

Evaluation of Methods and Procedures for Best Management Practices Monitoring and Reporting in the Southeast United States

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ABSTRACT: Every state in the Southeast US has developed a set of Best Management Practices (BMPs) to protect water quality during silvicultural activities. These BMPs are voluntary in the southeast, although water quality protection is mandatory under the Clean Water Act. Although the Southern Group of State Foresters (SGSF) has adopted a Silvicultural BMP Implementation Monitoring Protocol, each state Forestry agency has developed inspection and reporting methods to comply with EPA requirements. Inconsistencies between the States have led to a concern about the ability to measure progress within a particular state and make meaningful comparisons between states. This paper evaluates the methods and procedures that each individual state has developed for both operational inspections as well as implementation inspections for reporting purposes. Only three of the nine states forestry agencies reviewed had the right to trespass and only one state had enforcement powers. The number of sites inspected for reporting purposes varied between 5 and 400, and sites selection procedures included aerial reconnaissance, timber receipts and geographical stratification. This study concludes that a more detailed protocol, especially setting the scope, the assessment methodology and the reporting procedures, is required to address the inconsistencies identified.

INTRODUCTION

The Clean Water Act of 1972, particularly section 208, exempts timber harvesting activities as long as best management practices are used to protect water quality. The EPA has since required proof that these BMPs are being implemented (Ryder 2003). The monitoring of implementation and effectiveness of these practices will help foresters and other land managers understand the value of these techniques and help in making sound decisions to protect water quality.

The Southeast has employed a voluntary non-regulatory approach to BMP implementation and monitoring. In comparison, the Pacific Northwest states have developed Forest Practices Acts in which silvicultural activities are highly regulated. A study in Virginia showed that a non-regulatory BMP system, compared to a hypothetical regulatory system, resulted in a better costs benefits ratio (Aust et al 1996). Currently, the EPA has approved silviculture BMPs for each southern state (SGSF 2002). Each state has also developed individual monitoring and formal reporting systems.

Monitoring of BMPs is undertaken for several reasons such as, to determine if technical specifications are being met ('compliance

monitoring') and to reveal if the implementation actually protects site and water quality ('effectiveness monitoring') (Ellefson 2001). Another main goal of monitoring is for enforcement of water quality infringements. Other objectives include education, environmental and site quality protection and detection of any adjustments that may need to be made to the technical requirements of BMP implementation.

Monitoring inspections occur at two levels, either during or after closure of routine operations and those inspections that are performed for formal reporting of BMP implementation. Figure 1 illustrates how these two levels reveal information about BMP compliance and water quality protection.

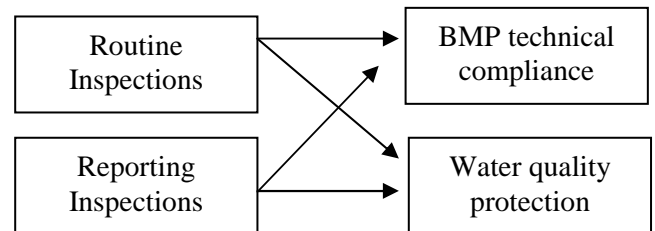


Figure 1. Flow chart demonstrating how routine monitoring inspections and formal reporting inspections relate to BMP compliance and water quality protection.

Due to the importance of these water quality topics, it would be beneficial to have a more uniform set of standards, definitions and protocols to ensure better management and understanding of the environment. Continuity among the states would encourage understanding of the progress, effectiveness and compliance of BMPs within the states as well as promote meaningful comparisons between the states.

METHODS

Information regarding BMP inspecting and reporting procedures, on all southern states that have a coastline, was collected. Phone interviews were held with most state BMP coordinators or the equivalent. BMP manuals and reporting surveys were obtained online and through the state forestry offices where possible. Additional information was collected through journal articles and conference proceedings, including the Southern Group of State Foresters (SGSF) Silviculture BMP Implementation Monitoring Protocol (BMP 2002).

TERMINOLOGY

Some confusion exists regarding how to refer to the types of visits that are carried out by the state agency. 'Monitoring' and 'Auditing' are terms often used to describe these inspections. The Oxford American Dictionary (1980) defines the terms as follows:

Monitor: to watch over, to record or test or control the working of.

Audit: an official examination of accounts to see that they are in order.

Inspect: to examine officially, to visit in order to make sure that certain rules and standards are being observed.

In this paper, we will use the term inspection for active site visits by the state agency – regardless of

the purpose of their visit. Each state may refer to these visits using their own terminology.

KEY RESULTS

A summary of the BMP inspecting protocols from the selected southern states is broken down in Table 1. Notification of harvest operations to the state forestry agency can be not required, voluntary or mandatory. Active harvest and closeout inspections can be addressed through a courtesy exam or audit, performed upon request from the landowner or logger, mandatory or as response from citizen complaint. Both notification and active/closeout inspections are performed for routine harvest activities. State Forestry agencies are responsible for developing and implementing BMPs, though Virginia is the only state responsible for enforcing water quality infringements. Three of the nine states examined have the right to trespass to inspect for BMP implementation and compliance. The number of sites inspected for formal reporting is listed along with whether or not the state monitors for water quality or BMP compliance or both.

The following is a brief summary from each of the states:

Alabama: Alabama has voluntary BMPs. They do not routinely visit individual logging sites unless they are invited by the landowner for a preharvest consultation, or are responding to a complaint. They do pursue an invitation upon the discovery of an operation. The Alabama Forestry Commission does not have the right to trespass. Six random sites per county per year are selected for 'aerial monitoring' of BMP implementation. The site is evaluated on implementation for each BMP category on a yes/no basis and also reports overall implementation (Greis *pers. com.* 2002). The Commission follows most of the protocols set forth in the SGSF protocol. The Alabama Department of Environmental Management handles the enforcement of water quality impairment and penalties (Hyland *pers. com.* 2003).

Table 1. Summary of information gathered by state.

States	Routine operations			Reporting		
	Notification	Active Harvest / Closeout Inspection	Enforcement Agency	Right to Trespass	Number of Sites Monitored	Monitor for Water Quality or BMP Compliance
Alabama	N	CE	N	N	>5	BMP
Florida	N	CA	N	N	>200	BMP
Georgia	V	CE	N	N	>400	BMP
Louisiana	N	~	N	Y	>250	BMP
Mississippi	N	~	N	Y	>250	BMP
North Carolina	V	SA	N	N	>200	Both
South Carolina	N	CE	N	N	>200	Both
Texas	N	~	N	N	150	Both
Virginia	Y	Y	Y	Y	>50	Both

N = no, Y = yes/always, V = voluntary
 CE = courtesy exam, SA = self audit, CA = courtesy audit
 ~ = depends on invitation from appropriate party

Florida: Florida has a quasi-regulatory system of BMP enforcement. Upon request from loggers, landowners, foresters or timber buyers, a county ranger will perform a courtesy audit. These can take place before, during or after a harvesting operation. Usually those sites that have a courtesy audit before or during harvest have another after closeout. To comply with the SGSF framework for Silviculture BMP Implementation Monitoring, over 200 sites are randomly selected for reporting by aircraft or on the ground and distributed by timber receipts (Prud'homme 2002). They examine 14 BMP categories and record yes/no answers then report compliance as a percentage (Greis 2002). The Department of Environmental Regulation is responsible for handling water quality violations (Vowell *pers. com.* 2003).

Georgia: Georgia has voluntary BMPs except in certain sensitive areas like stream crossings and wetlands where they are considered mandatory. They have a voluntary notification system in certain counties. Harvesting operations are regularly inspected through a courtesy exam program similar to South Carolina. After a harvest is closed out, a follow-up inspection is performed. Random site selection for reporting is determined using a stratified sample based on timber harvesting across ownership classes resulting in 420 sites for 2002. BMP categories are reported as being either in or out of compliance and the data is reported as percent compliance (Greis 2002). They attempt to perform a statewide reporting survey every 2 years and follow the SGSF protocol for implementation monitoring of BMPs. The Georgia Department of Environmental Quality is responsible for enforcing water quality violations (Green *pers. com.* 2003).

Louisiana: Louisiana Department of Agriculture and Forestry has voluntary BMPs except in wetland and other sensitive areas. They do not routinely inspect active or closed logging operations but will do an inspection upon invitation by landowner or responding to a complaint. Every three years they select at least 250 sites (or amount needed to achieve 95% confidence of BMP implementation) using aerial reconnaissance and inspect for BMP compliance using the SGSF protocol for Silviculture BMP Implementation Monitoring (Heaton *pers. com.* 2003 ; Thomas *pers. com.* 2003). Reporting is performed across 5 BMP categories and is listed as exceeding guidelines, full implementation, minor departure of BMP (still considered in compliance), needed but not applied or not applicable (Greis 2002). BMP compliance is reported as percentage of implementation. All enforcement issues and fines are handled through the Louisiana Department of Environmental Quality.

Mississippi: The Mississippi Forestry Commission has voluntary, nonregulatory BMPs but they will offer advice upon invitation. Routine inspections are performed on a discovery basis. Mississippi forest rangers do have the right to trespass for water quality monitoring. Attempts are made to mitigate water quality violations but penalties are handled through the Mississippi Department of Environmental Quality. Compliance and implementation reporting is in the process of adapting the SGSF protocol (Sampson *pers. com.* 2003).

North Carolina: North Carolina, like Florida and Virginia, has quasi-regulatory BMPs. They have a set of 'forest practice guidelines' pertaining to the protection of water quality, which contain specifications on BMPs (Gerow *pers. com.* 2003). County rangers will perform routine water quality inspection through the self-audit program on active or closed operations. These forest practice guideline self audits are performed at the request of loggers, landowners, timber buyers or citizen complaint. For SGSF compliance reporting, a minimum of 200 randomly selected sites are flown over to ensure they fit the selection criteria then an on-the-ground survey is completed. The sites are evaluated and yes/no implementation questions were answered as well as a qualitative rating of "no effort, poor, fair good or excellent" is assigned (Greis 2002). The NC

Department of Water Quality handles enforcement of water quality impairments (Gerow *pers. com.* 2003).

South Carolina: Routine BMP inspection is performed in South Carolina through the Forestry Commission's courtesy BMP exam program that attempts to identify potential water quality impacts. They make regular flights over drainage basins to locate harvest and site preparation operations. Then they will approach the landowner and ask permission to do a courtesy BMP exam. On the sites where these examinations are performed, they typically visit again after closure. They will also give an exam upon request or to respond to a citizen complaint. Over 200 sites are selected by aircraft for reporting purposes. These sites are stratified in a random manner by timber receipts followed by 3 on the ground inspections; one after harvest, one after site preparation and one two years after closure (Greis 2002). All water quality infringements are reported to the South Carolina Department of Health and Environmental Control (Jones *pers. com.* 2003).

Texas: Routine inspecting occurs by landowner/logger request. Currently, Texas is more in 'education mode' for a number of reasons including lack of sufficient personnel (Carraway *pers. com.* 2003). Texas has redesigned their monitoring and reporting protocol to follow the recommendations of the SGSF. Approximately 150 sites are selected via aerial reconnaissance and distributed regionally by ownership category and also by amount of timber harvested from each county (Simpson *pers. com.* 2003). The BMP categories are assessed using yes/no/NA questions and are then tallied for a rating of compliance (Greis 2002).

Virginia: Virginia has a mandatory 3-day notification system (before or after harvest begins). They attempt to visit every logging job and are obligated to visit the harvest site at least 15 days after notification and at least 15 days after closure (Poirot 2003). The VA Department of Forestry is the only state examined that is responsible for enforcement of water quality infringements. They strategically and randomly select 30 sites from the notification list biannually for auditing. An on the ground inspection determines compliance. To be in compliance the site must use all relevant BMPs

100% of the time and meet 100% technical specifications (Poirot *pers. com.* 2003). This method of reporting gives low compliance though 90% of sites showed effort to implement BMPs (Greis 2002).

DISCUSSION

The southeastern states reviewed in this paper use many different methods for routine inspections and formal EPA reporting inspections. Georgia and North Carolina have a voluntary notification system. Virginia is unique in that they are the only state where notification is mandatory and they are obligated to visit every harvest operation with a \$1000 fine for failing to do so (Poirot *pers. com.* 2003). A notification system does ensure that the state forestry agency is aware of harvesting operations and can inspect accordingly. Notification is crucial to consistency in protection of water quality especially concerning accurate representation of harvest operations results in EPA reporting.

All of the states examined will give advice on BMPs upon invitations from landowners, loggers, timber buyers or respond to citizen complaints. They are called either courtesy exams or audits and are routine in Alabama, Florida, Georgia, and South Carolina. North Carolina has a similar program called the NC Self-Audit Program. If an agency is invited to perform courtesy exam/audit, they will usually come back after closure to make sure the BMPs are working and there is no threat of sediment entering a waterway. There is much variation in the language used to describe these routine inspections.

Only Louisiana, Virginia and Mississippi have the right to trespass in order to inspect water quality infringements. Without this inherent right many state forestry agencies are unable to mitigate any threats or potential threats to water quality. Virginia is the only state with the responsibility of enforcement and penalizing water quality infringements. In the eight other states reviewed, the responsibility has remained with another state department of environmental health or environmental quality.

For formal reporting purposes for the EPA, most states attempt to follow the SGSF recommended framework for implementation of silviculture BMP monitoring (SGSF 2002). Some of the recommended guidelines address frequency of reporting, the attributes a monitoring site should have, which practices should be evaluated, how the sites should be 'graded' and how potential threat to water quality is evaluated (SGSF 2002). While these recommendations from the SGSF attempt to provide some continuity between the states, the guidelines are still very broad, leaving room for different interpretations. Some of the guidelines include, statewide monitoring to be undertaken at least every three years.

For site selection there is no minimum size, no water has to be present on the property, operation must be closed for no longer than two years and sites may be selected by, "aerial reconnaissance, severance tax records, notification logs...it is essential to achieve random, stratified random or randomized cluster statistical design to obtain an unbiased sample" (SGSF 2002). Sites that are considered ineligible are those that are using timber harvesting to undergo a change in land use. Some evaluation categories include the harvesting, site preparation, roads, stream crossings and streamside management zones.

In terms of scoring, the SGSF recommend to report a percentage of applicable practices and record BMPs on a yes/no/not applicable basis. The number of sites to monitor must be enough to "achieve an estimate of implementation that is $\pm 5\%$ within the 95% confidence interval" (SGSF 2002). These recommendations, while valuable, do not specify how exactly the monitoring should be performed; aerial survey (Alabama), on the ground (Virginia and North Carolina) or combinations, therefore making comparisons between the states is difficult.

Site selection methods vary throughout the evaluated states. All states attempt to obtain a set of random and unbiased sites. Some sites are chosen completely randomly with no stratification while others like Georgia and Texas sort by timber receipts while still others like North Carolina and Virginia sort by region. States that select sites by aerial reconnaissance include Alabama, Florida, Louisiana, North and South Carolina and Texas. The number of sites that each state ultimately chooses

varies widely with Alabama having the fewest and Georgia having the most. The SGSF recommends, "The sample size should be sufficient to achieve an estimate of implementation that is $\pm 5\%$ within the 95% confidence interval" (SGSF 2002).

Alabama, Mississippi and Louisiana perform their BMP 'implementation monitoring' inspections from the sky. Aerial surveying could fall short of accurately measuring the compliance and effectiveness of BMPs which can often only be seen by taking an up close look, for example, spacing between water bars, suitable stream crossings and stream side management zone widths.

All the states are actually inspecting for BMP implementation but North and South Carolina, Texas and Virginia also monitor for threat to water quality. Inspecting for both BMP compliance and water quality protection produces a more thorough approach because 100% implementation in all situations may still leave room for water quality degradation. Just because BMPs have been installed properly does not necessarily mean that no threat to water quality exists though BMPs have been proven effective in protecting water quality.

In spite of the effort to improve the monitoring and reporting processes there is a remaining inability to compare states compliance ratings. Some suggestions include having a more uniform protocol that dictates exactly how the survey is to be conducted, how often and how many sites to survey (whether they are proportional to the amount of harvesting jobs or some other stratified manner), standard terminology and a repeatable inspection method that will produce consistent results. Ample allotment of resources and planning would ensure availability of personnel and efficiency to make reporting as easy as possible.

CONCLUSION

To achieve accurate comparisons there is a need for a more detailed protocol, standard recording methodology and terminology and some quality control to prevent subjectivity. Currently, there still remains an inability to compare monitoring results among states. Even though there has been much effort through the Southern Group of State Foresters to unify the surveying and reporting of BMP

implementation, the guidelines they provide are not specific enough to produce results that can be used to compare implementation. The ability to compare results could provide evidence that technical requirements may need to be adjusted or reveal new innovative methods that are also effective in protecting water quality. A more standardized BMP monitoring protocol will become a valuable tool in the future for understanding BMP implementation and effectiveness amongst and between the states.

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