

**State Approaches for Monitoring the Application of Best
Management Practices and Forest Management Guidelines:
A Regional Summary**

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Abstract

Forestry has developed and published best management practices (BMPs) and forest management guidelines in 49 states. Although the major focus continues to be water quality protection, guidelines related to protecting wildlife habitat, visual quality, and cultural resources are becoming more common. These guidelines are applied across a wide range of forest landowner categories and forest management activities. A survey of state forestry agencies found that compliance monitoring for guideline application is conducted in 38 states. All southern states have monitoring programs. States tend to monitor all public and private forest landowner categories in their states. Monitoring sites are most frequently selected from a subsample of sites from all landowner categories. In many states, all sites have an equal probability of being selected for monitoring. In other states, a variety of criteria are used to identify potential candidate monitoring sites. Southern states concentrate on monitoring the application of water quality BMPs while northern and western states evaluate sites against a broader array of guidelines (e.g., cultural resources, visual quality, wildlife habitat) in addition to the water quality BMPs. Southern states monitor a wide range of forest management activities while northern and western states focus on monitoring timber harvesting and associated road construction and maintenance.

Keywords: best management practices, compliance monitoring, forest management guidelines, forestry, site selection, water quality

Introduction

The development, promotion, and application of best management practices (BMPs) and forest management guidelines (FMGs) have been institutionalized within public and private forestry. Forestry responded to the requirements of the 1972 Federal Water Pollution Control Act Amendments, commonly referred to as the Clean Water Act (CWA), by developing practices to be commonly applied within the individual states to control forestry nonpoint sources of pollution. The US Environmental Protection Agency (EPA) assigned to the states the principal responsibility for development of BMPs and programs to ensure their application. In the years since the initial development of BMPs, the states' forestry communities have worked to refine and improve the application of practices addressed under the umbrella of BMPs (Ellefson et al. 2001; Ice and Stuart 2001). In addition, the further development of state guidelines has evolved over time to include practices that protect other forest resource values and functions (for example, MFRC 1999; Society for the Protection of New Hampshire Forests 1997).

Part of the continual process of BMP and FMG development is the effort to demonstrate to the public, agencies, and legislatures that the guidelines developed, adopted, and promoted in the states are being implemented on the ground. The EPA required states to not only develop and promote BMPs, but also to demonstrate their use within the state. In response, states initiated compliance monitoring programs to document the application of these guidelines on public and private forest land. Compliance monitoring is the systematic gathering of information to determine whether forest management guidelines or rules are actually being applied in the

intended manner by landowners and timber harvesters (Ellefson et al. 2001). Conducting on-site field reviews or inspections has become standard practice in forestry (Ice and Stuart 2001).

Compliance monitoring surveys have increased over time and have become part of the institutional fabric of their BMP and FMG programs within many states. Ice and Stuart (2001) reported that BMP compliance surveys were conducted within 18, 22, 29, and 30 states during 1990, 1992, 1996, and 2000, respectively. Ellefson et al. (2001) reported that 34 states conducted compliance monitoring in 1997. The differences between the two studies may reflect how the states interpreted and responded to specific survey questions related to their programs.

Many states have adopted voluntary approaches to develop, promote, and ensure compliance with their state BMPs and FMGs. It is critical to forestry that these approaches are transparent and credible to the public, agencies, and legislatures that expect forest management to achieve a high level of resource protection. The transparency of these programs is reflected in the numerous state compliance survey reports that have been published (Adams 1998; Briggs et al. 1998; Eagle 1999; Filbert et al. 1999; Fortunate et al. 1998; Hughes and Feduccia 1999; Phillips and Dahlman 2002; Vowell 2002). The credibility of the states' programs depends on the thoroughness to which the BMPs and FMGs are evaluated on-site. That thoroughness depends, in part, on the methodologies for selecting compliance monitoring sites.

The purpose of this study was to document information about statewide compliance monitoring programs for BMPs and FMGs in the United States in 2002. While the authors

recognize that some landowners conduct additional compliance monitoring on their lands or lands that they manage (e.g., many forest industry companies conduct audits of timber harvest sites), the focus of this study was on statewide programs.

Approach

We evaluated the most recent versions of each state's BMP or FMG manuals, brochures, or rules to identify the kinds of BMPs and FMGs that have been developed and the major forest management activities to which these practices are recommended. We also mailed state foresters in all 50 states a survey in early 2002 to gather information on statewide forestry efforts to monitor the application of BMPs and FMGs on public and private forest land in their respective state. The objective of the survey was to gather information related to: (1) state oversight responsibilities for compliance monitoring, (2) approaches to collecting compliance monitoring data, (3) land ownership categories monitored in the state, (4) broad categories of BMPs and FMGs monitored in the state and the type(s) of forest management activities for which these categories of BMPs and FMGs are recommended, and (5) site selection methodology. We also asked state forestry staff to provide a perspective on the strengths and weaknesses of their programs. The state's survey response data were summarized by region of the country (i.e., north, south, and west).

Results

With the exception of Arizona, all states have developed and published BMPs or FMGs (Table 1). These practices and guidelines are published in a number of formats. States that have adopted voluntary approaches for implementing their BMPs or FMGs generally have published these practices in guidebooks or manuals (e.g., Arkansas, Connecticut, Florida, Minnesota, Montana, Pennsylvania, South Dakota) or brochures (e.g., Kansas). For states that have enacted forest practices acts, forest management practices are often published as rules (e.g., California, Oregon).

Table 1. Number of states by region that have developed forestry best management practices (BMPs) or forest management guidelines (FMGs).

Region*	Number of states within region	Number of states where BMPs or FMGs have been developed
North	20	20
South	13	13
West	17	16**
Total	50	49

* **North:** Delaware, Indiana, Maine, Maryland, Michigan, Minnesota, Missouri, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia, Wisconsin, Connecticut, Illinois, Iowa, Massachusetts, New Hampshire, New Jersey, New York.

South: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia.

West: Alaska, California, Hawaii, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Wyoming, Colorado, Kansas, Nebraska, Washington.

** Arizona has not developed forestry best management practices or forest management guidelines.

States have focused their efforts on developing BMPs and FMGs to protect water quality (Table 2). The specification of widths and amounts of residual vegetation adjacent to water bodies is incorporated within the vast majority of state programs, regardless of region (Blinn and Kilgore 2001). Water crossings and approaches to water bodies and the use of appropriate water

diversion structures are the most common recommendations related to road and skid trail construction and maintenance. Specific recommendations to minimize or repair impacts from rutting for roads and skid trails and for the general harvest area are also common for a majority of states. Most of these guidelines address the protection of water quality and wetlands to meet the expectations of the CWA and to protect site productivity.

Table 2. Number of states by region that have developed best management practices (BMPs) or forest management guidelines (FMGs) for various categories of forest management guidelines. Numbers in parentheses represent the percent of states within the region that have developed BMPs or FMGs for a specific category of guidelines.

Guideline category	Number of states by region			
	North	South	West*	Total
Number of states that have developed BMPs or FMGs	20	13	16	49
Riparian or streamside management zone				
Width and residual trees	19 (95)	13 (100)	16 (100)	48 (98)
Filter strip	6 (30)	2 (15)	2 (6)	10 (20)
Preplanning for timber harvests and roads	17 (85)	11 (85)	15 (94)	43 (88)
Road and skid trail construction and maintenance				
Crossings and approaches to waters	20 (100)	13 (100)	15 (94)	48 (98)
Water diversion structures	20 (100)	13 (100)	16 (100)	49 (100)
Rutting	12 (60)	5 (38)	10 (63)	27 (55)
Timber harvesting				
Landings	20 (100)	13 (100)	16 (100)	49 (100)
Proper handling and disposal of fuel, lubricant, and waste products	18 (90)	13 (100)	15 (94)	46 (94)
Closing the sale	20 (100)	12 (92)	15 (94)	47 (96)
Rutting and compaction within harvest area	13 (65)	10 (77)	7 (44)	30 (61)
Wetlands protection	15 (75)	11 (85)	12 (75)	38 (78)
Wildlife habitat retention				
Live leave trees and snags	7 (35)	3 (23)	12 (75)	22 (45)
Coarse woody debris	4 (20)	1 (8)	4 (25)	9 (18)
Visual quality protection	6 (30)	2 (15)	5 (31)	13 (27)
Cultural resource protection	4 (20)	1 (8)	4 (25)	9 (18)

*Arizona is not included as it has not developed forestry best management practices or forest management guidelines.

In recent years, a broader array of forest management guidelines has been developed to minimize impacts to other important forest resource functions and values. As an example, in some states, guidelines have been developed to protect wildlife habitat, visual quality, and cultural resources. Those guidelines have been developed for 22%, 13%, and 9% of states, respectively (Table 2) and are more commonly found for the northern and western states. The retention of live leave trees and snags is particularly important to western states. The development of guidelines to protect resource functions and values beyond water-related issues may be due to increased concern for these issues in the northern and western states.

Best management practices and FMGs are broadly applied to the major forest management activities (Table 3). Guidelines for timber harvesting and for road construction and maintenance have been developed and published for the 49 states with guidelines. Regional differences are apparent in the development and publication of BMPs and FMGs for the other major forest management activities (i.e., pesticide use, mechanical site preparation, fire management, reforestation). Southern states have developed and published guideline protection strategies for almost all forest management activities. The percentage drops to about three quarters of the western states and about half or less of the northern states.

Table 3. Number of states by region that have developed best management practices (BMPs) or forest management guidelines (FMGs) for major forest management activities. Numbers in parentheses represent the percent of states within the region that have developed BMPs or FMGs for a specific forest management activity.

Forest management activity	Number of states by region			
	North	South	West	Total
Number of states that have developed BMPs or FMGs	20	13	16	49
Timber harvesting	20 (100)	13 (100)	16 (100)	49 (100)
Road construction and maintenance	20 (100)	13 (100)	16 (100)	49 (100)
Pesticide use	11 (55)	12 (92)	12 (75)	35 (71)
Mechanical site preparation	9 (45)	12 (92)	13 (81)	34 (69)
Fire management	9 (45)	12 (92)	12 (75)	33 (67)
Reforestation	10 (50)	9 (69)	11 (69)	30 (61)

Breadth of Compliance Monitoring Programs

The number of states where compliance monitoring occurs is shown in Table 4.

Nationally, 38 states that have developed BMPs or FMGs have also developed programs to monitor their application on public and private forest lands. This represents an increase in the number of states as compared to earlier reports (Ellefson et al. 2001; Ice and Stuart 2001), suggesting that states are continuing their efforts to facilitate continuous improvement in the application of these guidelines. This is particularly apparent for the southern region where 100% of the states monitor compliance. In the north and west, 65% and 75% of states, respectively, monitor guideline compliance. While our survey did not inquire as to why some states have chosen not to establish compliance monitoring programs, forestry is not an important land use within some states (e.g., Iowa, Kansas, Nebraska).

Table 4. Number of states by region that monitor the application of best management practices (BMPs) or forest management guidelines (FMGs).

Region	Yes*	No**
North	13	7
South	13	0
West	12	4
Total	38	11

* **North:** Delaware, Indiana, Maine, Maryland, Michigan, Minnesota, Missouri, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia, Wisconsin.

South: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia.

West: Alaska, California, Hawaii, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Wyoming.

****North:** Connecticut, Illinois, Iowa, Massachusetts, New Hampshire, New Jersey, New York.

West: Colorado, Kansas, Nebraska, Washington. Arizona has not developed forestry best management practices or forest management guidelines.

The major landowner categories identified in our survey were state, county, national forest, nonindustrial private forest (NIPF), private industrial, and tribal. The presence of these landowner categories within individual states, and the number of states that monitor BMPs and FMGs for these landowner categories are presented in Table 5. Regardless of region, compliance monitoring is most common for state, NIPF, and private industrial ownerships. It occurs less often on national forest, county, and tribal lands. For the states that monitor guideline use, compliance monitoring is conducted across the broadest array of landowner categories in the South and the fewest in the West.

Table 5. Number of states by landowner category that monitor the application of best management practices (BMPs) and forest management guidelines (FMGs) within regions. Numbers in parentheses represent the percent of states that monitor the application of BMPs and FMGs, considering only states that contain that landowner category within the region.

Region	Number of states by landowner category					
	State	County	National Forest	Nonindustrial private forest	Private industry	Tribal
North (13 states)						
Number of states with landowner category	13	12	10	13	12	5
Number of states that monitor the landowner category	13 (100)	7 (58)	6 (60)	12 (92)	10 (83)	3 (60)
South (13 states)						
Number of states with landowner category	11	12	13	13	13	7
Number of states that monitor the landowner category	11 (100)	9 (75)	11(85)	13 (100)	13 (100)	4 (57)
West (12 states)						
Number of states with landowner category	12	9*	11	12	7	9
Number of states that monitor the landowner category	12 (100)	4 (44)	4 (36)	11 (92)	7 (100)	2 (22)
Total (49 states)						
Number of states with landowner category	36	33	34	38	32	21
Number of states that monitor the landowner category	36 (100)	20 (61)	21 (62)	36 (95)	30 (94)	9 (43)

*Hawaii, Montana, South Dakota, and Utah have 7,000 acres or less of state or county timberland (Smith et al. 1997).

Oversight Responsibility

State agencies have assumed the principal responsibility for providing oversight for compliance monitoring programs and for collecting the monitoring data (Table 6). This is similar to previously published reports (Ellefson et al. 2001; Ice and Stuart 2001).

Multidisciplinary teams containing a range of natural resource professionals and the general public, generally organized by state agencies, are only used in the northern and western states.

Table 6. Summary of approaches for providing oversight to the collection of monitoring data within landownership categories by region.

Group with oversight responsibility	Number of states by landowner category					
	State	County	National Forest	Nonindustrial private forest	Private industry	Tribal
North / South / West						
Number of states with landowner category by region	13 / 11 / 12	12 / 12 / 9	10 / 13 / 11	13 / 13 / 12	12 / 13 / 7	5 / 7 / 9
State agency takes the lead	10 / 11 / 9	4 / 8 / 4	2 / 10 / 0	7 / 12 / 9	4 / 12 / 6	1 / 4 / 0
Multidisciplinary teams of natural resource professionals and the general public	5 / 0 / 7	3 / 0 / 3	2 / 0 / 4	5 / 0 / 7	4 / 0 / 3	2 / 0 / 1
Third party audit						
National panel of auditors	1 / 1 / 0	1 / 0 / 0	0 / 0 / 0	0 / 2 / 0	1 / 5 / 1	0 / 0 / 0
State panel of auditors	1 / 1 / 1	1 / 1 / 0	1 / 1 / 0	2 / 3 / 2	2 / 5 / 2	1 / 1 / 0
*Other:	1 / 0 / 0	1 / 0 / 0	0 / 0 / 0	2 / 0 / 0	2 / 0 / 1	0 / 0 / 1

*Master Logger/MD Forestry Association for state, county, NIPF, and private industrial (MD); college students employed by the RRBRP for private industrial (ND); SFI partners for NIPF and private industrial (PA); routine BLM compliance monitoring and inspection program (ID); routine tribal forestry compliance monitoring and inspection program (ID); multidisciplinary review of BLM lands (MT,WY); other federal (OR).

The use of third party audits is still relatively uncommon for state-conducted compliance monitoring programs, but is used most frequently for monitoring of NIPF and private industrial land in the southern states.

Water quality, wetland protection, and riparian or streamside management zone BMPs and FMGs are broadly evaluated for all states and across all ownerships in compliance monitoring programs (Table 7). The evaluation of wildlife habitat, visual quality, cultural resource guidelines is an important component of the compliance monitoring programs for the northern and western states.

As noted above, BMPs and FMGs were developed for application to a broad range of forest management activities (Table 3). Guideline monitoring programs for these activities are applied most commonly to timber harvesting and forest road construction and maintenance (Table 8). Northern and western states tend to focus their monitoring efforts on timber harvesting and forest road management guidelines, evaluating them across a relatively broad range of resource issues (e.g., water quality, wetland protection, wildlife habitat, cultural resources). In contrast, the southern states tend to monitor water quality, riparian or streamside management zones, and wetland protection across a relatively wide range of forest management activities.

Table 7. Types of best management practices (BMPs) or forest management guidelines (FMGs) monitored by landowner category within regions. Numbers in parentheses represent the percent of states that monitor the type of BMP or FMG, considering only states that contain that landowner category within the region.

Type of BMPs or FMGs monitored	Number of states by landowner category					
	State	County	National forest	Nonindustrial private forest	Private industry	Tribal
North						
Number of states with landowner category monitored	13	7	6	12	10	3
Water quality	12 (92)	7 (100)	6 (100)	10 (83)	9 (90)	3 (100)
Riparian or streamside management	12 (92)	7 (100)	5 (83)	10 (83)	8 (80)	3 (100)
Wetlands protection	11 (85)	6 (86)	4 (67)	10 (83)	8 (80)	3 (100)
Visual quality protection	6 (46)	2 (29)	2 (33)	2 (17)	2 (20)	1 (33)
Cultural resources protection	5 (38)	2 (29)	2 (33)	1 (8)	1 (10)	1 (33)
Wildlife habitat retention	4 (31)	1 (14)	2 (33)	3 (25)	2 (20)	1 (33)
Forest soil productivity	3 (23)	2 (29)	2 (33)	3 (25)	3 (30)	1 (33)
South						
Number of states with landowner category monitored	11	9	11	13	13	4
Water quality	10 (91)	7 (78)	10(91)	12 (92)	12 (92)	4 (100)
Riparian or streamside management	11 (100)	8 (89)	11(100)	13 (100)	13 (100)	4 (100)
Wetlands protection	9 (82)	6 (67)	9 (82)	11 (85)	11 (85)	4 (100)
Visual quality protection	0 (0)	0 (0)	0 (0)	0 (0)	1 (8)	0 (0)
Cultural resources protection	1 (9)	0 (0)	0 (0)	0 (0)	1 (8)	0 (0)
Wildlife habitat retention	1 (9)	1 (11)	1 (9)	1 (8)	2 (15)	1 (25)
Forest soil productivity	2 (18)	2 (22)	2(18)	2 (15)	3 (23)	2 (50)
West						
Number of states with landowner category monitored	12	4	4**	11	7	2
Water quality	11(92)	4(100)	4 (100)	9 (82)	6 (86)	1 (50)
Riparian or streamside management	11 (92)	4 (100)	4 (100)	11 (100)	7 (100)	1 (50)
Wetlands protection	9 (75)	4 (100)	3 (75)	9 (82)	5 (71)	1 (50)
Visual quality protection	5 (42)	2 (18)	1 (25)	3 (27)	4 (57)	1 (50)
Cultural resources protection	4 (33)	2 (18)	1 (25)	4 (36)	5 (71)	1 (50)
Wildlife habitat retention	5 (42)	3 (27)	1 (25)	4 (36)	4 (57)	1 (50)
Forest soil productivity	7(58)	4 (9)	2 (50)	6 (55)	6 (86)	1 (50)

*Includes municipal monitoring for water quality, wildlife habitat, and wetlands protection (VT); includes Department of the Army land monitoring for water quality, riparian management, wetlands protection guidelines (GA); BLM land monitored for water quality BMPs (ID, MT, WY); other federal lands monitored (OR).

**Two respondents indicated that national forests were monitored but in a separate process. Therefore, data was not provided on these 2 forests.

Table 8. Number of states by forest management activity and region that monitor best management practices (BMPs) or forest management guidelines (FMGs) for various categories of forest management guidelines. Numbers represent states in the North/South/West.

Guideline category*	Number of states by forest management activity							
	Timber harvesting	Forest road construction and maintenance	Mechanical site preparation	Pesticide use	Timber stand improvement	Reforestation	Forest recreation	Fire management
Water quality	12 / 13 / 12	11 / 13 / 11	3 / 12 / 10	5 / 12 / 6	4 / 9 / 6	2 / 11 / 8	2 / 1 / 0	3 / 9 / 10
Riparian or streamside management	12 / 12 / 12	11 / 12 / 11	3 / 11 / 9	5 / 11 / 6	5 / 6 / 6	2 / 10 / 6	2 / 1 / 0	3 / 7 / 7
Wetlands protection	10 / 10 / 7	9 / 11 / 7	2 / 9 / 5	4 / 9 / 5	4 / 3 / 4	2 / 7 / 4	2 / 1 / 0	2 / 5 / 4
Visual quality protection	5 / 0 / 2	4 / 0 / 1	1 / 0 / 1	1 / 0 / 0	1 / 0 / 0	1 / 0 / 1	1 / 0 / 0	1 / 0 / 2
Cultural resource protection	3 / 2 / 2	3 / 0 / 2	1 / 1 / 1	1 / 1 / 0	1 / 0 / 0	1 / 0 / 1	2 / 0 / 0	1 / 1 / 1
Wildlife habitat retention	4 / 2 / 4	2 / 1 / 4	1 / 1 / 4	1 / 1 / 3	1 / 1 / 2	1 / 1 / 3	1 / 0 / 0	1 / 2 / 3
Forest soil productivity	4 / 2 / 7	4 / 2 / 6	1 / 2 / 7	1 / 2 / 2	1 / 2 / 3	1 / 2 / 5	1 / 0 / 0	1 / 2 / 4

*These are broad categories of resource protection, each of which may contain numerous specific practices under several of the guideline categories listed in Table 2.

Site Selection Approaches

Critical to the success of compliance monitoring is the selection of sites that are broadly representative of the types of forest management activities occurring within the state. Key decisions that need to be made include deciding what landowner categories will be monitored (i.e., state, county, National Forest, nonindustrial private, private industry, tribal), identifying the sources of information or approach that will be used identify potential candidate sites to monitor, and developing criteria to use for determining which sites will actually be monitored. States vary in the methods used for each of these key decisions.

Landowner categories that are monitored -- The most commonly reported approach is to select some sites from all landowner categories (Table 9). Some states, all in the northern and western regions, employ more than one approach to site selection. For example, Indiana monitors all timber harvests on state forest lands and a random sample of some nonindustrial private forest (NIPF) and private industrial sites. Southern states only employ one approach in selecting sites, generally involving a method that subsamples the population of potential sites. Northern and western states frequently select all sites from all landowner categories or some sites from all landowner categories.

Sources of information for identifying potential candidate sites -- States frequently access a variety of information sources for identifying potential candidate sites to monitor (Table 10). The most commonly cited method to identify potential candidate sites is through the use of intent to harvest notification laws. These statutes are more commonly found in the northern and

western states. The use of local knowledge and citizen complaint closely follows the use of intent to harvest notification laws. These three methods account for 56% of the approaches used to identify potential candidate sites. Local knowledge may make it difficult to develop a monitoring program that has statistical validity across the state.

Table 9. Number of states applying various methods to identify sites to monitor best management practices and forest management guidelines, by region.

Site selection method	Number of states by region			
	North	South	West	Total
Some sites from all landowner categories	6	7	2	15
Some sites from some landowner categories	4	4	5	13
All sites from some landowner categories	4	0	3	7
All landowner categories and all sites are monitored	2	2	3	7

Table 10. Number of states by region that apply various methods to identify potential candidate sites for monitoring. States could report more than one method of site selection.

Method of site identification	Number of states by region			
	North	South	West	Total
Intent to harvest notification process	7	2	7	16
Local knowledge	3	6	6	15
Citizen complaint	6	4	3	13
Timber sales database	3	1	4	8
Aerial reconnaissance or drive by discovery	2	5	0	7
Sample sites are submitted by landowners or loggers	3	2	1	6
Aerial photography of randomly selected areas	1	4	0	5
Satellite imagery (change detection)	2	1	1	4
Reporting requirements of tax laws	3	1	0	4

Criteria for determining which sites are actually monitored -- States use multiple criteria for screening sites to monitor (Table 11). The most commonly cited criteria are: (1) all sites have an equal chance of selection, (2) proximity to water resources, and (3) minimum size of timber

harvest. These account for 65% of the criteria identified by states in our survey. Equal chance of selection is particularly prevalent for southern states as is proximity to water for western states.

We could not determine from the survey whether the sites monitored were screened by the landowner or by the state prior to final selection. For some criteria used for filtering potential candidate sites such as “time since harvest” and “minimum size of forest management activity” (Table 11), the landowner could make the decision based on these criteria. For other screening criteria such as “proportion of timber harvest by landowner category” and “erosion potential,” the state would more appropriately select the sites from a comprehensive review of all sites submitted.

Table 11. Number of states by region that apply additional criteria to filter potential candidate sites for monitoring. States could report more than one additional criteria.

Criteria used to select sites	Number of states by region			
	North	South	West	Total
None, all sites have equal chance of selection	5	8	3	16
Proximity to water resources	6	1	8	15
Minimum size of forest management activity	3	4	4	11
Erosion potential	1	0	5	6
Proportion of timber harvest by landowner category	1	3	2	6
Time since harvest	1	2	3	6
*Other:	1	2	2	5

*Volume of harvest (RI, SD), commodity drain report (SC), previous harvest inspection data (VA), proximity to other (nonwater) protected resources (OR).

Program Strengths and Weaknesses

The survey included two open-ended questions about program strengths and weaknesses. While each question received a large number and broad range of responses, some themes are

reported below. In general, respondents tended to report many more strengths than weaknesses about their program. There were no regional patterns to the responses.

One question inquired about the strengths and weaknesses of the monitoring program's ability to identify representative sites for compliance monitoring. Strengths included the fact that the program was statewide, continuous, random, and had statistical validity; that it used a consistent methodology; that the intent to harvest notification system, permit process, or ad valorem tax registration process provided a good method for identifying potential candidate sites to monitor; that use of aerial photography did not bias the identification of sites; and that forest inventory and analysis (FIA) data was a useful way to stratify sites by landowner category for monitoring.

While there was an overwhelming level of support for a state's program's ability to identify representative sites, several states still reported weaknesses in their program. The more common weaknesses included noting that a significant amount of resources (i.e., personnel, time, money, and training) are needed to do adequate monitoring; program managers don't believe that they have knowledge of all timber sales and thus some sites don't get considered during the site selection process (e.g., lack of information about activities on NIPF land, smaller tracts or areas where thinning occurs are more difficult to identify using aerial techniques); and a voluntary system is dependent on securing landowner permission for access on private parcels.

The second question asked about the strengths and weaknesses of their monitoring program related to its ability to evaluate sites for application of BMPs or guidelines. Strengths included the consistency of evaluations due to methods, people, and/or training; a reduced or little subjectivity of measurements; use of the protocol adopted by the southern group of State Foresters, making results comparable among states; the program requires consensus from the audit team which may also be an educational process for team members; sites are monitored during the harvesting activity which “keeps operators and landowners on their toes” and allows problems to be identified and fixed during the operation; and areas of potential significant risk are targeted, sometimes for multiple inspections during active operations. Weaknesses were a lack of resources (e.g., personnel, time, money, and training) to evaluate the sites; the difficulty of taking generally descriptive BMPs and evaluating their application under varying site conditions and operating methods; and lack of effectiveness monitoring results to correlate with compliance monitoring results.

Conclusions

State forestry communities have a good track record of responding to statutory mandates by developing and implementing practices to protect forest resource functions and values. Forty-nine states have developed and published these guidelines. The northern and western states have expanded the types of guidelines beyond water quality to include recommendations to protect other important resources such as wildlife habitat, visual quality, and cultural resources.

The number of states that have developed compliance monitoring programs continues to increase. State forestry agencies tend to provide the oversight for these programs, particularly in the South. State forest, NIPF, and private industrial lands are most frequently monitored, with tribal, county and National Forest lands evaluated less frequently. The focus of monitoring within the southern states is on water quality BMPs which are evaluated across a broad range of forest management activities. While monitoring focuses on timber harvesting and associated road construction and maintenance in the northern and western states, it occurs across a broad array of resources (e.g., water quality, wildlife habitat, visual quality, cultural resources). Overall, respondents are generally positive about program accomplishments and direction of their programs while recognizing inherent problems associated with their limited resources.

References

- Adams, O. 1998. Implementation monitoring of forestry best management practices for site preparation in South Carolina. *Southern Journal of Applied Forestry* 22(2):74-80.
- Blinn, C. R., and M. A. Kilgore. 2001. Riparian management practices: A summary of state guidelines. *Journal of Forestry* 99:11-17.
- Briggs, R. D., J. Cormier, and A. Kimball. 1998. Compliance with forestry best management practices in Maine. *Northern Journal of Applied Forestry* 15(2):57-68.
- Eagle, D. M. 1999. *Arkansas voluntary forestry best management practices implementation monitoring: Results from second survey BMP implementation monitoring, Arkansas Forestry Commission survey period:1998-99*. Arkansas Forestry Commission.
- Ellefson, P. V., M. A. Kilgore, and M. J. Phillips. 2001. Monitoring compliance with BMPs: The experience of state forestry agencies. *Journal of Forestry* 99(1):11-17.

- Filbert, J., L. Cooper, and S. Holaday. 1999. *Wisconsin's forestry best management practices for water quality: The 1995-1997 BMP monitoring report*. PUB-FR-145-99. Wisconsin Department of Natural Resources, Bureau of Forestry.
- Fortunate, N., P. Heffernan, K. Sanger, and C. Tootell. 1998. *Montana forestry best management practices monitoring: The 1998 forestry BMP audit report*. Montana Department of Natural Resources and Conservation, Forestry Division.
- Hughes, M. S., and D. Feduccia. 1999. *Louisiana's voluntary compliance with forestry best management practices-1997*. Louisiana State University, Agricultural Experiment Station.
- Ice, G. G., and G. W. Stuart. 2001. *State nonpoint source pollution control programs for silvicultural sustained success: The National Association of State Foresters 2000 Progress Report*. Washington, DC: National Association of State Foresters.
- Kilgore, M. A., P. V. Ellefson, and M. J. Phillips. 2002. Ensuring the application of sound forestry practices on private forests. Challenges facing the design and implementation of state compliance monitoring programs. In *Forest Policy for Private Forestry: Global and Regional Perspectives*, eds. Teeter, L., B. Cashore, and D. Zhang, chapter 12. Wallingford, UK: CABI Publishing.
- Minnesota Forest Resources Council (MFRC). 1999. *Sustaining Minnesota Forest Resources: Voluntary Site-Level Forest management Guidelines for Landowners, Loggers, and Resource Managers*. St. Paul, MN: Minnesota Forest Resources Council.
- Phillips, M. J., and R. Dahlman. 2002. *Monitoring the implementation of the timber harvesting and forest management guidelines on public and private forest land in Minnesota: Report 2001*. DNR Document MP-0902. St. Paul, MN: Department of Natural Resources.
- Society for the Protection of New Hampshire Forests. 1997. *Good forestry in the Granite State: Recommended voluntary forest management practices for New Hampshire*. Concord, NH: Society for the Protection of New Hampshire Forests.
- Vowell, J., and R. Lima. 2002. *Results of Florida's 2001 silviculture BMP compliance survey*. Tallahassee, FL: Florida Department of Agriculture and Consumer Services, Division of Forestry.