EPA antidegradation criteria and protection of impacted wetlands.

A total of 336 waterbodies within the state were identified in the Assessment as being impaired by NPS pollution -- i.e., the waterbody does not meet or only partially meets designated uses. Agricultural runoff (67%) and urban runoff (43%) were the two greatest contributors of NPS pollution to impaired waterbodies. Other NPS categories contributing to impairment were construction (14%); abandoned gravel, sand, and clay mines (6%); silviculture (4%); on-site wastewater systems (4%); hazardous waste (0.3%); channelization (2%); landfills (0.6%); sludge (0.3%); other (1%); and unknown (3%) (several waterbodies were impacted by more than one NPS category). Primary causes of impairment were nutrients (53%), fecal coliforms (46%), turbidity (37%), DO depletion (29%), ammonia (27%), toxic materials (23%), pH (20%), suspended solids (14%), and BOD (8%). Each waterbody identified as being impaired was listed in the Assessment Report.

D. State 319 Management Plan

The South Carolina Nonpoint Source (Section 319) Management Program Plan was also completed and submitted to EPA in August 1988; a revised Plan was submitted in April 1989 (128). The proposed Management Program was to be based on a two-part strategy: 1) DHEC coordination of program implementation on a watershed basis, involving the efforts of cooperating agencies to which authority for specific components of the Program have been delegated (e.g., SCFC for silviculture), and focused on a prioritized list of targeted waterbodies selected from among those listed in the Assessment Report as being impacted by NPS pollution; and 2) implementation of general NPS control programs

statewide including education, technical, and financial assistance and regulations. The Program was designed to protect water quality in the state and to meet state and federal water quality goals. Both the Assessment Report and the Management Program Plan were viewed as updating the state's Water Quality Management Plan initiated under the 208 Planning process. Success in meeting Program objectives was to be evaluated based upon monitoring water quality conditions -- using a combination of biological monitoring, habitat assessment, and chemical water quality evaluation techniques -- in the waterbodies targeted for Program emphasis. The Plan was prepared by DHEC with assistance from the same agencies that contributed to the Assessment Report.

Section VII of the Plan describes the Forestry NPS Management Plan. This section presents an overview of forest ownership patterns and economic importance in the state, and of the potential NPS pollution problems (sediment, nutrients, organic enrichment, elevated temperature, and pesticides and herbicides) associated with silvicultural practices. The section identifies the SCFC as the agency responsible for silvicultural NPS control programs on state lands and for providing technical assistance to non-industrial private forest landowners, and it summarizes key components of SCFC NPS control programs for forest management operations. The SCFC applies, in a regulatory manner, the practices contained in the state Erosion, Sediment, and Stormwater Management Plan on state forest lands which it administers, and includes these practices in the professional advice given to other state agencies that own forest land. The SCFC also is the lead agency responsible for planning and developing forestry BMPs; assistance is provided in this process by the SCFA, Clemson University Forestry Extension Service, and other interested members of the forestry community. In addition to BMP development, SCFC also promotes, with assistance from others, use of BMPs through targeted educational and training efforts, and assists forest landowners with the proper management of their lands. In cooperation with the SCFA, SCFC has developed and widely disseminated two publications, "Voluntary Forest Practice Guidelines for South Carolina" (134) and "Best Management Practices for South Carolina's Forest Wetlands" (135), and encourages landowners, industry foresters, consulting foresters, loggers, contractors, and others to follow the BMPs contained in these manuals. The Management Plan notes that, while they do describe BMPs that prevent sediment runoff, the Voluntary Forest Practice (VFP) Guidelines are not oriented toward water quality protection in any comprehensive manner, and require thorough revision in order to do so.

The SCFC, again through cooperation with SCFA and Clemson, is developing expanded education and training programs involving video and slide tape programs designed to educate landowners and the forestry community on, and to promote the use of, BMPs, for both general and specific audiences. Training sessions using

these materials were to be initiated in 1989 at numerous sites across the state. The SCFC is also responsible for providing technical assistance as part of the forestry cost-share programs administered by USDA-ASCS under the Forestry Incentives Program. Established BMPs are to be included in all technical assistance provided under this program.

The silviculture section of the 319 Management Plan concludes by listing the currently recommended BMPs for protecting water quality from forestry activities -- under the headings of Forest Access Roads, Harvesting, and Site Preparation, for both upland and wetland sites -- and enumerates a four-year action plan of recommended improvements in the silvicultural NPS control program administered by SCFC with assistance from SCFA and Clemson University. The four main components of this plan are: encourage use of the BMPs outlined in the VFP Guidelines and Wetlands BMP manual on private forest lands, and ensure these BMPs are used on all state lands; develop and implement education and training programs (slide-tape-video productions) dealing with silvicultural NPS problems and proper BMPs; evaluate and revise BMPs as required based on new research results; and develop an updated BMP manual for silvicultural practices in South Carolina.

E. Forestry BMP Manual(s)

Forestry BMPs were initially developed in South Carolina in 1976 (127, 137) and have undergone two revisions. In addition to their listing in the Nonpoint Source Management Program Plan (128), they are available to members of the forestry community in two separate manuals -- a set of Voluntary Forest Practice (VFP) Guidelines for general silvicultural operations and a BMP manual for operations in forested wetlands. In addition, a process to revise and update existing BMPs was initiated in 1991. A draft, revised BMP manual was prepared in 1992 and is undergoing review by a variety of groups.

The manual of VFP Guidelines was developed and published by the Forest Practices Committee of the SCFA (134). As emphasized above, these Guidelines represent a set of practices that will lead to better forest management and a better forest environment, and include practices designed to reduce impacts of soil erosion on water quality. While some of these practices contribute to water quality protection, they should not be viewed as a comprehensive set of BMPs for water quality protection. The manual contains an overview of forestry in South Carolina and of the SCFA, and of the purpose of this manual. Recommended practices are presented under the headings of Forest Protection (Wildfire, Insects and Disease, and Natural Disaster Damage); Forest Development (Access Roads - Planning, Construction, and Maintenance, and Water Control); Wetlands (Wetlands Values and Forest Roads); Forest Management Alternatives (Timber Production,

Site Evaluation and Choice of Species, Management Systems, Regeneration Methods, Even-Aged Management, Clearcutting, Seed Tree, Shelterwood, Uneven-Aged Management, Multiple-Use, Wildlife, Grazing, Recreation and Aesthetics, and Water); Cultural Activities (Prescribed Burning, Prescribed Burning in Forest Stands, Controlled Burning for Site Preparation, Smoke Management, Control of Competing Vegetation, Fertilization, Thinning, Harvesting, Site Preparation, and Use of Herbicides); Reforestation (Time to Plant, Seedling Care, and Planting Techniques); and Safety. An Appendix lists state and federal agencies that play a role in forest management and protection programs, and a Glossary defines key terms. The manual is fairly general in its recommendations, and contains no tables, figures, or illustrations with specific numerical criteria.

The wetlands BMP manual was published in 1989 by the SCFC with assistance from the SCFA and its wetlands committee (135). Additional information was provided for this manual by the USDA-FS, Clemson University, North Carolina State University Hardwood Cooperative, and Florida Division of Forestry. The manual contains an overview of wetland forests, BMPs, and potential water quality impacts resulting from forest roads, harvesting, and site preparation. Recommended BMPs are presented under the headings of Forest Road Construction (Types of Roads, Main Access Roads, Limited Use Roads, Road Bed Material, Roads in Muck and Headwater Swamps and Black River Bottoms, Bridges and Culverts, and Other Erosion Prevention Measures); Regeneration (Natural Regeneration, Artificial Regeneration, and Site Preparation Methods); Harvesting (Scheduling, Felling, Log Decks, and Regeneration Cut Area); Stream Management Zones (Primary SMZ's and Secondary SMZ's); and Protecting Sensitive Resources. Several Appendices provide additional information -- Recommendations for Seeding, Mulching and Fertilizing Roads, Fills, and other disturbed areas; Definitions of Forest Sites (i.e., forest wetland types) and of key Forestry and Other Terms; a listing of Navigable Waters defined by South Carolina, including upper and lower limits of permit jurisdiction by county and waterbody; and a description of the South Carolina Scenic Rivers Program. The manual does contain some figures and tables with specific numerical criteria, but is not as detailed as the wetland BMP manuals of some other southern states. The manual specifies different widths for primary and secondary SMZ's along navigable streams as a function of slope percent, and lists practices permitted and to be avoided in each zone.

The SCFC initiated comprehensive revision of its silvicultural BMPs in 1991 (127, 136). The new BMPs are intended to provide forest landowners and the professional forestry community with detailed guidelines for protection of water quality as well as site productivity, wildlife habitat, and aesthetics. The new manual will replace both the VFP Guidelines and the wetland BMP manual. This revision, a direct outgrowth of

recommendations in the NPS Management Plan (128), was prepared by the SCFC with assistance from Clemson University, USDA-FS, and SCFA/forest industry. A draft manual was completed in 1992 and is being reviewed by members of the forestry community, regulatory agencies, and environmental organizations in the state; public hearings will be held to assist local groups in understanding and becoming familiar with the new BMPs (136). When finalized, the revised manual will be published with Section 319 funds provided by EPA. The new manual will include up-to-date practices to reduce both on-site and off-site water quality impacts of forestry operations; will address cumulative effects; will include practices to protect wildlife habitat; will include recommendations for SMZs along intermittent streams; and will pay special attention to the potential for water quality problems in the Blue Ridge Mountains, southern Piedmont, and southern Coastal Plain (127).

F. State Forest Practice Rules

South Carolina has not established specific forest practice rules. However, introduction of a Forest Practices Act is currently under active debate. The approach under consideration would designate SCFC as the lead state agency for both enforcement and monitoring. Pushed by forest industry, this move has apparently been stimulated by recent increases in enforcement actions against forest operators by SCDHEC (127).

G. Special Rules -- Wetlands, Cumulative Effects, or Groundwater

Besides the statutes cited earlier and the voluntary BMPs for both uplands and wetlands, South Carolina has no special rules for protection of wetlands, cumulative effects, or groundwater pertinent to silviculture. Pending wetland legislation was mentioned in one recent summary of state programs (10), but apparently has not yet been enacted.

H. Program Changes Since 1980

In its last summary of silvicultural NPS control programs in the southern U.S., NCASI (18) recognized a number accomplishments of the South Carolina program. The program has undergone a number of important changes since that time (127, 128). SCDHEC has developed a much more aggressive approach toward investigating reports of silvicultural NPS pollution problems. SCFC worked with others in the state to revise the VFP Guidelines for forestry (1988), publish a BMP manual for forested wetlands (1988), and initiated a detailed process to develop and publish a new and revised BMP manual (1991). The Commission also worked with others to enhance its training and education programs, initiated a new BMP compliance monitoring program, and planned an

effectiveness monitoring effort. It also hired a new Forest Hydrologist (Tim Adams), and provided continuing education opportunities for him through Clemson University (5).

I. Educational and Training Programs to Promote Compliance

In cooperation with Clemson University Extension and SCFA, the SCFC maintains an active and recently enhanced program of public outreach, education, and training to inform landowners, forestry practitioners, and the public regarding the importance of NPS control programs and proper techniques for implementing forestry BMPs (127, 128, 133). These organizations have recently cooperated to develop a revised BMP manual and a new set of video and slide tape programs, for both general and specific audiences, dealing with NPS problems and BMPs. These programs are being presented to landowners, industry and consulting foresters, loggers, contractors, and others practicing forest management in training sessions offered throughout the state. In 1989, for example, 14 such sessions were held targeted at loggers (5). A series of public hearings are also planned to inform members of the forestry community and the general public concerning the new BMPs and BMP manuals (136).

J. Compliance Survey Methods and Results

The SCFC, in cooperation with the SCFA, Clemson University, USDA-FS, The Nature Conservancy, South Carolina Wildlife and Marine Resources Department, and Martin Brothers, Inc., undertook and published the first detailed survey and analysis of statewide compliance with BMPs in 1991 (137). The objectives of this survey were to establish a reference point of overall BMP compliance for 1988-1990, and to determine the level of individual BMP compliance, whether landowners were aware of BMPs, and if landowners were using the advice of professional foresters in conducting harvesting operations. Each site selected for the survey was visited by a multi-disciplinary team (soil scientist, hydrologist, logger, wildlife biologist, conservationist, ecologist, forest manager) which evaluated both compliance with individual BMPs and overall acceptability of the total operation. Sites of recent logging activity were identified from aerial observations during SCFC aerial fire patrols in spring 1990, and further evaluated through aerial photography in order to obtain a relatively representative stratified sample of sites according to site type (upland, wetland), location relative to stream, tract size, landowner type (private - large and small, federal, state, industry), and physiographic region (Mountain, Piedmont, Coastal Plain). Selection was not truly random, and final site selection was somewhat biased toward wetland sites and those adjacent to streams. Sites meeting criteria were visited by SCFC staff to ensure they had been logged in the past two years. If so, the site was visited following contact with the owner. The survey was conducted in April - August 1990. Sites were evaluated based

on a four page form developed for the survey, and on information solicited from the landowner.

Data resulting from the survey were entered into a computer and analyzed in spreadsheet format. Overall ratings and results for individual BMPs were summarized by site, landowner class, site type, soil drainage class, presence/absence of professional forestry advice, SCFC District, and physiographic region. The Survey report presents and analyzes results in great detail. Key findings of the survey may be highlighted as follows:

1) Percent compliance (i.e., % with moderate to high level of total BMP implementation) by ownership class was: 100% state and federal (few such sites were sampled); industry 95%; large private (>1000 acres) 86%; and small private 78%. Excluding state and federal, industry lands had the highest level of high implementation and the lowest level of low implementation. Rankings for small private owners were just the reverse. Overall, 84% of sites had an acceptable level of BMP implementation or better.

2) Although 72% of owners used professional forestry advice, only 56% said they were aware of VFP Guidelines and wetland BMPs. 83% of owners had a written sales contract, but only 37% required compliance with VFP or BMPs. Yet, 96% reported satisfaction with the logging operation. Clearly, "considerable effort must be focused on educating landowners about potential long-term productivity site losses and possible harm to wetland and aquatic functions due to inadequate BMP implementation." This is especially true for small, private, non-industrial owners.

3) Highest levels of compliance across all ownership classes occurred for roads and log decks; lowest levels of compliance were seen for SMZs, skid trails, and rutting. Deep rutting was associated with certain site types, % of site that was wetland, and soil drainage class; it was especially prevalent in Coastal Plain sites.

4) Highest compliance ratings were seen on dry upland sites with mixed pine hardwoods, moderately well drained soils, < 50% wetland area, moderate size harvest area, and presence of professional forester advice. Lowest ratings were most common on mixed bottomland hardwood sites, poorly drained soils, high percentage wetlands, small cut size, and absence of professional forester advice.

5) Overall, lack of SMZs along navigable and non-navigable streams (particularly on private lands) and deep rutting in skid trails were the major problems reported statewide. Other key problem areas involved stream crossings, roads, and Section 404 violations (some of these were probably development rather than true silvicultural operations, but all used the silviculture exemption, an obvious misuse of the exemption; true silviculture 404 problems were infrequent and associated with roads and ditches).

6) There was only an imperfect relationship between ratings of overall compliance and BMP implementation and direct assessments of acceptability based on presence/absence of on-site and off-site impacts. Thus, evaluations of the acceptability of forestry operations must consider both implementation of specific BMPs and overall levels of compliance and impact.

Several specific recommendations for follow-up actions were made based on results of this initial survey:

1) Landowners and loggers need to be educated on the benefits of BMP implementation.

2) BMPs need to be revised to provide more specific guidelines, especially regarding SMZs.

3) BMPs need to be monitored on a regular basis, at least every two years. Future monitoring should include more quantitative procedures that assess how well specific BMPs are functioning to minimize on-site and off-site impacts.

4) The SCFC should assume responsibility for BMP monitoring, and must promote better private non-industrial landowner compliance. The forestry community must regulate itself in order to assure resource protection while harvesting timber. Training for loggers and landowners should be a cooperative effort among the Commission, Clemson University Forestry Extension Service, and SCFA.

5) Landowners must be made aware of Section 404 of the CWA and encouraged not to use the silvicultural exemption for other (e.g., development) purposes.

K. Research on BMP Effectiveness

The SCFC recently sponsored a research project through Clemson University on BMP effectiveness (127). Two Ph.D.

students were funded to use US EPA Rapid Bioassessment Protocols to monitor logging operations within the state. Results (being defended before a Clemson graduate committee) were promising, demonstrating water quality protection when BMPs were implemented. Several publications are planned. The SCFC is also planning to initiate a program of effectiveness monitoring (127). This program will be based on a weight of evidence approach, and will include both above/below site sampling for benthic organisms and stream habitat assessments.

Considerable water quality research has been conducted within the state by the Clemson University School of Forest and Recreation Resources; Dr. David H. Van Lear is the relevant contact. Also, extensive research conducted by the USDA-FS Coweeta Hydrologic Laboratory (Otto, NC) applies to both the Blue Ridge Mountains and the Piedmont portions of the state. Limited additional research has also been conducted by the USDA-FS Research Work Unit at Charleston, pertinent to the coastal region. Drs. Bill Harms and Marilyn Buford are appropriate contacts.

L. Special Problems or Issues

The Blue Ridge Mountains, southern Piedmont, and southern Coastal Plains are regions of the state where silvicultural NPS pollution has the potential to be locally significant. All three areas will receive increased attention in the revised BMP manual, currently undergoing final review (127). Another key issue within the state at present involves debate over possible introduction of a formal Forest Practices Act, which might designate SCFC as the lead agency for both NPS monitoring and enforcement. In contrast to the situation in some other southern states, this action is being pushed by forest industry, apparently in response to recent increases in enforcement actions against forest operators by SCDHEC (127).

XII STATE REPORT FOR TENNESSEE

A. Program Overview

The Tennessee Department of Environment and Conservation (TDEC), Division of Water Pollution Control (TDWPC), has been designated as the lead agency for assessing and managing NPS pollution within the state and for meeting the state's responsibilities under relevant federal water quality legislation including Section 319 of the Clean Water Act of 1987. Responsibility for controlling NPS pollution resulting from forest management operations has in turn been delegated to the Tennessee Department of Agriculture, Division of Forestry (TDF).

The TDEC manages NPS pollution problems which result from silvicultural and other sources pursuant to the Tennessee Water Quality Control Act. In the case of silviculture, the Department manages a strictly non-regulatory program: under an existing cooperative agreement with the TDF, it investigates complaints of NPS pollution problems from forest management operations (138). If problems or violations are discovered, the landowner is notified and corrective actions prescribed. But, because silviculture is specifically exempted from regulation under the Water Quality Control Act (7, 9), TDEC does not have the authority to regulate such problems. Only if practices are found to be directly impacting streams, in the sense of a point source, can action be taken by the TDEC under its Anti-Degradation Clause. The EPA Administrator of Region IV, in a letter to the Governor of Tennessee approving the state's NPS Management Program, noted his concern that "existing exemptions of agricultural and silvicultural activities ... could pose serious limitations on the implementation of the management program," but also noted his willingness to work with the state to achieve the goals laid out in its Management Program (139).

The TDF has developed a voluntary program of BMP formulation and promotion for the control of NPS pollution from forest management activities (5, 138, 140, 141). The primary goal of the program is to inform and educate natural resource and forestry professionals, forest landowners, loggers, and other forest operators concerning the potential for soil erosion and water pollution during forestry operations and to assist them in the use and application of BMPs. The current program has five key components: 1) develop BMP educational materials, and provide training on BMPs to members of the forestry community through workshops, presentations, and field days; 2) provide technical assistance to members of the forestry community on BMPs, especially through the Forest Stewardship and Stewardship Incentive Programs; 3) establish demonstrations of water quality management and BMP installation on state forests; 4) sponsor research on BMP effectiveness on state forests; and 5) develop a statewide compliance monitoring program to determine the level at which BMPs are actually and accurately being used within the state. The TDF also incorporates water quality management planning and BMP implementation into the management of state forests, and is encouraging landowners, wood-using industries, and consultants to include application of BMPs in timber sale contracts. The TDF's Forest Stewardship Program (142) was designed to make forestry assistance available to private landowners and to increase public awareness of forest stewardship. The Program makes free on-the-ground assistance from a team of natural resource professionals available to landowners, including development of detailed plans for multiple use of forest lands. These plans include guidance in water quality protection. Excellence in forest management and stewardship is recognized under this Program through

identification of landowners as Stewardship Forest Owners, and their forest lands as Tennessee Stewardship Forests. The federal Stewardship Incentives Program, administered through TDF, makes cost-share funds available to those participating in the Forest Stewardship Program, as much as 75% of costs up to $10,000 annually (143).

Thus, Tennessee has a strictly voluntary, non-regulatory program for silvicultural NPS control. Only if NPS pollution results from a point source discharge directly into a waterbody can any regulatory or enforcement actions be taken.

B. Water Quality and NPS Control Statutes and Regulations Relevant to Forest Management

The primary statute pertaining to control of NPS pollution is the Tennessee Water Control Act (7, 9, 144). This Act establishes the TDWPC as the lead agency responsible for administering state programs under the Clean Water Act, under authority of the Tennessee Water Quality Control Board. This Act grants broad authority to control water pollution within the state. The Act defines pollution broadly, and lists decayed wood, sawdust, silt, shavings, bark, and rock as potential pollutants subject to regulation. However, the Act also specifically exempts silviculture from regulation unless a point source discharge is involved. This statute is the only southern state law that explicitly exempts forestry operations from water quality regulation unless point source discharges of pollutants are involved.

Under provisions of the Scenic Rivers Act (7, 9, 145), commercial timber harvest is prohibited in protected river areas within the conservation or public use easement, as defined in the law.

C. State 319 Assessment Report

The Tennessee Nonpoint Source (Section 319) Assessment Report was completed and submitted to EPA in June 1989 (146). Primary work on the Report was performed by the TDEC, TDWPC, with assistance from numerous other state and federal agencies, including the TDF for silviculture components, under the leadership of an interagency Management Advisory Group. The primary source of information for this Assessment was the state's 1986 and 1988 305(b) reports; various other sources of information were used to corroborate the information and data contained in these two earlier water quality assessments. Of the 11,069 miles of rivers and streams within the state, 85% (9,428 miles) were assessed; similarly, 100% of the total of 538,657 acres of lakes in the state were assessed.

In Tennessee, NPS pollution affects about 77% of the total lake acres that were identified as being impacted and not fully capable of supporting designated uses; similarly, NPS pollution affects about 82% of total river miles that were identified as impacted and not fully capable of supporting designated uses. For lakes, the major sources of NPS pollution were upstream impoundments (25%), agriculture (12%), hydro/habitat modification (8%), urban runoff (5%), construction (3%), land disposal (1.5%), forestry (1%), and resource extraction (0.4%). Comparable data for rivers and streams on major sources of impacts were upstream impoundments (35%), agriculture (28%), hydro/habitat modification (11%), resource extraction (11%), construction (10%), urban runoff (10%), land disposal (2%), and forestry (2%). When impacts were broken out as major or moderate/minor, forestry was ranked near the bottom of each for both lakes (0% major impact, 1% moderate/minor) and rivers (1% major impact, 1% moderate/minor). Summary data were not presented on major uses impacted or on major causes of impairment. Detailed data on impacted waterbodies were presented by river basin and waterbody.

A 1990 report by the TDEC concluded that forestry practices in Tennessee are responsible for only about 3% of total NPS loadings within the state (138).

D. State 319 Management Plan

The Tennessee Nonpoint Source Management Program Plan was also completed and submitted to EPA in June 1989 (139). The Plan, prepared by the same agencies that contributed to the Assessment Report, designated the TDEC (then termed the Tennessee Department of Health and Environment) as the lead agency for managing NPS control programs in the state. The Plan presented a detailed overview of the general characteristics of the state, including climate, geology, soil resources, and land area and ownership/use patterns.

Chapter 3 of the Plan summarized the NPS Management Plan for Forestry Activities in Tennessee. The forestry Plan was based on implementing measures which would substantially reduce water pollution resulting from forestry activities. The main thrust of the program was to inform and educate natural resource professionals, forest operators, and forest landowners concerning the potential for soil erosion and water pollution during forestry operations, and to train them to apply BMPs to minimize adverse water quality impacts in order to achieve state water quality goals. The Plan was based on a non-regulatory program involving application of forestry BMPs. Justification for this approach was summarized based on a 1988 National Association of State Foresters Position Statement on "Efficient Achievement of Clean Water Goals in the Forestry Sector" (147). The Plan also summarized information on the potential water quality impacts of forest management operations, and identified four areas of water

quality concern in Tennessee based on input from biologists employed by the Tennessee Wildlife Resources Agency (TWRA) and by river basin managers in TDEC: the leaving of logging debris, tree tops, and branches in or adjacent to streams following forest harvest in west Tennessee; inadequacy of stream buffer zones and drains in large (i.e., several hundred acres) industry operations involving clearcutting and site preparation; erosion from logging roads, skid trails, and log landings in steep topography; and aerial application of forestry herbicides. The Plan re-designated the TDF as the lead agency responsible for managing silvicultural NPS programs in the state, and listed the membership of the Advisory Group that prepared the silvicultural Plan (TDF, University of Tennessee - UT, Tennessee Conservation League, Tennessee Forestry Association, Tennessee Farm Bureau Federation, and Tennessee Department of Agriculture).

The silviculture NPS Management Plan also listed the existing forestry BMPs for Tennessee, under the headings of Forest Access Roads, Forest Products Harvesting, Mechanical Site Preparation for Reforestation, Machine Planting of Tree Seedlings, Prescribed Use of Fire, Pesticide Use, and Livestock Exclusion. These BMPs were developed in 1985 with the advice and approval of a 208 Technical Advisory Group composed of representatives from the wood-using industries, forestry consultants, UT, University of the South, Society of American Foresters, TDEC, TWRA, UT Agricultural Extension Service, TVA, USDA-FS, USDA-SCS, US Army Corps of Engineers, and private forest owners, and approved by the State Water Control Board. Although the existing BMPs were considered adequate to protect water quality, two strategies were proposed to determine and enhance BMP effectiveness for application in specific land resource areas of the state: modify existing BMPs to protect fragile sites and sites of high erosion hazard in each of the eight land resource areas of the state, and initiate a cooperative research project at the Pickett State Forest with the Center for Management, Utilization, and Protection of Water Resources at Tennessee Technological University to assess the effectiveness of specific BMPs. The impact of existing BMPs on ground water in the state was briefly discussed, and concluded to be largely beneficial.

Accomplishments of the forestry water quality management program since 1985 were briefly summarized in the Plan. These included a 1985 update of the state's original 208 Water Quality Management Plan for Forestry, for the four-year period through 1989, and the hiring of a new forester to manage the Program. For the coming four-year period through 1992, the Plan proposed the following enhancements in the forestry NPS Management Program and requested financial resources to fund each item: reprint BMPs for forestry; expand training of natural resource professionals, forest operators, and landowners in use of BMPs; develop NPS informational brochures; conduct cooperative research on BMP effectiveness; refine BMPs for specific sites and

conditions; furnish technical assistance to landowners in targeted watersheds; monitor BMP implementation and effectiveness statewide; and install BMP demonstrations on state forests and/or forest industry lands. Program coordination with federal agencies and other members of the forestry community was briefly reviewed.

The Plan concluded by enumerating specific objectives for the Program for two time periods, 1989-1992 and 1993-2000. For the initial implementation period of 1989-1992, program objectives were to conduct a program of continuous water quality management planning and program evaluation; inform and train natural resource professionals, forest managers and operators, and landowners concerning water pollution caused by forest management operations and use of BMPs to reduce erosion and adverse water quality impacts; and encourage and evaluate the implementation of BMPs. Specific Annual Programs of Work for Fiscal Years 1989 through 1992 were included. Following the initial period of program implementation, the program's objectives for 1993-2000 were to be: informing and training the forestry community, especially loggers and other forest operators, regarding water quality management and BMPs; furnishing technical assistance to forest operators; evaluating application and effectiveness of BMPs through monitoring; and conducting research to test BMP effectiveness in specific Land Resource Areas.

E. Forestry BMP Manual(s)

Forestry BMPs were initially developed and published in 1985. The initial BMPs were developed as non-regulatory guidelines to prevent soil erosion and protect water quality, and were focused on logging roads, skid trails, and mechanical site preparation (10, 138, 140). The TDF currently maintains two BMP manuals, one for general timber harvesting operations and a second one for operations in wetlands.

The primary BMP manual for forestry in Tennessee is a fairly brief, 11-page loose-leaf document that contains no tables, figures, or illustrations presenting specific numerical criteria (148). Following an Introduction that discusses water quality protection and the use and benefits of BMPs, the manual presents recommended BMPs under the headings of Locating and Constructing Forest Roads; Planning the Timber Harvest (Log Landings and Skid Trails); Protecting Streams During Timber Harvesting; and Revegetating Roads, Skid Trails and Log Landings. The final section presents Recommended Seed Mixtures for Shaded Woodland, for Grassland and Pasture, for Wildlife, and for Temporary Cover Anywhere. Under each section, specific Guidelines of practices to follow are enumerated followed by practices to avoid. An

appendix serves as a Reference Guide to Forestry BMPs, and lists specific BMP Guidelines for Forest Roads and Forest Harvesting (Log Landings, Skid Trails).

The wetland BMP manual was published in 1990, and was intended to expand knowledge of BMPs and to provide guidelines to foresters, loggers, forest landowners, and others in wetland management (10). Because a copy of this newer manual was not provided by the state contact, no detailed information can be presented on its organization.

F. State Forest Practice Rules

Tennessee has not established any specific forest practice rules. However, a bill supporting establishment of a Forest Practices Act was introduced and defeated in the state legislature in 1992 (138).

G. Special Rules -- Wetlands, Cumulative Effects, or Groundwater

Besides the statutes cited earlier and the voluntary BMPs for both uplands and wetlands, Tennessee has no special rules for protection of wetlands, cumulative effects, or groundwater.

H. Program Changes Since 1980

As summarized in the last NCASI summary of forestry NPS control programs in the southern U.S., there was initially no recognition in Tennessee of water quality problems resulting from forestry practices, and thus no need for BMPs (18). Subsequently, water quality problems were identified in relation to logging roads, skid trails, and mechanical site preparation. BMPs were to be developed and implemented focused on these areas; they were initially published in 1985. Training was to be initiated regarding forest roads, BMPs, Forestry Incentive Program, and related forest management plans. This renewed interest in silvicultural NPS control was supported by forest industry (18). Even in 1989 the program was still described as being in the early stages of implementation (10).

Effectively, the entire program described in this section has developed, not just since 1980, but in the past six years (138, 140). BMPs were established and published and also revised; a second BMP manual for wetlands was developed (5). A full-time position was created and a Forest Hydrologist hired to administer the NPS control program. Education and training programs have been substantially enhanced, and a compliance monitoring program initiated.

I. Educational and Training Programs to Promote Compliance

The TDF has recently made major enhancements in its educational and training programs related to water quality protection and BMP implementation (5, 138, 140). The primary emphasis of these programs is to familiarize and educate natural resource and forestry professionals, forest landowners, and loggers and other forest operators in proper BMPs, in the effective and economical application of BMPs, and in the resulting water quality benefits. Training materials that the Division has prepared and distributed include BMP handbooks and informative brochures (e.g., 149), forestry NPS information, videos, and slide tape programs. These materials have been utilized in BMP seminars and presentations, field days, field tours, and technical assistance sessions and on-site inspections. The TDF has established two special BMP Demonstration Areas on the Natchez Trace and Chuck Swan State Forests, two priority targeted watersheds identified for special funding and emphasis by TDEC and EPA. On both Areas TDF has established demonstrations of BMPs for road construction, maintenance, and retirement/revegetation; proper harvesting methods; site preparation techniques; and establishment of SMZs. The TDF has also established and maintained a demonstration of BMPs for mechanical site preparation for reforestation on the Bledsoe State Forest. A final component of the TDF education effort is the Forest Stewardship Program (142), which helps to increase public awareness regarding proper methods of forest stewardship. The TDF estimates that it has reached over 3,500 members of the forestry community through its education efforts over the past six years (138).

J. Compliance Survey Methods and Results

Tennessee has recently developed and implemented a new program for monitoring BMP compliance (5, 138). Results of the first compliance survey conducted in 1992 are being analyzed and a summary report prepared. The major goals of this new monitoring program are to (140): determine the overall effectiveness of voluntary approaches to preventing silvicultural NPS pollution; measure the level of compliance with established BMPs statewide; determine which ownership groups are using BMPs, and where additional education and training are required; provide information to revise and improve BMPs; and provide data on the level of BMP implementation for reporting to EPA and TDEC. Current information suggests that many forest industries in the state are taking BMP implementation seriously, and incorporating them into land management plans, but hard data to substantiate this supposition are not currently available (140).

K. Research on BMP Effectiveness

The TDF is continuing a major cooperative research project on BMP effectiveness with the Water Resources Center, a Tennessee Center of Excellence at Tennessee Technological University (5, 138, 140, 141, 150). The project is being conducted on Rock Creek watershed on the Pickett State Forest, and is focused on the effectiveness of specific forestry BMPs (road construction, timber harvest, site preparation, herbicide use) in preventing water quality degradation following timber harvest. Results to date have revealed no detectable changes in water quality conditions, based on both chemical and biological water quality sampling protocols. A report and publications summarizing results are in preparation.

Water quality research conducted by the USDA-FS Coweeta Hydrologic Laboratory (Otto, NC) applies to the eastern, mountainous regions of the state. Similarly, much of the research at the USDA Forest Hydrology Laboratory (Oxford, MS) applies to the western portions of Tennessee, especially forests that grow in hilly upland sites on loessial soils. A portion of this work was actually conducted on sites in western Tennessee.

L. Special Problems or Issues

The TVA Chip Mill Permit issue has been a major stimulus within the state to discussions of the merits of regulatory versus non-regulatory approaches to water quality protection and NPS program management (138). This issue has increased awareness of forestry practices and accelerated efforts to adopt a Forest Practices Act in the state. Such an act was introduced but defeated in the 1992 session of the state legislature. Existing BMPs have received considerable attention, and their effectiveness in protecting water quality has been under "close inspection."

XIII STATE REPORT FOR TEXAS

A. Program Overview

The Texas Water Commission (TWC) has been designated as the lead agency responsible for assessing and managing NPS pollution within the state and for meeting the state's responsibilities under relevant water quality legislation including Section 319 of the Clean Water Act of 1987. Responsibility for controlling NPS pollution resulting from agricultural and silvicultural activities has been assigned to the Texas Soil and Water Conservation Board (TSSWCB) under the Agriculture Code of Texas. The TSSWCB has in turn delegated responsibility for managing the silvicultural NPS control program to the Texas Forest Service (TFS).

The TWC and TSSWCB manage NPS pollution problems which result from silvicultural and other sources pursuant to the Texas Water Quality Act. In the case of silviculture, the Commission and Board manage a limited semi-regulatory program: they manage and coordinate the overall program, and are authorized to investigate and regulate NPS pollution problems from silviculture on a complaint basis. If warranted, corrective actions may be implemented through formal enforcement actions. Relevant statutes specify penalties for continued violation, which may be substantial -- i.e., up to $10,000 per day. Although such regulatory actions are authorized, they currently are not employed (151).

The TFS has recently developed a voluntary program of BMP formulation and promotion for the control of NPS pollution from forest management operations (151, 152). The program, initiated in June 1990 following approval of the state's Nonpoint Source (Section 319) Management Plan, is a cooperative project designed to reduce NPS pollution from forestry activities based on widespread adoption of voluntary BMPs within the state. The TFS is responsible for working with others in the state, including the TSSWCB, Texas Forestry Association (TFA), Texas A&M University Extension Service, and forest industry to develop, evaluate, revise, and disseminate forestry BMPs. The TFS manages an active education and training program, involving radio and TV interviews, newspaper and magazine articles, BMP manual distribution, BMP meetings and workshops, BMP exhibits and presentations at special events, and educational materials targeted at forest operators. The Service also integrates BMPs into state forest management programs (e.g., development and implementation of a Fireline BMP Guidelines policy), provides technical assistance concerning proper BMP use to members of the forestry community, and has established BMP demonstration areas on two state forests (Jones and Fairchild) where 30 practices are demonstrated at 18 stops. The TFS maintains coordination in program management with other state and federal agencies, evaluates program progress and implements revisions as needed, has established a program of monitoring BMP compliance and completed its first compliance survey, and encourages inclusion of logging performance standards in timber sale contracts (5, 152).

Thus, Texas has a non-regulatory program for silvicultural NPS control, backed up by authority (which is not currently invoked) for a limited regulatory program for violators, and the authority to make the entire program regulatory if current voluntary approaches are not effective in protecting water quality. The following statement, from a brochure discussing silvicultural BMPs (153), is instructive in this regard: "However, if voluntary BMPs fail to eliminate nonpoint source pollution problems, the next step could well be regulations and permitting. By implementing BMPs, the forestry community has an

opportunity to demonstrate respect for the natural resources, including high quality water, upon which it depends."

B. Water Quality and NPS Control Statutes and Regulations Relevant to Forest Management

The primary statute pertaining to control of NPS pollution is the Texas Water Quality Act (7, 9, 154). The Act establishes the TWC and the State Water Development Board, under the Department of Water Resources, as the lead agency responsible for control and abatement of NPS pollution within the state. It authorizes the Commission to grant authority to issue discharge permits to local governments; to issue rules, regulations, and orders to control water quality; and to issue penalties to violators. Pollution is defined broadly enough in the Act to include forestry NPS discharges. The Act specifically mentions agricultural waste, presumably including forestry residues, and specifically lists decayed wood, sawdust, shavings, bark, and runoff from cultivated and uncultivated land that may impair water quality.

A second relevant statute is the Texas Stream Obstruction Act (7, 9, 155). This Act prohibits obstruction of navigable streams by cutting and felling of trees.

C. State 319 Assessment Report

The Texas Nonpoint Source (Section 319) Assessment Report was completed and submitted to EPA in August 1988; an Update to the Plan was submitted in August 1991 (156). Primary work on the overall Report, particularly the non-agricultural sections, was completed by the TWC, Water Quality Division, Pollution Abatement Unit. The TSSWCB coordinated development of agricultural components, assisted by the TFS for silviculture. Primary data for the Assessment came from TWC Surface Water Monitoring Program data, as assessed in the state's 305(b) Report for 1990. Additional data and information came from the following sources: TWC District Office personnel; statewide monitoring data in STORET, particularly USGS data; results of a questionnaire mailed out to over 200 representatives of federal and state agencies, river authorities, cities, universities, and environmental organizations; all 208 TSSWCB Soil and Water Conservation Districts (particularly focused on agricultural and silvicultural impacts); and site-specific fish kill and other information from the TWC District Offices and Texas Parks and Wildlife Department. These sources provided both monitored and evaluated data. For the purposes of this Assessment, ambient monitoring data and professional evaluations were available for 16,184 miles of rivers and streams; 1,543,897 acres of reservoirs; 1,990 square miles of bays; and 3,879 square miles of gulf waters.

Although the Assessment Report listed all waterbodies believed to be impacted by NPS pollution, no summary statistics ranking impacts by designated uses impacted, primary causes of impact, or key categories of NPS impact (including silviculture) were provided, nor was it apparent how to calculate such statistics from the data and information provided. Thus, it is not possible to compare silviculture with other categories of NPS impact in terms of relative importance. Careful inspection of the data tables revealed only a very few waterbodies for which silviculture was listed as a category of impairment. Other categories such as agriculture, septic tanks, sewage treatment systems, petroleum and oil & gas activities, urban runoff, and flow regulation were listed much more frequently. But, although it can be stated qualitatively that silvicultural activities are a relatively minor cause of NPS impacts to surface waters in Texas, an exact quantitative comparison of silviculture with other NPS categories cannot be provided.

D. State 319 Management Plan

The Texas Nonpoint Source (Section 319) Management Program Plan was also completed and submitted to EPA in August 1988; and, an Update to the Plan was submitted in August 1991 (157). As with the Assessment Report, primary work on the overall Plan, particularly non-agricultural sections, was completed by the TWC, Water Quality Division, Pollution Abatement Unit. The TSSWCB coordinated development of agricultural components, assisted by the TFS for silviculture. The primary objective of the Program was to establish management programs and BMPs for those categories of pollutants that impact surface waters in the state as revealed in the companion Assessment Report. The Plan also delineated the TWC's methodology for prioritizing watersheds/waterbodies, and for prioritizing NPS implementation projects. The key to the state's NPS management strategy was seen as participation and cooperation among the several state, local, and federal agencies responsible for managing NPS related activities. EPA gave its approval only to select portions of the original 1988 Program Plan, including the agricultural and silvicultural components. Additional information was requested on several components of non-agricultural, surface water NPS pollution. The NPS Management Program Plan provided by the state for this project was only the Update for the select non-agricultural NPS components; copies of the original Plan were no longer available. However, the components of the approved Silvicultural NPS Control Program have been summarized in other formats (5, 152), which provided the basis for the information presented here.

No silvicultural NPS control program had been developed in Texas prior to EPA approval of the agriculture and silviculture components of the state's NPS Management Program. In the Program Plan, the state proposed a silvicultural NPS control program

composed of six tasks, with milestones and implementation schedule as specified in the Plan, and requested funding from EPA for its program. EPA provided funding for the program in FY 1990 through a Section 319 Grant to the State of Texas. With this funding, Texas initiated its Silvicultural Nonpoint Source Project (152), a project designed to reduce NPS water pollution from forestry activities based on widespread adoption of voluntary silvicultural BMPs. The TFS implemented the Project through its Forest Resources Development Department, under the supervision of a BMP Project Coordinator (Roger Lord), a BMP Staff Forester (Jay Tullos), and a BMP Project Leader (John Norris).

The six tasks which collectively comprise the Silviculture NPS Management Program may be summarized as follows:

1) Develop and implement a strategy for the distribution and use of education and training materials on forestry BMPs and NPS control programs;

2) Integrate forestry BMPs into relevant state forest management programs;

3) Develop Silvicultural BMP Demonstration Sites on select state forests;

4) Coordinate the silvicultural NPS control program with other appropriate state and federal agencies;

5) Continually evaluate each program component and revise as needed; and

6) Develop and implement a program to monitor BMP compliance.

With the funding received from EPA, all of the above tasks have been implemented and provide the basis for the NPS control program for Texas summarized in this section.

E. Forestry BMP Manual(s)

Forestry BMPs were initially established and published in summer 1990. BMPs were modeled after those for Arkansas, and were developed by TFS with assistance from TSSWCB and TFA. The BMP manual (158) contains an introductory discussion of forestry in Texas and of the role and benefits of BMPs in controlling silvicultural NPS problems. Recommended BMPs are presented under the headings of Planning (General and Planning Design); Road Construction and Maintenance (Road Location, Construction, Drainage, Water Crossing, and Maintenance); Harvesting (Harvest Design, Felling and Bucking, Skidding, and Disposal of debris and litter); Mechanical Site Preparation/Planting (General and Equipment Operations); Fire - A Management Tool; Silvicultural Chemicals (Maintenance of Equipment, Mixing, Managing Spills,

Aerial Application, Ground Application, Limitations on Application, Container handling and disposal, and Records); and SMZ (General). Following presentation of the BMPs, the manual contains a lengthy section that presents detailed Technical Guidelines for Implementing BMPs. Guidelines are presented for Truck Haul Roads; Skid Trails; Log Decks, Landings, and Portable Sawmill Locations; Broad-Based Dip; Rolling Dip; Water Bars; Cross Road Drainage by Pipe or Open Top Box Culvert; Water Turnouts; Stream Crossings; SMZ; and Salvage and Sanitation in SMZ's. Each section of technical guidelines summarizes recommendations in four or five subsections: Definition, Purpose, Condition Where Practice Applies, Specifications, and (in some cases) Maintenance. The manual concludes with a lengthy Glossary defining key terms. Overall, the manual is produced in an easy to use spiral bound format and contains numerous figures, illustrations, and tables containing specific numerical criteria.

A process to update and revise BMPs was initiated as a specific outcome of the first compliance survey, and of the problems it revealed (152). Specific revisions resulting from this survey included extension of SMZs to include protection of intermittent streams, and increased attention to practices to reduce fireline erosion. The revised manual in undergoing review prior to publication.

F. State Forest Practice Rules

Texas has not established formal forest practice rules.

G. Special Rules -- Wetlands, Cumulative Effects, or Groundwater

Besides the statutes cited earlier and the voluntary BMPs for forestry operations, Texas has no special rules for protection of wetlands, cumulative effects, or groundwater.

H. Program Changes Since 1980

It was noted in several recent reviews of NPS control programs in the southern U.S. (10, 18) that only upon identification and documentation of silviculture-related water quality problems would BMPs and a silviculture NPS control program be developed and implemented. Even as late as the 1989 review by Siegel, no such problems had been identified and no program developed. Thus, the entire program described in this section has been developed since 1980 and, in fact, since approval of the state's Nonpoint Source Management Program Plan by EPA in 1990. The totally new program (the Texas Silvicultural Nonpoint Source Project) was funded by a FY 1990 Section 319 Grant from EPA and is managed by the TFS through its Forest Resources Development Department (152). The Program is administered by a BMP Project Coordinator, working together with a BMP Staff Forester and a BMP Project Leader.

I. Educational and Training Programs to Promote Compliance

The TFS has implemented an aggressive program of education and training since initiation of its silviculture NPS control program in 1990 (152). TFS staff estimate their educational efforts have reached an audience of over 20,000 individual landowners, foresters, loggers and silvicultural contractors, and the general public over the past three years. Key program components include: radio and television interviews and appearances; articles in relevant newspapers/letters and magazines and general news releases; distribution of the BMP manual to landowners, foresters, and loggers in cooperation with TFA, forest products companies, and forestry consultants; BMP meetings and workshops for various audiences including forest landowner associations; BMP exhibits and presentations at special events; and distribution of educational flyers to loggers, truckers, and other silvicultural contractors in cooperation with major forest products companies. Another key component of the TFS educational effort involves establishment of BMP demonstrations on the Jones and Fairchild State Forests, where 30 different forest practices related to erosion remediation along roads, skid trails, and firelines; SMZs; installation of wing ditches, water bars, broad-based dips, open top box and steel cross drain culverts; use of geotextile low water crossings; culvert stream crossings; and revegetation of roads and skid trails are demonstrated at 18 tour stops. The TFS has also disseminated information on BMPs at the Annual Leadership Conference of county forest landowner associations, and at workshops sponsored by individual associations for their members (5).

J. Compliance Survey Methods and Results

The TFS has now developed a program for monitoring BMP compliance statewide, and has completed its initial compliance survey (152). Results are being summarized for publication. The initial survey evaluated 162 representative sites on which silvicultural activities had occurred during the period of 1990-1992. About 88% of the sites received an acceptable overall compliance rating. However, compliance varied with ownership, type of operation, landowner and contractor knowledge of BMPs, level of professional forester involvement, and other site-specific factors. Compliance was found to be highest on sites: managed under public ownership, where a forester was involved, with non-erodible soils, where the landowner and logger or contractor were familiar with BMPs, where the landowner or their representative supervised the operation, and where the operation involved site preparation or commercial thinning. Compliance was lowest on sites: owned by non-industrial private landowners having < 1,000 acres, where a forester was not involved, on erodible soils, where the landowner and logger or contractor were unfamiliar with BMPs, where the work was not supervised, and where the operation involved clearcutting.

A number of major deficiencies were identified in the survey, as follows:

- Permanent roads -- failure to stabilize stream crossings, roadside ditches dumping into streams;
- Temporary roads -- lack of water bars or other drainage structures, incorrect or poorly designed stream crossings, use of log or dirt stream crossings, failure to restore and stabilize stream crossings;
- SMZs -- lack of SMZs on intermittent streams (not in BMPs then current), logging debris left in stream channels without SMZs;
- Site preparation -- erosion on firelines surrounding the area.

In terms of water quality impacts, stream crossings were the most significant problem observed. The key deficiencies were use of log and dirt crossings on temporary roads and failure to restore and stabilize crossings on both permanent and temporary roads. When BMPs were properly implemented, they were effective in controlling NPS pollution. Failures were the result of incorrect implementation or failure to use other needed BMPs at the same time.

Two key weaknesses in existing BMPs were identified through this initial compliance survey, and have already been incorporated into the BMP revision process described above. These weaknesses were 1) extension of SMZs to include protection of intermittent streams and 2) increased attention to practices to control fireline erosion.

In terms of ownership classes, highest compliance was found on public lands, especially those managed by USDA-FS. Major forest products companies have done a "commendable job" of incorporating BMPs into operations on fee-owned lands, though some deficiencies were noted, but need to expand efforts on purchased timber tracts. Large non-industrial private landowners had compliance rates at least as high as forest industry, probably due to involvement of consulting foresters. The major weakness in compliance was seen on smaller non-industrial private tracts. Even in such cases, however, compliance was considerably higher when both owner and logger were familiar with BMPs. "Education is clearly the key to improving compliance on this ownership category" (152).

The TFS estimated that the level of implementation of voluntary BMPs revealed in this first survey has already reduced stream sedimentation in East Texas by about 40% over the "no BMP" level. But, the Service also recognized the need for a sustained cooperative educational effort to reach the estimated 150,000 non-industrial private landowners and 2,500 loggers and contractors in the state (152).

K. Research on BMP Effectiveness

The TFS is not currently sponsoring or cooperating in any research within the state on BMP effectiveness. However, the state contact (151) did provide a photocopy of pertinent pages taken from Glasser (15) summarizing forest water quality research conducted in East Texas. Most of this work was conducted by staff from the Departments of Forestry at Texas A&M and Stephen F. Austin Universities. Additional research relevant to forestry NPS control in Texas has been conducted by the University of Arkansas at Monticello, and by the USDA-FS Forest Hydrology Laboratory (Oxford, MS). In addition, results of the initial TFS compliance survey provide evidence that BMPs are effective in controlling NPS pollution when properly applied (152).

L. Special Problems or Issues

The CZMA is an issue relevant to forestry in Texas. However, it is general public concerns with the environmental impacts of forestry that are likely to have an impact on future changes in silvicultural NPS control programs in Texas rather than any single specific issue (152).

XIV STATE REPORT FOR VIRGINIA

A. Program Overview

The Virginia Water Control Board (VWCB) has been designated as the lead agency responsible for assessing and controlling NPS pollution within the state and for meeting the state's responsibilities under relevant federal water quality legislation including Section 319 of the Clean Water Act of 1987. The VWCB is responsible for enforcing provisions of the Virginia Water Control Law, for establishing water quality standards, for monitoring waters of the state to assess compliance with established standards, and for overall water quality management. The Virginia Department of Soil and Water Conservation (VDSWC) is responsible for developing and implementing the provisions of the state's Water Quality or NPS Management Program and for coordinating the various Program components, for administering local erosion and sediment control programs consistent with the Virginia Erosion and Sediment Control Law, and for coordinating the Chesapeake Bay NPS Pollution Program; VDSWC is also the lead agency for agricultural NPS control in the state. Responsibility for implementing and managing the forestry NPS Control Program has been delegated to the Virginia Department of Forestry (VDOF), with assistance from VDSWC (159, 160).

The VWCB manages NPS pollution problems which result from silvicultural and other sources pursuant to the Virginia Water

Control Law. In the case of silviculture, it manages a limited regulatory program: it manages and coordinates (with VDSWC) the overall program, and is authorized to investigate and regulate NPS pollution problems from silvicultural operations on a complaint basis. It may initiate civil actions and levy fines of up to $10,000 per day. However, with the recent passage of the Virginia Forest Water Quality Law, which gives VDOF authority to investigate and regulate water quality violations from forestry operations, this authority may be viewed as an ultimate regulatory backstop to be used cooperatively with VDOF actions.

The VDOF has implemented a comprehensive, voluntary program of BMP development, dissemination, awareness, education, and monitoring for the control of NPS pollution resulting from forest management operations (5, 10, 11, 160, 161, 162, 163). Following establishment of the Chesapeake Bay Agreement in 1987, the VDOF developed a formal policy statement in 1988 that recognized quality water as an integral component of forest resources, and established water quality protection as the number one priority of the Department while still maintaining a high level of silvicultural activity. This policy statement elaborated a set of goals and objectives (summarized in Section XIV, D below) focused on reducing sedimentation to the Chesapeake Bay from silvicultural activities by 40% by the year 2000, in accord with the Agreement. In order to achieve compliance with voluntary BMPs, the VDOF established a Forest Task Force for Water Quality, made up of 25 members drawn from forest industry, consulting foresters, Virginia Polytechnic Institute and State University (VPI&SU) Cooperative Extension Service, the Lumber Manufacturers Association, and the Virginia Forestry Association (VFA). This Task Force was assigned responsibility to oversee the statewide BMP effort, and to recommend adjustments in and areas of emphasis for the NPS control program.

The VDOF and Task Force have together implemented a multifaceted program for silvicultural NPS control. The VDOF works with others in the state, including the VFA and VPI&SU Department of Forestry and Cooperative Extension Service, to develop, disseminate, evaluate, and revise forestry BMPs. The VDOF maintains a vigorous program of BMP education and awareness targeted at both the general public and the forestry community, including BMP awareness sessions focused on both the importance of water quality protection and BMP implementation, and the threat of future regulation; and information dissemination via videos, programs for the public, newspaper articles, and TV programs. The VDOF provides special training in BMPs and water quality protection for members of the forestry community through meetings, workshops, presentations and exhibits at special meetings, one-on-one contacts with loggers and other forest operators during its site inspection program, field demonstrations, video and slide-tape programs, publications and brochures, and field and bus tours. VDOF also provides technical

and cost share assistance (through the federal Forest Incentives Program, Agricultural Conservation Program, and Reforestation of Timberlands Act, and the Virginia Agriculture Cost Share Program) to forest landowners and operators in implementing water quality protection measures; provides management assistance to other state and local agencies; employs BMPs in all operations on state forest lands; includes BMPs in forest management plan advice for private landowners; and recommends incorporation of BMPs into timber sale contracts. BMPs are required for payments to landowners under the Reforestation of Timberlands Program.

A key component of the overall VDOF NPS control program involves evaluation of both program success in reducing NPS pollution and BMP implementation and effectiveness. VDOF has developed a baseline database of erosion and sedimentation rates from forestry operations, stratified by region of the state and time since harvest. It also maintains an aggressive program of on-site inspection: the goal of this program is inspection of all timber harvest operations in the state, to determine the degree and success of BMP implementation. Results of this inspection are discussed on site (if possible) with the landowner, timber buyer, and logger, and entered into a statewide database for subsequent analysis. Consistent with the recently passed Forest Water Quality Law, the VDOF maintains an aggressive program of investigating water quality problems or violations revealed by citizen complaints or its own on-site inspection program. Under this legislation, VDOF may enter into Special Orders to implement corrective measures for identified problems, and issue Stop-Work Emergency Orders, including civil penalties of up to $5,000 per day, in response to serious water quality degradation or failure to comply with Special Orders. VDOF is also sponsoring and cooperating in research on BMP effectiveness, conducting chemical and biological water quality monitoring at three sites in the state, and conducting systems modeling studies to assess water quality impacts of timber harvest and to evaluate policy alternatives. The Forest Task Force maintains a review team that is responsible for monitoring program progress in attaining its stated sediment reduction goals.

Finally, VDOF has worked with the VFA and Lumber Manufacturers Association to develop a system for recognizing consulting foresters and forest products buyers who receive training in and implement BMPs, and of loggers who use BMPs. It has also established Memoranda of Understanding with the state's consulting foresters, to encourage BMP training and provision of services consistent with state BMPs; and with forest products buyers, to encourage them to commit to the voluntary BMP program, to require contract loggers to adhere to BMPs, and to receive training in BMPs. Through the end of 1991, 92 of 117 consulting foresters in the state, and 51 forest products buyers, had executed these MOUs.

Thus, Virginia has a non-regulatory program for silvicultural NPS control, backed up by an aggressive regulatory program for violators managed by VDOF, by authority (not currently employed) for an additional regulatory element for violators on the part of VWCB, and by the authority to make the entire program regulatory if current voluntary approaches are not effective in protecting water quality. Indeed, the success of the entire program is tied through the NPS Management Program to the achievement of specific goals for reductions of sediment yield from forestry operations by the year 2000. Should these goals not be achieved, the State Forester is required to draft and submit legislation for the implementation of mandatory BMPs, and thus for a regulatory program of silvicultural NPS control (160).

B. Water Quality and NPS Control Statutes and Regulations Relevant to Forest Management

The primary statute pertaining to control of NPS pollution is the Virginia Water Control Law (7, 9, 164). The Law establishes the Water Control Board as the lead water pollution control agency in the state. Following a hearing, the Board is authorized to issue orders to prevent pollution and to seek injunctive relief against violators. It can initiate civil actions and fines of up to $10,000 per day of violation, particularly if fish are killed as a result of pollution discharge. The legislation is broad enough to cover NPS pollution, and to provide the Water Control Board with the authority to regulate forestry activities that contribute to NPS pollution. The statute specifically lists decayed wood, sawdust, shavings, and bark as potential pollutants.

The Virginia Erosion and Sediment Control Law (160, 165), administered by the VDSWC, specifies procedures which must be followed in controlling and reducing erosion from lands in the state. The Virginia Erosion and Sediment Control Handbook specifies technical practices and BMPs which must be implemented consistent with this Law. Currently forestry operations are exempt from the provisions of this statute.

The Virginia Forest Water Quality Law (163, 166), which became effective on July 1, 1993, provides the VDOF with specific legal authority to protect water quality from excessive sedimentation originating from forestry operations. The legislation is intended to complement the existing voluntary NPS control program, by allowing the VDOF to regulate the activities of operators who are unwilling to cooperate with the existing program and who are causing water quality degradation. If a problem is found during regular monitoring of forestry operations by VDOF county personnel, the owner and/or operator are provided with recommendations and a designated time frame for corrections. A Notice of Required Action is issued if corrective actions are not taken. If the problem is still not corrected, an informal

conference is scheduled and a Special Order written, signed by both VDOF and logger, specifying corrective actions and a time frame for completion. If the terms of the Special Order are not followed, a Stop-Work Emergency Order is issued by the Regional Forester, a formal hearing scheduled, and a civil penalty of up to $5,000 per day assessed. A Stop-Work Emergency Order may be issued at any time if a severe water quality problem is found to exist. The legislation also includes provisions for a final inspection by VDOF at the conclusion of the harvesting job. If the owner or operator has followed proven conservation measures and protected water quality, they are relieved from any future water quality corrective actions on that tract.

The Virginia Debris in Streams Laws (7, 9, 167) prohibit depositing timber or like material into the waters of the state, and placing tree tops or logs into rivers or streams such that they obstruct the movement of fish or boats for periods of one week or more.

The Virginia Scenic Rivers Act (9, 168) allows permitted activities to continue on rivers and river segments as designated on an individual basis; the Act specifies that the continuation of forestry activities on designated rivers is encouraged.

The Virginia Wetlands Act (9, 169) specifically permits harvesting of forest products in wetlands.

C. State 319 Assessment Report

The Virginia Nonpoint Source (Section 319) Pollution Assessment Report was completed and submitted to EPA in April 1988; a revised version was submitted in May 1989 (159). Primary work on the Assessment Report was completed by the VDSWC, with input and assistance from a NPS Advisory Group composed of representatives from numerous state and federal agencies and other organizations including VWCB, VDOF, and VFA. Data for the Assessment were drawn from current site-specific ambient monitoring data, data from state 305(b) reports, and evaluative data including modeling studies, other assessment studies, and best professional judgment. Primary results of the assessment were summarized by major river basin in the state.

NPS pollution was found to be causing widespread impacts to surface waters throughout Virginia. A total of 4,294 miles of rives and streams, and 498 square miles of estuaries, were listed as impacted by NPS pollution. Primary causes of impact to freshwaters were elevated bacteria (87%), excessive sedimentation (54%), elevated nutrients (46%), elevated metals (35%), and pH problems (11%). For estuaries, primary causes of impairment were elevated nutrients (99%), elevated bacteria (71%), elevated metals (53%), pesticides (46%), and excessive sedimentation (31%). The VWCB has identified many waters of the state as well

as all estuarine waters draining into Chesapeake Bay as nutrient enriched in reference to its existing nutrient standard, accounting for the high percentage of waters classified as nutrient impacted. Of the 161,089 acres of public lakes in the state, 13,737 acres (or 8.5%) were assessed as impaired.

The two major categories of NPS impact identified in the Assessment were agricultural and urban sources; urban particularly included failing and nonexistent septic systems. Both were common in five of the nine river basins assessed. Mining was a localized impact in only the Tennessee-Big Sandy River Basin, as was silviculture in the Chowan River Basin. The Report noted, however, that data and information on forest-related NPS impacts were limited. Only a single lake, representing 130 of the 13,737 acres impacted (1%), was listed as impacted by silviculture.

D. State 319 Management Plan

The Virginia Nonpoint Source (Section 319) Pollution Management Program Plan was completed and submitted to EPA in August 1988; a revised Plan was submitted in May 1989 (160). Primary work on the Plan was completed by VDSWC with input and assistance from a NPS Advisory Group composed of representatives from a number of state and federal agencies and other organizations including VWCB, VDOF, and VFA. The Plan specifies that the VDSWC will have primary responsibility for implementing the Section 319 Management Program, for coordinating the various NPS control programs with one another, and for ensuring that these programs are consistent with the programs of the VWCB required to achieve compliance with established water quality standards. Similarly, the VWCB is noted as being the lead water quality management agency in the state responsible for establishment of water quality standards, for monitoring to measure compliance with standards, and for overall water quality management and regulation.

The forestry section of the NPS Management Plan reviews the possible impacts of forestry operations on water quality; identifies the VDOF as the lead agency responsible for the Forestry NPS Management Plan (with assistance in Plan implementation provided by VDSWC); summarizes the purpose and goals of the Plan, and the responsibilities, authority, and functions of the agencies contributing to the Plan; identifies resources available for the Plan; and establishes Plan milestones for the period 1989-2000.

The overall purpose of the Plan is to assure that silvicultural activities meet the requirements of the federal Clean Water Act; six specific goals have been established for the Forestry Program:

1) Reduce sediment and nutrient loadings to Chesapeake Bay by 40% by the year 2000, consistent with the 1987 Chesapeake Bay Agreement;

2) Monitor and evaluate sources of sediment and nutrients to waters of the state from silvicultural activities beginning with 1989;

3) Reduce erosion from silvicultural activities by proper implementation of BMPs on all forestry operations statewide (private, industrial, federal, state);

4) Conduct 90% of harvest operations according to a preharvest plan by 1995;

5) Develop and implement an education program for forest landowners and loggers concerning water quality impacts of silvicultural activities and required water quality protection measures; and

6) Locate and identify problem areas and assist with/encourage corrective actions.

The Plan specifies the responsibilities and actions to be taken by the VDOF, VDSWC, VPI&SU Department of Forestry and Cooperative Extension Service, and USDA-FS and -SCS in the areas of technical assistance, monitoring, training and education, research, cost share assistance, and program evaluation, as well as the proposed scheduling of these activities over the coming 10-year period. The Plan also specifies the following goals for reductions in sediment yield resulting from forestry operations: by 1991, 10% reduction; 1995, 30%; and 2000, 40% (the level of reduction identified in the 1987 Chesapeake Bay Agreement). Of critical significance for the forestry NPS control program, should these goals not be met, the Management Plan specifies that the State Forester, with the concurrence of the VWCB, will draft and submit legislation for the implementation of mandatory silvicultural BMPs. Such an action would obviously lead to a transition from a voluntary to a regulatory program of NPS control for forestry operations.

E. Forestry BMP Manual(s)

Forestry BMPs were initially developed in Virginia in the early 1980's, and were revised in 1988-89 during the Section 319 assessment and reporting process. BMPs were developed and revised by VDOF in cooperation with VFA, VPI&SU Department of Forestry and Cooperative Extension Service, forest industry, and others. The BMP revision not only revised existing BMPs but also added a new section of BMPs for operations in forested wetlands. The VDOF currently maintains and distributes a single BMP manual (170), along with a smaller pocket guide that can be taken to the

field by loggers and others (5). The BMP manual contains an introductory section that reviews the purpose and use of BMPs relative to water quality protection from forestry operations and encourages their adoption; reviews the relationship of forestry operations to water quality, including discussions of factors causing soil erosion and of the major water pollutants potentially generated during silvicultural operations (sediment, nutrients, organics, temperature, and chemicals); and discusses the relationship of water quality BMPs to wildlife habitat relative to the potential impacts of forest harvest on habitat.

The bulk of the manual presents the individual BMPs in a section entitled "Technical Specifications for Forestry Activities and BMPs." Individual BMP Guidelines are presented for Pre-Harvest Planning; Truck Haul Roads; Skid Trails; Log Decks, Landings and Portable Sawmill Locations; Streamside Management Zone (SMZ); Broad-Based Dip; Rolling Dip; Water Bars; Cross Road Drainage by Pipe or Open Top Box Culvert; Stream Crossings; Water Turnouts; Site Preparation and Regeneration; Revegetation of Bare Soil Areas (Seeding Seasons, Seeding Mixtures and Guidelines, Critical Area Planting, and Additional BMP Measures); Wildlife Control and Reclamation; and Salvage and Sanitation in SMZ's.

A separate section of the manual presents BMPs for forested wetlands. This section begins with a discussion of the management of forested wetlands, particularly in reference to wetlands hydrology and wetlands soil types. It presents a description of Timber Harvest Management Systems for forested wetlands, a Key to Forested Wetlands Soils, a Description of Forested Wetland Types, and a discussion of Natural Regeneration of forested wetlands. Specific BMP Guidelines are presented for Pre-Harvest Planning; Truck Haul Roads; Skid Trails; Log Decks; Streamside Management Zone (SMZ); and Cross Drainages (Pipe Culverts, Rip-Rap, Fords, and Bridges).

In both of the main sections of the BMP manual, individual BMPs are presented and discussed under four sub-headings: Definition, Purpose, Condition Where Practice Applies, and Specifications. BMPs are presented in considerable detail, and the manual includes numerous tables, figures, and illustrations containing specific numerical criteria.

The manual concludes with a list of References, a Glossary of key terms, a table of Soil Erodibility Categories for use with the USLE, and a listing of additional Selected References.

F. State Forest Practice Rules

Virginia has not established formal forest practice rules. It is conceivable that long-term resolution of the Chesapeake Bay issue could lead to the establishment of such rules, particularly

if established sedimentation reduction goals are not met, but to date there has been no move in this direction.

G. Special Rules -- Wetlands, Cumulative Effects, or Groundwater

Besides the statutes cited earlier, the voluntary forestry BMPs, and the special measures taken to protect water quality in the Chesapeake Bay following the Chesapeake Bay Agreement of 1987, Virginia has no special rules for protection of wetlands, cumulative effects, or groundwater.

H. Program Changes Since 1980

In its last survey of silvicultural NPS control programs for the southern U.S., NCASI (18) noted that Virginia's program was based on voluntary BMPs developed to provide performance standards appropriate to the physiographic and hydrographic characteristics of the state. VDOF was training its own and other natural resource agency staff, loggers, and foresters in BMP implementation. The Division had developed management guides for access roads and trails, site preparation, tree planting, pesticide use, forest harvesting, revegetation, forest recreation, and wildfire control and reclamation. VDOF foresters were including BMPs in recommendations for forest management plans. BMP implementation was targeted in specific priority watersheds. Program success was being gaged in terms of numbers of BMPs implemented, people contacted through training, resources committed to the program, and water quality improvements. However, it was also noted that future program developments were likely to be constrained by shrinking budgets. Nonetheless, a more recent survey found Virginia to have one of the three most active southern programs in terms of budget and personnel (11).

Subsequent to the 1987 Chesapeake Bay Agreement, and the VDOF adoption of the policy statement that water quality protection would be the Division's first priority, significant enhancements and growth have occurred in the state's forestry NPS control program. A forest hydrologist has been hired to manage the overall NPS control program. BMPs have been revised, including addition of a new section of BMPs for forested wetlands. Significant enhancements in the overall program have occurred in the areas of education and training, monitoring and inspection, program evaluation, and cost share assistance. The overall success and future direction of the program have been tied to the achievement of established goals for reductions in erosion and sedimentation, water quality protection has been established as the number one priority of the entire VDOF program through elaboration of a formal policy statement, and the program has been clearly linked to the water quality goals established under the Chesapeake Bay Agreement. Finally, the newly enacted Forest Water Quality Law gives the VDOF specific authority to deal aggressively with operators who are causing water quality degradation.

Associated with the increased emphasis on water quality protection from forestry operations in the state, there has been a large increase in awareness of both the importance of BMPs and the consequences of irresponsible water quality management. Rates of compliance with forestry BMPs have increased, and most members of the forestry community appear to be making a sincere effort to apply BMPs properly when harvesting timber. The threat of future regulation of forestry operations if the existing voluntary program of NPS control fails has proved to be an effective mechanism encouraging these changes (162).

I. Educational and Training Programs to Promote Compliance

A recent survey of NPS control programs by Cubbage et al. (11) concluded that Virginia maintained the most vigorous education and training program in the South. Education and training are certainly key component of the state's current NPS control program (5, 160, 161, 162).

The expanded NPS control program was initiated through a series of 30 statewide "awareness meetings" attended by loggers, foresters, landowners, agency staff, and the public. These meetings focused on the design of the voluntary NPS control program, the importance of BMP implementation, and the "threat" of future regulation. This awareness component has remained an active part of the public education effort. VDOF attempts to educate the public on water quality protection approaches through videos, TV programs, newspaper articles, continuing awareness sessions, and public programs for civic, conservation, and professional organizations statewide.

VDOF also sponsors and conducts, with assistance from VFA, forest industry, and VPI&SU, BMP and water quality protection training sessions and workshops for loggers, consulting and industry foresters, VDOF and other agency staff, and forest landowners. It distributes the BMP manual and a smaller, pocket-sized edition for loggers, as well as BMP and water quality videos and publications. It has sponsored special workshops and training sessions on rutting, pre-harvest BMP planning, BMPs in fire line construction and reforestation, and inclusion of BMPs in forest management plans. It uses BMP exhibits at special meetings, such as the East Coast Logging Exposition, and cooperates with VFA, VPI&SU, and forest industry in including BMP training and demonstrations at VFA meetings and Forestry Bus Tours. The VDOF also conducts field demonstrations of proper BMPs, including a cooperative demonstration with VDSWC of its rainfall simulator to show the impacts of forestry operations on erosion and sedimentation with and without BMPs. A video of this latter demonstration has been produced and distributed. Finally, a key ingredient of the VDOF site inspection program involves one-on-one sessions with loggers and other forest operators to evaluate and provide feedback on proper BMP application.

J. Compliance Survey Methods and Results

An initial survey of logging operations by VDOF in 1987 revealed that less than 50% had employed adequate BMPs to achieve water quality protection (5). Since initiation of its expanded NPS control program in 1988, VDOF has maintained an active component of on-site inspection to evaluate BMP compliance and program success (5, 161, 162). Its goal in this program component is to inspect all logging operations conducted on sites five acres in size or larger; to date inspections have been conducted on 60-90% of sites in individual forest districts. VDOF developed and revised an inspection form for this purpose, and trained its own and industry foresters in its use. VDOF or industry foresters conduct an interim and a final on-site visit and inspection of identified operations to determine if proper BMPs were applied correctly. Results are discussed on site with the landowner, logger, and timber buyer, and entered into a database by owner, logging contractor, consulting forester, timber buyer, and geological province. Results are analyzed in order to assess compliance, evaluate program success, and evaluate the overall condition of forest waters in the state and the water quality benefits of specific BMPs. Reports can be generated that identify practices, loggers, or specific locations needing improvement.

Three time periods have been surveyed and results analyzed in terms of overall compliance: January - October 1989, October 1989 - August 1990, and January 1990 - January 1991. The latest results show the following rates of compliance by BMP category: haul roads, 93%; skidding, 93%; landings, 94%; and SMZs, 100%. As compared with the initial time period, these results represent the following percentage improvements in BMP compliance: haul roads, +14%; skidding, +11%; landings, +10%; and SMZs, +29%. They represent an even larger improvement over the initial, less comprehensive survey in 1987. Based on these compliance results, the VDOF estimated that its NPS control program had achieved greater than a 10% reduction in sedimentation from forestry operations (actually, a 14.5% reduction, compared with the program goal of 10% reduction by 1991), largely due to the increased use of SMZs on perennial streams. Further reductions in forest sedimentation, consistent with program goals, would be contingent on improved implementation of other BMPs, as well as new BMPs (e.g., extension of SMZs) to prevent harvest impacts to intermittent streams.

In relation to compliance monitoring, the VDOF is also conducting water quality monitoring at three sites in the state, and investigating use of aerial photography for assessing BMP compliance (162).

K. Research on BMP Effectiveness

The VDOF is currently sponsoring and cooperating in several research efforts focused on BMP effectiveness (161, 162, 171). It funded a study of timber harvesting impacts on benthic macro-invertebrates, viewed as an overall indicator of the health of the steam ecosystem. The objectives of this study were to assess forest water quality at specific sites in the state, with baseline data on water quality based on sampling of benthic invertebrates; to determine effects of forest harvest on streams; and to compare biological with chemical measures of stream "health." Results were based on sampling benthic macro-invertebrates and chemical water quality parameters above and below timber harvests at a number of sites in the state. Study results revealed some water quality impacts due to harvest, largely related to changes in stream temperature. The duration or consequences of the measured changes are not yet clear (171). VDOF is also co-sponsoring, with VPI&SU, NCASI, and forest industry, the Nomini Creek Watershed Study (161, 162). This is a long-term study of the water quality impacts of forestry activities, and of the water quality benefits of BMPs. It is a continuation of an ongoing VDSWC study of agricultural BMPs as part of the overall Chesapeake Bay Program. Specific educational materials will be developed based on the results.

VDOF is also conducting chemical and biological ("rapid bio-assessments") water quality monitoring at three sites in the state, above and below sites of timber harvest. Results to date are very preliminary, but reveal no obvious signs of or trends toward water quality degradation. The Department is exploring the use of remote sensing (satellite imagery) to determine the quality of surface waters adjacent to forest lands, as well as changes in water quality following harvest, as part of the Nomini Creek Study. And, it is employing systems modeling studies to assess impacts of timber harvesting, including the relative importance of BMPs in reducing impacts, and to evaluate policy alternatives associated with the benefits of voluntary versus regulatory systems of water quality protection (161, 162).

Additional water quality and watershed research conducted by the USDA-FS also applies to portions of the state, specifically including work conducted at the Parsons, WV Timber and Watershed Laboratory (particularly their research on forest road system design and water quality impacts) and at the Coweeta Hydrologic Laboratory, Otto, NC.

L. Special Problems or Issues

Triggered by a variety of issues -- renewal of the Clean Water Act, strengthening of the Virginia Sediment and Erosion Control regulations, enactment of the 1987 Chesapeake Bay Agreement, and creation of the Chesapeake Bay Local Assistance

Department -- water quality and the supply of clean water have become a major public concern in Virginia (5). Virginia was one of four states in which respondents to a recent survey by Cubbage et al. (11) indicted that citizens, special interest groups, and natural resource agencies in the state would be likely to support greater regulation of forestry practices in the future, and mandatory BMPs including uncut buffer strips along lakes and perennial streams. There has been the public perception that forest management activities, especially logging, cause soil erosion and stream sedimentation. Forestry remains the only major industry not regulated by the Virginia Sediment and Erosion Control Law, which has led to greater scrutiny of forest management operations and the prospect of mandatory regulations. This possibility was enhanced by results of a 1987 survey of logging operations in the state, which revealed that less than 50% of operators had employed BMPs adequate to protect water quality. These issues definitely raise the prospect of a regulatory program of NPS control from forestry operations, or formal forest practice rules, being imposed by state or federal government, if it cannot be clearly documented that a voluntary program of BMP implementation is successfully protecting water quality, particularly associated with the Chesapeake Bay (5).

XV REGIONAL SUMMARY

The previous twelve sections of this report provide extensive information concerning the silvicultural NPS control programs developed and managed by the twelve states included by NCASI in the Southern Region and pertinent to the stated objectives of this review. In this final section of the report, several key aspects of these NPS control programs are highlighted in response to seven specific questions listed in the original NCASI RFP. Supporting details may be found in Sections III through XIV for the individual southern states.

A. Relative Importance of NPS Pollution from Forest Management Operations

The NCASI question was: "How does forestry compare to other nonpoint sources in terms of extent and nature of effects on water quality?" Based on information derived from the NPS (Section 319) Assessment Reports, it can be stated that, for each of the twelve southern states and the Southern Region as a whole, forestry represents a relatively minor source of NPS pollution as compared with other NPS categories such as agriculture, urban, hydromodification, and resource extraction. Data available for four states (GA, MS, TX, and VA) did not permit a quantitative ranking of NPS categories, but in all four of these states silviculture was listed as only a minor NPS source (e.g., < 2% of all NPS pollution in MS and VA). In four other states (NC, OK,

SC, and TN), forestry was ranked from fifth to ninth among all NPS categories, and accounted for 1 - 4% of impaired surface waters. In the remaining four states (AL, AR, FL, and LA), forestry was ranked higher as an NPS category (second through seventh) and accounted for a greater percentage of impaired surface waters (8 - 14%). However, even in these cases, forestry was associated with only minor or moderate impacts to surface water quality, largely resulting from silt or sedimentation. For example, forestry was ranked second in Arkansas, but this state has identified only three significant sources of NPS pollution, and forestry accounted for only 8% of all impaired waters in the state. Similarly, forestry ranked third overall in Alabama, accounting for 8% of impaired waters, but it ranked last among NPS categories when only major water quality impacts were considered. Thus, forestry represents a relatively minor source of NPS impact for the southern U.S., far behind other categories such as agriculture and urban.

The only caveat to this generalization is that forestry can be a locally significant source of NPS pollution, particularly in areas where silvicultural activities are concentrated and where BMPs are not implemented. Similarly, several states pointed out correctly that reliable data for establishing quantitative comparisons and rankings of NPS categories are not fully available in many locations and that in many cases data on forestry impacts are scarce or it is difficult to separate forestry from other sources present within the same watershed. Nonetheless, it can still be concluded, for the Southern Region as a whole and for individual states within it, that forestry is a relatively minor source of NPS pollution.

B. Establishment of Silvicultural NPS Control Program

The NCASI question was: "Do all states with substantial commercial forest management activity have regulatory and/or non-regulatory programs in place to control nonpoint source pollution from forest management operations?" At the time of the last NCASI survey of silvicultural NPS control programs in the southern U.S., four states (LA, MS, TN, and TX) effectively had no viable NPS control programs in place. The remaining eight states maintained viable NPS control programs which were strictly voluntary in nature.

At the present time, all twelve states in the Southern Region have either voluntary or regulatory programs in place for the control of silvicultural NPS pollution. Four of these programs (LA, MS, TN, and TX) have developed in the last six years, particularly associated with the Section 319 assessment and planning process. Nine of the states (AL, AR, LA, MS, OK, SC, TN, TX, and VA) maintain voluntary programs of BMP implementation and education. The Georgia program is largely voluntary, with a limited regulatory backstop for violators and

with BMPs required in certain sensitive areas of the state. The Florida program is described as being quasi-regulatory -- voluntary, with a regulatory backstop for violators, with BMPs required for certain permitted activities in wetlands, and with BMPs required in specific counties where silviculture is a significant land use. Finally, the North Carolina program is completely regulatory, requiring BMP implementation to retain the silvicultural exemption from the state's Sediment Pollution Control Act. In general, the five southeastern states (VA, NC, SC, GA, and FL) have somewhat more well-developed and stringent programs, with greater regulatory components, than the seven south central states (TX, OK, AR, LA, MS, TN, and AL).

Not only do all states in the Southern Region have active NPS control programs in place, but all such programs have undergone substantial changes and enhancements since the time of the last NCASI survey. The only exceptions are perhaps Arkansas, whose program has not changed significantly (though it should in the future based on plans in its NPS Management Program), and Oklahoma, which has seen more of a shift in program emphasis, from monitoring and research studies to BMP implementation and technology transfer, along with modest program enhancements. Four state programs (LA, MS, TN, and TX) are completely new, and the NPS control programs in the remaining six states (AL, FL, GA, NC, SC, and VA) have changed substantially over the past decade. Programs in three of these six states (FL, GA, and NC) have acquired strong regulatory elements (particularly NC, which is now strictly regulatory), and all six programs have seen enhancements in education and training efforts, technical assistance, and BMP compliance monitoring.

C. Rates of Compliance with BMPs and NPS Control Programs

The NCASI question was: "What is known about rates of compliance with BMPs and other programs to control nonpoint source pollution from forestry operations?" With the exception of Mississippi, which has no BMP compliance monitoring program in place or under development, all other states in the Southern Region have implemented, or are designing, programs to survey rates of BMP compliance on a recurring, routine basis statewide. The Oklahoma program is under development; no surveys have yet been conducted. Compliance monitoring programs for nine states (AL, GA, LA, NC, SC, TN, TX, and VA) are effectively new since 1988 or later, and each has completed between one and three compliance surveys. Monitoring and survey programs in both Arkansas and Florida have been in existence for over a decade each. However, while the results of Florida's surveys have been thoroughly analyzed and compiled, little use has been made of the extensive data collected in Arkansas.

Detailed results of these various compliance survey programs have been presented and discussed in the various state report

sections above. Each of the surveys has revealed wide variation in the degree of compliance and success across different BMPs and water quality protection practices, including areas where compliance is high and others areas requiring improvements and targeted education/training efforts to improve compliance. Overall BMP compliance rates have generally fallen in the 80 and 90% brackets. The only exception to this has been Louisiana, whose initial survey revealed an overall compliance rate of 51%. Nonetheless, this was considerably improved over an early, less thorough survey which revealed only 10% compliance with BMPs. In those states where several surveys have been conducted, compliance rates have increased over time in all cases. Specific geographic areas or site locations targeted for improvements in compliance rates in different states have included mountain sites with steep slopes. Similarly, BMPs identified for improvements have included SMZs, permanent and temporary roads, and site preparation practices. The major groups targeted for increased education and training efforts to improve compliance have consistently been small, private, non-industrial owners, and loggers.

D. BMP Effectiveness in Controlling NPS Pollution

The NCASI question was: "When BMPs are implemented, do they effectively control nonpoint source pollution from forest management operations?" Certainly, the greatest threat of water quality degradation associated with forest management operations comes from the failure to correctly implement proper BMPs, rather than from inherent flaws in the BMPs themselves. Indeed, there is a considerable body of literature that demonstrates the effectiveness of BMPs when correctly and consistently implemented. Many of the practices now included among state BMPs did not originate as such, but were individual practices shown to be effective in protecting water quality through applied watershed or water quality research conducted, for example, by the USDA-FS or by various universities. Some of this large body of forest watershed and forest water quality research is referred to in the various state summaries above. It is also summarized in a variety of publications and research summaries, particularly including (relative to the southern U.S.) Ice (2), Neary et al. (3), Riekerk et al. (4), Glasser (15), Blackmon (172), and Brown et al. (173). The research summaries of Glasser (15) and Blackmon (172) are especially useful in this regard, and demonstrate that BMPs can prove quite effective in minimizing damage to water quality from forestry operations. Many of the states in the southern U.S. also have programs in place -- including water quality monitoring studies, cooperative research on BMP effectiveness, and surveys to monitor and assess BMP compliance and effectiveness -- that are providing additional support for the effectiveness of present BMPs.

This does not imply that all existing BMPs are completely effective, that current BMPs provide full water quality protection following forest harvest, or that we know all we will ever need to know about the functioning of forest and stream ecosystems. As summarized in previous sections of this report, current monitoring efforts by specific southern states have identified some deficiencies in present BMPs and areas requiring new BMPs (e.g., extension of SMZs to protect intermittent streams). Some of these identified problems have already been addressed by recent revisions to current BMPs. Moreover, we still have much to learn about the specific processes through which forest management practices impact water quality, in both uplands and wetlands; about the cumulative downstream impacts of forestry operations; and about the impacts of forestry practices on the biological components of stream ecosystems. Nonetheless, although there remains room for improvement in BMPs and related water quality protection measures, the greatest threat to forest water quality comes, not from any lack of effectiveness of existing BMPs, but rather from the failure of forest operators and landowners to implement BMPs properly and consistently. This failure, and the water quality problems it causes, are particularly severe for forest operations on small, private, nonindustrial forest holdings, the largest and most diverse forest ownership class in southern U.S. forestry.

E. Regulation of Water Quality Standards Violations

The NCASI question was: "In each state with voluntary BMPs, what authority does the state have to control the actions of a logger or landowner who is blatantly disregarding BMPs and causing obvious impacts to water quality?" Only the state program in Tennessee, where silviculture is exempt from the state's Water Quality Control Act, lacks the authority to control the actions of loggers or landowners who blatantly disregard BMPs. All of the remaining eleven state programs at least have the authority to control the actions of violators (even though some states do not currently exercise that authority). All eleven states also have the legislative authority to make the entire silvicultural NPS control regulatory (NC already is) if current approaches fail to protect water quality. This "threat" of a future regulatory program is particularly acute in Virginia -- under this state's NPS Management Program, specific goals for reductions in sedimentation from forestry operations were established. Failure to meet these goals will require the State Forester to draft and submit legislation for initiation of a regulatory NPS control program.

Essentially four levels of regulatory control of silvicultural NPS violators exist among the remaining eleven state programs. In five states (AR, LA, MS, OK, and TX), the lead state water pollution management agency has authority to investigate silvicultural water quality problems and to regulate

the actions of violators, including imposing substantial fines, but this authority is not currently invoked in relation to forest management activities. Hence, six of the twelve southern states (these five plus TN) currently have no effective mechanism in place for regulating the actions of violators of water quality protection laws (though five of the states do have the authority to do so).

In four states (AL, FL, GA, and SC), the lead water pollution management agency actively uses its authority to investigate and regulate the actions of violators and to levy substantial fines. In Virginia, this authority to investigate-regulate-fine rests with the Department of Forestry, instead of the Water Control Board, which again actively employs it to regulate violators (note that the Water Control Board also has the authority, but it is not used given the new authority assigned to the Department of Forestry under the state's recently passed Forest Water Quality Law). Finally, the North Carolina program is completely regulatory and includes active regulation and fining of violators.

F. Educational Programs to Promote Compliance with BMPs and NPS Controls

The NCASI question was: "What extension/educational activities are planned or underway to promote compliance with BMPs and other programs to control nonpoint source pollution from forest management operations?" All twelve southern states maintain aggressive and innovative educational and training programs designed to enhance compliance with BMPs and NPS control programs. Each of the state programs includes specific combinations of training sessions and workshops for members of the forestry community, public education efforts, BMP demonstrations, on-the-ground one-on-one sessions with loggers and other forest operators, and BMP manuals and other publications/brochures/video presentations, as appropriate for its defined NPS control program. Although some of the state programs have tended to stand out a bit in terms of longevity, accomplishments, and resources committed to the program, each of the programs is ongoing, and each has shown substantial enhancement since the time of the last NCASI survey. Even the four states that have only recently initiated silvicultural NPS control programs have established viable and recognizable education/training components. In addition, for the few states which have completed more than one statewide BMP compliance survey (e.g., FL and VA), there is limited evidence that these education efforts are leading to increased awareness of BMPs as well as increased rates of compliance with existing BMPs. The unique elements that make up each state's educational program are described and summarized in detail in sections III through XIV above.

G. Special Protection Measures for Sensitive Sites

The NCASI question was: "Are there locations and/or site conditions in the region where the potential for nonpoint source pollution is substantially greater than average? If so, what special measures are being used (or considered) to reduce potential effects?" Most state contacts easily identified special or sensitive areas within their states where the potential for NPS pollution is substantially greater than average -- e.g., mountainous areas with thin soils and steep slopes, highly erodible soils (e.g., loess), areas in or adjacent to wetlands, and areas draining into nutrient-sensitive or special waters (e.g., Chesapeake Bay). In most cases, state programs rely on proper and careful application of established BMPs to reduce NPS effects in these areas. Only a few states have established special protection measures for such areas. South Carolina, for example, is concerned about the potential for accelerated erosion in the Blue Ridge Mountains, the southern Piedmont, and the southern Coastal Plain, and is seeking to provide special protection for these areas through its process to revise and update BMPs. Florida has established special requirements for certain permitted activities in wetlands and waters of the state, while Georgia has formulated special rules for the protection of particular sensitive areas (water supply watersheds, wetlands, river corridors, and mountains) requiring BMP implementation. North Carolina is considering special protection measures for mountain trout streams, wetlands, and water supply watersheds (3 watersheds in 16 counties), while concern over pollution and sedimentation to the Chesapeake Bay is effectively driving Virginia's program.

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APPENDIX A

PROJECT SUMMARY: SOUTHERN REGIONAL REVIEW OF STATE NON-POINT SOURCE CONTROL PROGRAMS AND BEST MANAGEMENT PRACTICES FOR FOREST MANAGEMENT OPERATIONS

(Mailed to all State Contacts)

PROJECT SUMMARY

Southern Regional Review of State Non-point Source Control Programs and Best Management Practices for Forest Management Operations

Background

FTN Associates, Ltd. currently is under contract with the National Council of the Paper Industry for Air and Stream Improvement, Inc. (NCASI; Dr. George Ice, Project Officer) to conduct a review of state non-point source (NPS) control programs and best management practices (BMPs) for forest management operations. FTN's review is focused on the twelve states of the Southern Region: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas and Virginia. Jack B. Waide is the FTN Project Scientist for this effort.

The objectives of this Southern Regional Review are to:

1) Summarize available information about the magnitude of forest management effects on water quality, and the relative importance of forestry and other non-point sources;
2) Identify and describe state statutes, regulations, and programs for controlling non-point source pollution from forest management operations;
3) Summarize studies of compliance with regulatory and/or non-regulatory non-point source control programs for forestry;
4) Identify and describe educational/extension efforts to promote compliance with regulatory and non-regulatory non-point source control programs for forestry; and
5) Summarize studies of the effectiveness of regulatory and/or non-regulatory non-point source control programs for forestry.

Appropriate individuals within each state -- especially in the state forestry/silvicultural NPS control agency, and also in the state environmental/water quality/NPS management agency, if needed -- are being contacted to obtain information pertinent to this review. Additional supporting information will be obtained from other individuals located in the 12-state southern region. Once assembled this information will be carefully analyzed and summarized in a report to NCASI. Similar reports are being prepared by other contractors for three additional regions of the U.S. (Central-Lake States, Northeast, West).

We are contacting you in the hope that you can provide information pertinent to our review, as listed below. Any information you can provide will be sincerely appreciated, and will contribute substantially to the success and final products of this project. We thank you in advance for your time and effort.

Information Requested

We would sincerely appreciate receiving information on the following items/topics for your state (or, if appropriate, for the entire 12-state southern region). We hope that most of this information can be supplied in the form of existing brochures, documents, manuals, or summaries, and that you will not have to prepare new materials in response to our questions. However, we will certainly also appreciate any written comments or information you are able to provide beyond existing documents, no matter how brief.

1) Does your state have regulatory and/or non-regulatory programs in place to control NPS pollution from forest management operations? When were these programs initiated/implemented? Can you provide us with a description/summary/ overview of your program(s)?
2) Have these programs changed substantively since 1980? If so, can you summarize the major changes that have occurred?

3) Similarly, do you envision substantive future changes in your programs, and can you summarize these expected changes, if any? What are the major issues that will drive future changes?

4) Is the authority for managing/controlling NPS pollution associated with forest management operations delegated to your agency, or is that authority retained by or shared with another agency (e.g., state department of environmental regulation, soil and water commission)? What is that agency, if any?

5) Relevant to your state silvicultural NPS control program, can you provide us with copies of the following information:
   - All state water quality and NPS control statutes, regulations, and programs relevant to forest management;
   - State 319 Assessment Report;
   - State 319 Management Plan;
   - State Forestry BMP manual(s);
   - State forest practice rules, if any exist; and
   - Any special rules or BMPs for wetlands, cumulative effects, groundwater, or other special issues.

6) Within your state, what is known about rates of compliance with BMPs and other programs to control NPS pollution from forestry operations? Have you conducted, and can you provide us with results of, compliance surveys? (We would also be interested in knowing your methods for assessing compliance.) Do you have educational and/or training programs in place (or planned) to promote compliance? Can you describe such programs? Are they proving to be effective in increasing compliance?

7) If your state program for controlling silvicultural NPS pollution is based mostly upon voluntary BMPs, do you have the authority to control the actions of landowners

or loggers who blatantly disregard BMPs and obviously cause impacts to water quality and beneficial uses? If you have such authority, do you ever exercise it?

8) Are there locations and/or site conditions in your state where the potential for silvicultural NPS pollution is substantially greater than average? If so, what special measures are being used or considered to reduce potential effects in such sites?

9) When BMPs and NPS control programs are properly implemented within your state, do they effectively control NPS pollution from forest management activities? Have specific studies of the effectiveness of regulatory and/or non-regulatory NPS control programs for forestry been conducted within your state (e.g., by universities or the USDA Forest Service)? Can you summarize the major findings of such research, or the status/contact points of ongoing research on BMP effectiveness?

10) Are there any special issues or problems within your state influencing current or future forestry BMPs, regulations, or NPS control programs (e.g., CZMA issues, the TVA chip barge issue in Tennessee)?

11) For your state (or the southern region), can you provide specific information on the:

- extent and geographic distribution of major forest types;
- extent, geographic distribution, and nature of forest management activities; and
- economic importance of forest-based industries as compared with other industries.

12) Finally, for your state (or the southern region), how does forestry compare to other non-point sources in terms of extent and nature of effects on water quality?

Summary

Considerable interest exists in assessing and preventing the potential impacts of NPS pollution associated with forest management operations on water quality and identified beneficial uses of water. These NCASI-sponsored regional reviews will provide useful information on the status and success of state NPS control programs and BMPs for forest management operations; they will also update the last general review and summary NCASI conducted of these programs nearly a decade ago. We sincerely appreciate any information you can provide us, and will carefully and gratefully acknowledge your contributions in our final report to NCASI. Thank you again for your time and your efforts!

APPENDIX B

SUMMARY OF INFORMATION RECEIVED
NCASI SOUTHERN REGIONAL REVIEW PROJECT
STATE NPS CONTROL PROGRAMS & BMPs FOR FOREST MANAGEMENT OPERATIONS

SUMMARY OF INFORMATION RECEIVED
NCASI SOUTHERN REGIONAL REVIEW PROJECT
STATE NPS CONTROL PROGRAMS & BMPs FOR FOREST MANAGEMENT OPERATIONS

1) Alabama --

State NPS Management Agency:
Alabama Department of Environmental Management (ADEM)
Water Division
1751 Congressman W. L. Dickenson Drive
Montgomery, AL 36130
Steve Foster (NPS Coordinator)
(205) 271-7839

Silvicultural NPS Control Agency:
Alabama Forestry Commission (AFC)
513 Madison Avenue
Montgomery, AL 36130-0601
Don Burdette, Environmental Forester
(205) 240-9378

Information received --
- Letter from Burdette containing detailed answers to questions, 9/21
- Section P-11, Environmental Forestry, AFC Procedural Manual (info on statutes and regs)
- Summary of Revision Process - AL BMPs for Forestry
- Memo re: AFC role in BMP process
- 1992 Instructor's Manual to AL BMPs for Forestry training course
- BMP Monitoring Report Summary & Form (AFC Memo)
- MoA, AFC-ADEM re: coordinated NPS control/Silvicultural BMP promotion efforts
- AFC BMP brochure
- Draft of revised BMPs (AL BMPs for Forestry, 1992, Draft)
- AL Handbook of WQ BMPs for Silviculture, 1989 (existing BMP Manual)
- WQ Management Guidelines & BMPs for AL Wetlands, 1989
- Forests of AL, AFC 1990
- Wood Products Export Directory, AFC
- USDA-FS FIA (SO) Reports for AL, complete except for Forest Resources of AL
- 319 Assessment Report (1989) & Management Plan (1989) (2 copies each)

2) Arkansas --

State NPS Management Agency:
Arkansas Department of Pollution Control & Ecology (ADPCE)
Water Division
8001 National Drive
P.O. Box 8913
Little Rock, AR 72209
Jim Wise, Chuck Bennett
(501) 570-2114

Arkansas Soil & Water Conservation Commission (ASWCC)
101 East Capitol, Suite 350
Little Rock, AR 72201
Bob Morgan, Tom Lane
(501) 682-1611

Silvicultural NPS Control Agency:
Arkansas Forestry Commission (AFC)
P. O. Box 4523, Asher Station
Little Rock, AR 72214
Randall Leister, Management Staff Forester
(501) 564-2531

Information received --
- Detailed notes from meeting with Leister & others, 9/15
- AR Division, SAF Briefing Papers (clearcutting, UEAM, wildlife)
- A Plan to Review AFC's Voluntary BMP Guidelines Program, AFC
- AFC summary, Monitoring Silvicultural Activities for WQ (2 versions)
- AFC Implementation Plan for NPS Silvicultural Control Measures, 1981
- BMPs Check List for NPS Control, AFC
- Summary of General Authorities (statutes/regs) re: AFC activities
- BMPs Pocket Guides (BMPs & WQ) (2 versions)
- BMP Guidelines for Silviculture (current BMP Manual)
- Copy of Act 91 re: tree tops in navigable streams
- MoU, AFC-Cleveland Co. Soil & Water Dist., re: AR WQ Management Plan
- AFC WQM Monitoring results re: USLE (3 sets of monitoring results)
- AR's Forest, Status & Change - 1988, AFC 1988
- AR's Fourth Forest: Alternatives for the Future, Ag. Exp. Stn. Spec Rpt. 133, 1989
- USDA-FS FIA (SO) Reports for AR, complete set
- 319 Assessment Report (1991) & Management Plan (1992, Draft)

3) Florida --

State NPS Management Agency:
Florida Department of Environmental Regulation (FDER)
Nonpoint Source Management Section, Bureau of Surface Water Management
2600 Blair Stone Road
Tallahassee, FL 32399-2400
Eric Livingston
(904) 488-0782
State Water Management District (WMD) Contacts:
* Northwest Florida WMD, Route 1, Box 3100, Havana, FL 32333
  [Mr. Richard Musgrove, (904) 539-5999]
* St. Johns River WMD, P. O. Box 1429, Palatka, FL 32077
  [Ms. Heather Nixon, (904) 329-4500]
* Suwannee River WMD, Route 3, Box 64, Live Oak, FL 32060
  [Mr. Terry Demott, (904) 362-1001]
* South Florida WMD, P. O. Box 24680, West Palm Beach, FL 33416-4680
  [Ms. Terrie Bates, (407) 686-8800]
* Southwest Florida WMD, 2379 Broad Street, Brooksville, FL 33512
  [Mr. Clark Hull, (904) 796-7211]

Silvicultural NPS Control Agency:
Florida Department of Agriculture & Consumer Services, Division of Forestry (FDOF)
3125 Conner Boulevard
Tallahassee, FL 32399-1650
Jeff Vowell, Hydrologist
(904) 488-4090

Information received --
- Detailed notes from phone conversation with Vowell, 9/16
- Letter from Vowell containing detailed answers to questions, 8/24
- Review of Forestry Regulations of the 5 Florida WMDs
- Policy 2.13 of Franklin Co., FL re: forestry operations adherence to BMP Manuals
- List, Selective Literature on Impacts to WQ from Silviculture Activities
- Select FL statutes pertaining to forestry operations
- Map of Major Forest Types in FL
- FL Forest Facts, 1991, FDOF
- Silviculture BMPs Manual, FDOF, 1990 (revised) (2 copies)
- Management Guidelines for Forested Wetlands in FL, FDOF/FFA
- 1991 Silvicultural BMP Compliance Survey, FDOF, 1992
- USDA-FS FIA (SE) Reports for FL, complete set
- 319 Assessment Report (1988) and Management Plan (1989)

4) Georgia --

State NPS Management Agency:
Georgia Department of Natural Resources (GDNR)
Environmental Protection Division, WQ Management Team
7 Martin Luther King, Jr. Dr., SW
Suite 643
Atlanta, GA 30334
Ted Mikalsen, Environmental Specialist IV
(404) 656-4988

Silvicultural NPS Control Agency:
Georgia Forestry Commission (GFC)
P. O. Box 819
Macon, GA 31298-4599
Frank Green, State WQ Coordinator
(912) 751-3480

Information received --
- Letter from Green containing detailed answers to questions, 9/21
- GDNR memo re: guidelines for handling potential silvicultural WQ problems
- Sample Forest Products Sale Agreement for Private Landowners, GFC
- Results of the BMPs for Forestry in GA Compliance Survey, 1991, GFC
- GFC BMPs Compliance Survey form
- Preliminary map, GA Geol. Surv., Streams > 400 cfs, 1991
- Preliminary Draft, GA Geol. Surv., Areas Subject to Mountain Protection, 1991
- GDNR Rules & Environ. Plang. Criteria (Protection of WS, Groundwater, Wetlands)
- GA counties & forms of logging regulation
- Map of Major Forest Types in GA
- The Economic Importance of Forestry to Georgia, GFC, 1992
- Recommended BMPs for Forestry in GA, GFC, 1985 (current BMP Manual)
- BMPs for Forested Wetlands in GA, GFC Wetlands Committee, 1990
- USDA-FS FIA (SE) Reports for GA, complete except for GA's Forests
- 319 Assessment Report (1989, 1991 update) & Management Plan (1989)

5) Louisiana --

State NPS Management Agency:
Louisiana Department of Environmental Quality (LDEQ)
Office of Water Resources, Planning & Assessment Division
P. O. Box 82215
Baton Rouge, LA 70884-2215
Barbara Romanski, Jan Boydston
(504) 765-0741

Silvicultural NPS Control Agency:
Louisiana Department of Agriculture & Forestry (LDAF)
Office of Forestry
P. O. Box 1628
Baton Rouge, LA 70821-1628
Don Feduccia, Chief, Forest Management
(504) 925-4500

Information received --
- Notes on questionnaire returned by Feduccia + notes from phone call, 9/16
- Forestry BMPs Training Seminars brochure, LDAF, 1992
- LDAF memo on value of goods from State Forest-Product Mills, 1992
- Map of LA Forest Types, LDAF
- LA Forestry BMPs (3-page summary/overview), LDAF
- BMPs Implementation Survey Procedures & forms, LDAF
- Recommended Forestry BMPs for LA, LDAF, 1988
- USDA-FS FIA (SO) Reports for LA, complete set except for Forest Resour. of LA
- 319 Assessment Report (1992) & Management Plan (1992)

6) Mississippi --

State NPS Management Agency:
Mississippi Department of Environmental Quality (MDEQ)
Water Quality Management Section, Bureau of Pollution Control
P. O. Box 10385
Jackson, MS 39209
Robert Seyfarth, NPS Coordinator
(601) 961-5171

Silvicultural NPS Control Agency:
Mississippi Forestry Commission (MFC)
301 North Lamar Street
Suite 300
Jackson, MS 39209
Everard Baker, Private Lands Forester
(601) 359-1386

Information received --
- Notes on questionnaire returned by Baker, 11/18
- Summary of MS statutes re: Pollution of Waters, Air, Etc.
- Silvicultural Water Quality Assessment, MFC, 1980
- The Forest Landowner and Water Quality, MFC brochure
- Silvicultural Best Management Practices, MFC/MFA, 1989 (brochure)
- Mississippi's BMPs Handbook, MFC/MFA, 1989 (current BMP manual)
- Mississippi's BMPs for Wetlands, MFC/MFA, 1991
- USDA-FS FIA (SO) Reports for MS, complete set
- 319 Assessment Report (1989) and Management Plan (1989)

7) North Carolina --

State NPS Management Agency:
North Carolina Dept.of Environment, Health, & Natural Resources (NCDEHNR)
Division of Environmental Management, Water Quality Section
512 N. Salisbury Street
P. O. Box 27687
Raleigh, NC 27611
Beth McGee, David Harding, Alan Clark
(919) 733-5083

Silvicultural NPS Control Agency:

North Carolina Department of Environment, Health, & Natural Resources
Division of Forest Resources (NCDFR)
512 N. Salisbury Street
P. O. Box 27687
Raleigh, NC 27611
Whit Collier, Watershed Protection Forester
(919) 733-2162

Information received --
- Response from Collier containing detailed answers to questions, 12/14
- Forest Practices Guidelines Related to WQ (Performance Stds., 1/1/90)
- Performance Standards (Summary of) (NCDFR synopsis of above regs., 8/90)
- An Act to Limit the For. Exemption under the Sediment. Polln. Control Laws, 1989
- NCDEHNR MoA re: protection of surface/ground water from forestry degradn., '91
- NCDEHNR MoA re: forestry exemption from Sedimentn. Polln. Control Law, '89
- NCDEHNR Memo re: Referral Procs. for Land Disturbances from Forestry, '92
- NCDEHNR/DEM Admin. Code Sectn. re: Surf. Water Standards, Monitoring, '90
- NC Admin. Code, NCDEHNR, (Title 15A, Ch. 4) Sedimentation Control, 4/1/92
- State Summary, Compliance w/ NC Forest Practices Guidelines, NCDFR, 1992
- NCDFR data on NC Forest Resources & Forest Industry, 1992
- Forestry Best Management Practices Manual, NCDFR, 1989 (current BMP manual)
- BMPs for Forestry in the Wetlands of NC, NCDFR, 1990
- Water Quality and Forestry, A Management Plan, NCDEHNR/DEM, 1979
- USDA-FS FIA (SE) Reports for NC, complete except for NC's Forests
- 305(b) WQ Progress Report, 1990
- 319 Assessment Report (1989) & Management Plan (1989)

8) Oklahoma --

State NPS Management Agency:
Oklahoma Conservation Commission
2800 North Lincoln Boulevard
Suite 160
Oklahoma City, OK 73105-4210
John A. Hassell, Director, Water Quality Programs
(405) 521-2384

(above is technical contact for NPS management; administrative lead agency is Oklahoma Department of Pollution Control)

Silvicultural NPS Control Agency:
Oklahoma Department of Agriculture
Forestry Division (ODAFS)
2800 N. Lincoln Boulevard
Oklahoma City, OK 73105-4298
Dr. Robert L. Miller, Hydrologist
(405) 521-3864

Information received --
- Notes on questionnaire from Miller containing answers to questions, 10/13
- Notes from phone conversations with Miller, 9/16 & 10/15
- ODAFS 319h Project Workplan, Monitoring Forestry BMP Compliance in OK
- ODAFS Forestry Action Agenda on Illinois R. Basin WQ Management, 10/2 mtg
- Oklahoma's Forest Resources, ODAFS/USDA-FS/OSU Forest Economics Pgm., '92
- Forest Manager's Guide (incl. BMPs) for WQ Management in OK, ODAFS, 1985
- USDA-FS FIA (SO) Reports for OK, complete set
- 319 Assessment Report (1989) & Management Plan (1990-91)

9) South Carolina --

State NPS Management Agency:
South Carolina Department of Health and Environmental Control (SCDHEC)
Water Quality Planning and Standards Section, Bureau of Water Pollution Control
2600 Bull Street
Columbia, SC 29201
Doug J. Fabel, Environmental Quality Manager
(803) 734-5228

Silvicultural NPS Control Agency:
South Carolina Forestry Commission (SCFC)
P. O. Box 21707
Columbia, SC 29221
Tim Adams, Forest Hydrologist
(803) 737-8800

Information received --
- Letter from Adams containing answers to questions, 9/17
- Notes from phone conversations with Adams, 9/16 & 10/15
- Voluntary Forest Practice Guidelines for SC, SC Forestry Assocn., 2nd revision
- BMPs for SC's Forested Wetlands, SCFC, 1988
- A Survey of Voluntary Compliance of Forestry BMPs, SCFC (D. Hook et al.), 1991
- SC Title 48, Environmental Protection & Conservation, Ch. 1 (statutes & regs)
- Forestry & SC's Forest Resources: Their Economic Importance, SCFA
- USDA-FS FIA (SE) Reports for SC, complete set
- 319 Assessment Report (1988) & Management Plan (1988)

10) Tennessee --

State NPS Management Agency:
Tennessee Department of Environment & Conservation
Division of Water Pollution Control, Nonpoint Source Program
7th Floor, L & C Annex
401 Church Street
Nashville, TN 37243
Dr. Andrew N. Barrass, Manager, NPS Program
(615) 741-7883

Silvicultural NPS Control Agency:
Tennessee Division of Forestry (TDOF)
Department of Conservation
701 Broadway
Nashville, TN 37219-5237
Robin P. Bible, Forest Hydrologist
(615) 360-0720

Information received --
- FAX letter from Bible containing detailed answers to questions, 10/22
- A Pgm. Strategy for Forestry NPS Pollution, TDOF WQ Mgmt. Pgm, 1992-93
- Pickett Project Proves Forestry BMPs Work, TDOF brochure, 1992
- TN's For. Stewardship Pgm., A For. Consn. Pgm. for Private Lands, TDOF, 1991
- Cost-Sharing for For. Practices under the Stewardship Incentive Pgm., TDOF, 1992
- Clean Water from TN's Forests, TDOF WQ Mgmt. Pgm., TDOF, 1992
- Forestry NPS Education in TN, R. P. Bible, TDOF
- BMPs for Timber Harvesting in Tennessee, TDOF
- USDA-FS FIA (SO) Reports for TN, complete set
- 319 Assessment Report (1989) & Management Plan (1989)

11) Texas --

State NPS Management Agency:
Texas Water Commission (TWC)
Office of Water Resources Management, Standards & Assessment
1700 N. Congress Avenue, Room 1129
P. O. Box 13087
Austin, TX 78711-3087
Arthur Talley
(512) 463-8205

Silvicultural NPS Control Agency:
Texas State Soil & Water Conservation Board (TSSWCB)
(silviculture & agriculture)
P. O. Box 658
Temple, TX 76503
James Moore, Janet Gonser
(817) 773-2250

Texas Forest Service (TFS) (silviculture)
300 System Administration Building
College Station, TX 77843-2136
Roger Lord, Staff Forester
(409) 845-2641

P. O. Box 195
Carthage, TX 75633
John Norris
(903) 693-9771

Information received --
- Brief notes on questionnaire returned by Norris, 11/2
- Summary/overview of TX Silvicultural NPS Project, from EPA report
- Silvicultural Practices (Lord & Dreesen), Silvic. NPS Polln. Mgmt., TSSWCB
- Map of Tree Regions of Texas
- Texas BMPs for Silviculture, Texas Forestry Assoc. (current BMP manual, 1990)
- USDA-FS FIA (SO) Reports for TX, complete set
- 319 Assessment Report (1990) & Management Plan (1990)

12) Virginia --

State NPS Management Agency:
Virginia Department of Conservation & Recreation
Division of Soil & Water Conservation
203 Governor Street
Suite 206
Richmond, VA 23219
Stuart D. Wilson, NPS Program Coordinator
(804) 786-4382

Silvicultural NPS Control Agency:
Virginia Department of Forestry (VDOF)
Alderman & McCormick Roads
P. O. Box 3758
Charlottesville, VA 22903
Samuel H. Austin, Forest Hydrologist
(804) 977-6555

Information received --
- Highlights of VDOF WQ Studies, 1990-91, VDOF, 1991
- Silvicultural NPS Pollution Reduction Accomplishments, VDOF, 1991
- Effects of Timber Harvesting on Benthic Invert. Popns. in SW VA, VDOF, 1992
- Forestry BMPs for WQ in VA, VDOF (revised, containing new wetlands section)
- USDA-FS FIA (SE) Reports for VA, complete except for VA's Forests
- 319 Assessment Report (1989, revised) & Management Plan (1989, revised)

13) Other Information Sources --

(a) USDA-FS, Southern Region, State & Private Forestry
1720 Peachtree Road, NW
Atlanta, GA 30367
George E. Dissmeyer, S&PF Water Program Manager
(404) 347-7221

Information received --
- NASF Survey Results, Implementation of Silvicultural NPS Programs, 1991
- Southern Report on Forestry NPS Management, USDA-FS, R-8, SW&A, 1990
- A Status Rpt., Implementn. of the Silvic. NPS Pgm. in Southern States, USFS, 1991
- Aquatic Ecosystem Approach to Monitoring, Dissmeyer, USDA-FS, R-8, S&PF

(b) USDA-FS, Southern Forest Experiment Station
Room T-10210, U.S. Postal Service Bldg.
701 Loyola Avenue
New Orleans, LA 70113
Dr. William C. Siegel, Project Leader (Evaln. of Legal, Tax, & Economic Influences)
(504) 589-6652

Information received --
- Series of research papers on legal/economic aspects of NPS control/WQ protection
- Data base printout re: NPS control statutes by state for US

(c) USDA-FS, Southern Forest Experiment Station
Forestry Sciences Laboratory
P. O. Box 906
Starkville, MS 39759
Roy C. Beltz, Project Leader; John F. Kelly (Forest Inventory & Analysis, Mid-South)
(601) 324-1611

Information received --
- Sets of FIA Reports for 7 southern states (AL, AR, LA, MS, OK, TN, TX)

(d) USDA-FS, Southeastern Forest Experiment Station
P. O. Box 2680
Asheville, NC 28802
Noel D. Cost, Project Leader; Raymond M. Sheffield (Forest Inventory & Analysis)
(704) 257-4350

Information received --
- Sets of FIA Reports for 5 southeastern states (FL, GA, NC, SC, VA)

(d) USDA-FS, Southeastern Forest Experiment Station
P. O. Box 2680
Asheville, NC 28802
Noel D. Cost, Project Leader; Raymond M. Sheffield (Forest Inventory & Analysis)
(704) 257-4350

Information received --
- Sets of FIA Reports for 5 southeastern states (FL, GA, NC, SC, VA)

TABLE B-1 SUMMARY OF CONTACTS WITH AND INFORMATION RECEIVE FROM 12 STATES INVOLVED IN SOUTHERN REGIONAL REVIEW OF STATE NPS CONTROL PROGRAMS AND BMPs FOR FOREST MANAGEMENT OPERATIONS

Survey Activities	States											
	AL	AR	FL	GA	LA	MS	NC	OK	SC	TN	TX	VA
Contact state NPS management/ silvicultural NPS control agency	X	X	X	X	X	X	X	X	X	X	X	X
Distribute project summary & information request to state contacts by mail	X	X	X	X	X	X	X	X	X	X	X	X
Receive responses to questions raised in information request	X	X	X	X	X	X	X	X	X	X	X	X
Receive summary/overview of state silvicultural NPS control program	X	X	X	X	X	X	X	X	X	X	X	X
Receive copy(ies) of state forestry BMPs manual(s)	X	X	X	X	X	X	X	X	X	X	X	X
Receive copies of state 319 Assessment Report & Management Plan	X	X	X	X	X	X	X	X	X	X	X	X
Receive information on pertinent statutes & regulations	X	X	X	X	X	X	X	X	X	X	X	X
Receive information on rates of compliance with forestry BMPs & silvicultural NPS control program	X	X	X	X	X		X	X	X	X	X	X

TABLE B-1
continued

SUMMARY OF CONTACTS WITH AND INFORMATION RECEIVE FROM 12 STATES INVOLVED IN SOUTHERN REGIONAL REVIEW OF STATE NPS CONTROL PROGRAMS AND BMPs FOR FOREST MANAGEMENT OPERATIONS

Survey Activities	States											
	AL	AR	FL	GA	LA	MS	NC	OK	SC	TN	TX	VA
Receive information on BMP effectiveness within state	X	X	X	X	X			X	X	X	X	X
Receive copies of USDA-FS FIA Reports for state	X	X	X	X	X	X	X	X	X	X	X	X
Receive information on forest extent & distribution, & economic importance of forestry in state	X	X	X	X	X	X	X	X	X	X	X	X
Receive other ancillary information on state forestry BMPs/silvicultural NPS control programs	X	X	X	X	X	X	X	X	X	X	X	X
Initiate summary & analysis of state information	X	X	X	X	X	X	X	X	X	X	X	X
Initiate writing of state summary for Draft Report	X	X	X	X	X	X	X	X	X	X	X	X
Follow-up by phone or in person	X	X	X	X	X	X	X	X	X	X	X	X