



***A Report from the
Council of Western State Foresters***

***Forestry Best Management Practices
for Western States:
A summary of approaches to water quality implementation and
effectiveness monitoring***

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ENSURING OUR FORESTS MEET THE NEEDS OF TODAY AND TOMORROW

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About the Council of Western State Foresters

Established in 1967, the Council of Western State Foresters (CWSF) is a nonpartisan organization of state, territorial, and commonwealth foresters of the Pacific Islands and Western United States. State Foresters are responsible for forest management on state and private lands, including assistance to landowners as well as wildfire and forest health protection services. The members of the CWSF include the 23 State and Pacific Island Foresters of the West.

Mission

Our mission is to promote science-based forest management that serves the values of society and ensures the health and sustainability of western forests.

Acknowledgements

The concept to create this report was introduced at the 2006 Lake Tahoe meeting of the Council of Western State Foresters (CWSF); it was subsequently adopted into its Western Water Resources Committee work plan. The CWSF is a separate 501(c)3 non-profit and the state component of the Western Forestry Leadership Coalition (WFLC), representing the 17 western state forestry directors and six territorial forestry agency directors in the Pacific.

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Objectives

The objective of this report is to provide an overview of forestry BMP implementation and effectiveness monitoring for states represented by Western Water Resources Committee of the Council of Western State Foresters. Specifically, this paper lists the western states which have active, organized BMP monitoring programs that gather information regarding (1) whether BMPs are being implemented and (2) if BMPs are effectively limiting non-point source pollution from forestry operations. An overview of forestry BMP programs for each state and territory are discussed and a summary of each state's efforts is then presented in Table 1. Forestry BMP monitoring activities for the southern and northeastern regions of the U.S. are also discussed for comparison points. Broad observations of forestry BMP monitoring efforts are then summarized in the concluding section. This report illustrates the progress that western states have made in ensuring forestry activities are practiced in such a way that they maintain the highest levels of water quality. Every effort was made to gather the most current data; however, more current data for some states could have been created since the last data call used to inform this report.

Background

Since the 1970s, non-regulatory forestry Best Management Practices (BMPs) in the western U.S. have provided guidance as minimum water quality protection standards for forestry operations. In 1987, Congress amended the Clean Water Act and added Section 319 to address non-point sources of pollution. Section 319 directed all States to develop non-point source pollution plans to address pollution of this nature; however, silvicultural activities were exempt from needing BMP permits for usage and reporting. This directive led western states to develop forestry BMP programs administered within the respective regulatory and non-regulatory frameworks of each state (see Table 1). Additionally, this directive allowed western states to develop their own unique forestry BMP programs. Most western states have initiated forestry BMP implementation and effectiveness monitoring efforts, while a few have not (see Table 1).

Individual State Reviews

Alaska

BMP implementation monitoring in Alaska is mandatory in order to demonstrate the effectiveness of BMPs in meeting water quality standards. Annual meetings are held by Alaska's Department of Natural Resources to identify the need for increased effectiveness when monitoring projects and potential means for funding. The recommendations from the annual meetings are then reviewed by the AK Board of Forestry. BMP compliance monitoring is conducted on all current timber harvest operations that are subject to the *Forest Resources and Practices Act*. Because these monitoring efforts are part of on-going inspections of harvesting

operations, monitoring data is collected on a continual basis. The monitoring efforts are coordinated by the division training officer. BMP effectiveness monitoring data is collected periodically by specific monitoring reports. *Compliance Monitoring Score Sheets* are completed for harvest activities during the routine inspections of timber harvesting operations on state, other public, and private timber lands. Scores range from 1 – 5. A score of ‘1’ represents that an attempt was rarely made to implement the BMP when it was applicable to a harvest activity and the BMP was applied in a manner that was ineffective in achieving the desired result. A score of ‘5’ indicates that the BMP was consistently implemented when it was applicable to a harvest activity and the BMP was applied in a manner that was effective in achieving the desired result. Upon completion of the score sheets, the *Field Inspection Reports* are then completed.

Arizona

The use of Best Management Practices in Arizona is voluntary; consequently, the state has no forestry BMP guidelines. As commented in Ice et al. (2004), “Forestry is generally ranked a low-priority water quality issue in the state” (p. 145). In fact, “Silviculture was not even listed as a probable source of stress to Arizona streams in the draft 2000 [*National Water Quality Inventory*] 305(b) report” (Ice et al. 2004 p. 145). Thus, a review of forestry BMP implementation or effectiveness has never been conducted in Arizona.

California

Under California’s *Forest Practice Act* (FPA), which was adopted in 1973 and implemented in 1975, Timber-harvesting Plans (THPs) must be submitted to the California Department of Forestry and Fire Protection (CDF) for review of compliance with the FPA and the *Forest Practice Rules* (FPRs). In 1984, *Forest Plan Rules* (FPRs) were certified by the State Water Resources Control Board as *Best Management Practices* under Section 208 of the *Federal Clean Water Act*. Additionally, the State Water Resources Control Board certified FPRs as BMPs with the condition that a monitoring and assessment program be implemented (Cafferata & Munn 2002).

By 1989, the California State Board of Forestry and Fire Protection (BOF) formed an interagency task force, later known as the Monitoring Study Group (MSG), to develop a long-term monitoring program “that could test the implementation and effectiveness of FPRs in protecting water quality” (Cafferata & Munn 2002 p. 4). This monitoring program has been funded by CDF since 1990. Cafferata & Munn (2002) state, “The primary goal of the MSG’s monitoring program has been to provide timely information on the implementation and effectiveness of forest practices related to water quality for use by forest managers, agencies, and the public” (p. 4). The MSG also has a long-term monitoring program that tests the effectiveness of FPRs and provides oversight to CDF in implementing the program.

In recent years, there have been a number of factors, such as the new requirements by the Regional Water Quality Control Boards for monitoring of Timber Harvesting Plans (THPs), which have significantly increased forestry-related water quality monitoring in California (Cafferata & Brandow 2006). More specifically, in the past ten years, many of the monitoring efforts have focused on learning more about the implementation and effectiveness of FPRs in

protecting California's water quality. Two long-term monitoring programs, for example, which assess FPRs implementation and effectiveness, are the *Hillslope Monitoring Program* (HMP) and the *Modified Completion Report* (MCR).

The *Hillslope Monitoring Program* began in 1996 and ran until 2002 when funding was no longer available. The purpose of the HMP was to determine if *Forest Practice Rules* were adequately protecting beneficial uses of water associated with commercial timber operations on nonfederal lands. Field inspections were conducted by independent contractors for 295 THPs. Data was prepared by CDF in a final report in 2002. Similar to the HMP, the *Modified Completion Report* (MCR) monitoring program also focused on looking at implementation rates and effectiveness of FPRs. However, unlike the HMP, this program was considered more cost-effective because it utilized CDF Forest Practice Inspectors rather than independent contractors to collect onsite monitoring information. Implemented from 2001 to 2004, data was collected on a random selection of 281 completed THPs (12.5% of total Plans). Also, based on the results from the HMP, high risk and highly sensitive parts of the Timber-harvesting Plan were sampled (i.e., roads, crossings, and watercourse and lake protection zones). Comparable to the findings in the HMP, compliance with FRPs was high and FRPs were found to be highly effective when properly implemented.

Currently, CDF has approximately 70 Forest Practice Inspectors, who have jurisdiction on both private forest lands, approximately 7,000,000 acres, and Demonstration State Forests, approximately 71,000 acres. In order to determine compliance with the FPA and FPRs, Forest Practice Inspectors are responsible for conducting pre-harvest inspections, active harvest inspections, and completion inspections. The CDF inspectors can also perform erosion control period inspections up to three years after harvest completion. The inspectors can apply enforcement where needed, including writing Notices of Violation and Citations (both criminal and civil).

In addition to the HMP, MCR, and the Forest Practice compliance inspection program, there are several cooperative in-stream monitoring projects that also assess the effectiveness of FPRs. For example, the *Caspar Creek Watershed Study* provides long-term hydrologic information (such as hydrologic changes, sediment production, and erosion impacts) from logging and road construction in managed second-growth conifer forests. The project is a cooperative effort between the USFS Pacific Southwest Research Station and CDF, which has been collecting data for more than four decades. Additionally, California is also required to report monitoring information to the Regional Water Boards. Timber companies, such as the Pacific Lumber Company, also have initiated in-stream and road-related monitoring.

Today, the CDF and MSG are developing a new *Interagency Mitigation Monitoring Program* (IMMP). The concept of IMMP "is that monitoring developed and performed jointly by the staff members of the affected agencies will produce a product that is useful to and accepted by each of the affected agencies" (Cafferata & Brandow 2006 pp. 3-4). The pilot program began in July 2006 and is looking specifically at watercourse crossing.

Colorado

Colorado adopted new voluntary BMPs for forest operations in 1998. To date, the state has not developed a formal program for BMP monitoring. As Ice et al. (2004) comment, “The state has used anecdotal feedback on BMP implementation...but has not conducted a formal survey to determine implementation” (p. 149). However, Colorado is currently working on developing a statewide BMP audit, which may be initiated in the fall of 2007.

Hawaii

Although forestry BMPs have been used in Hawaii for a few years, no monitoring programs have been established that evaluate BMP implementation and effectiveness. However, the state is currently working on a 15-year program, which will be implemented statewide in 2013, that proposes to link forestry programs, BMPs, and education and training programs to water quality goals. Contained in *Hawaii's Coastal Nonpoint Pollution Control Program Management Plan* (CNPCP), the state proposed to develop mechanisms to ensure that the appropriate BMPs are used in forestry operations. Currently, Hawaii requires BMPs to be incorporated into Forest Stewardship contracts and leases of State lands for forestry operations. Because commercial forestry operations have only recently expanded in Hawaii, the state is gathering more information to determine the appropriate BMPs needed to ensure that the management measures in the CNPCP are implemented statewide.

Idaho

In order to evaluate the implementation and effectiveness of forestry BMPs, Idaho is required, under the Idaho Non-point Source Management Plan, to conduct on-site reviews of timber harvest activities. Idaho's BMP monitoring program is the responsibility of the Idaho Department of Environmental Quality (DEQ), who coordinates and chairs the statewide Forest Practices Water Quality Audit (FPWQ Audit). The main purpose of the FPWQ Audit is to assess the application and effectiveness of forestry BMPs, as described by the *Idaho Forest Practices Act* (FPA) (McIntyre et al. 2005). The audits are one of the key steps “in the process to determine if forest practices are being implemented and maintained, and if water pollutants are being effectively controlled” (McIntyre et al. 2005 p. 8).

FPWQ Audits began in 1984 and have been conducted every four years, with the most recent audit in 2004. During intervening years, the Idaho Department of Lands (IDL) conducts on-going informal BMP audits. Audits are conducted by the FPWQ Compliance Audit team, which is comprised of a representative from IDL and from DEQ. The IDL's Forest Practices Program Manager has participated on every audit team, and personnel from IDL have also assisted with the audits by collecting data for the representatives.

The BMP monitoring procedure is developed and documented in a work plan that is written specific to the purpose and objectives of each given audit. In the 2004 FPWQ Audit, for example, the audit team proposed objectives that assessed the extent to which the FPA Rules were implemented and effective, as well as recommend rule and administrative procedure revisions to the FPA Rules. Timber sales in the 2004 audit were randomly selected based on three criteria: 1) they occurred on unstable geologic types; 2) they bordered or encompassed at

least 500 feet of a Class I stream; and 3) they were inspected previously by agency foresters with a final report. 27 timber-harvesting sites were audited for compliance, with four of these sites audited for effectiveness. McIntyre et al. (2005) state, "The 2004 audits addressed the FPA requirements for timber harvest and road construction and maintenance, and focused on specifications for retaining shade, leaving trees, and providing fish passage" (p. vi). The findings of the audits were then reported to the Idaho Governor, the Forest Practices Steering Committee, the Forestry Practices Act Advisory (FPAA) Committee, and the Idaho Board of Land Commissioners. The report also went to the Idaho Board of Environmental Quality and the IDL.

In addition to the state's monitoring program, a private forest products corporation is also analyzing BMP effectiveness. Initiated in 1990, The Potlatch Corporation and cooperators are evaluating the effectiveness of state forest practices rules in the Mica Creek Watershed in northern Idaho.

Kansas

The use of Best Management Practices in Kansas is voluntary. Consequently, no BMP monitoring program is in place. However, voluntary BMPs are promoted through watershed foresters.

Montana

Montana's water quality protection program for forestry involves a combination of regulatory and non-regulatory approaches that are implemented through the Forestry Division of the Department of Natural Resources and Conservation (DNRC). Since the 1970's, non-regulatory Forestry Best Management Practices (BMP) have provided guidance as minimum water quality protection standards for forestry operations. Several legislative actions in the late 1980's resulted in a more standardized process for BMP implementation. The *BMP Notification Law* (76-13-101 MCA) requires private landowners to notify the DNRC prior to harvesting timber. DNRC then provides forestry BMP information and technical assistance on how to apply the BMPs. An interdisciplinary technical workgroup with members representing a broad range of forestry interests within the state provides oversight to DNRC for BMP development and program implementation.

Montana also has a regulatory *Streamside Management Zone Law* (77-5-301 307 MCA) that prohibits certain forest practices within a defined buffer zone along stream channels and lakes where improper practices have the potential to result in erosion, water quality problems, and degradation.

Since the early 1990's, DNRC has been monitoring forest practices for BMP and SMZ implementation and effectiveness through a biennial statewide BMP audit process. The most recent forestry BMP audit process was completed in 2006. The audits were conducted by interdisciplinary teams with members representing natural resource specialists, forest industry, conservation interests, and private forest landowners. The teams evaluated 49 BMP practices and 12 SMZ practices at each of 45 sites distributed across the state by geographical region. The sites represented logging operations conducted since 2003 where timber harvest and related

activities had the greatest potential for impacting water quality. The results show that across all ownerships, BMPs were properly applied 96% of the time and were effective in protecting soil and water resources 97% of the time. In addition, SMZ practices were applied 98% of the time with 99% effectiveness. The results for 2006 are similar to audit results from the past several audit cycles and show a significant improvement in implementation and effectiveness from the early 1990's. The audit findings and recommendations were summarized in a comprehensive report (Rogers 2006) and presented to the Montana legislature.

Nebraska

The use of Best Management Practices in Nebraska is voluntary; consequently, there is no monitoring BMP program in place.

Nevada

The *Nevada Forest Practices Act* (FPA) regulates all silvicultural activities in Nevada. Under the FPA, a timber harvest permit and a performance bond are required; in which applicable forest practice rules are outlined. The Nevada Division of Forestry is responsible for reviewing the permit and bond, as well as for providing the harvest operator with oversight and guidance to BMP implementation. Silviculture BMPs in Nevada are voluntary.

The vast majority of commercial timber-harvesting throughout Nevada's portion of the Sierra Front ended in the 1970s. Today, commercial harvest projects are infrequent. However, if there is a commercial timber sale, then BMPs are implemented through the FPA permit process and are visually monitored for effectiveness. Monitoring data is only collected on a project specific basis during the project period.

Since the 1970s, the U.S. Forest Service has acquired some of the private timberlands. More recently, the remaining true timbered private lands have been incrementally converted to high value urban development. When forested private lands are converted to urban land uses, a Timberland Conversion Permit is required (under the FPA), which mandates that BMPs for site erosion control are in place until the development is complete.

Nevada's Division of Environmental Protection (NDEP) is responsible for surface and ground water quality throughout the state, and does surface water quality monitoring on a regular basis. NDEP has a state BMP manual, which was developed in the early 1990s. Currently, NDEP is working on a statewide protocol for BMP monitoring; however, no completion date has been set.

Pinyon-juniper woodlands occupy the majority of Nevada's remaining forested lands. Recently, they have become the focus of a growing biomass industry coupled with fuels reduction projects. As noted in Ice et al. (2004), "An emerging issue is the development of BMPs for harvesting pinyon-juniper forests for biomass recovery and to restore wildlands" (p. 154).

New Mexico

Best Management Practices in New Mexico are state regulations that are outlined in the *New Mexico Forest Harvest Guidelines*. Upon completion of a timber sale, the unit is inspected by the New Mexico Forestry Division. If the sale unit passes inspection, then the inspection form (referred to as the '208 form') is sent to the New Mexico Environment Department. The Environment Department's surface water quality bureau monitors TMDL; however, the results of the timber sale are not specifically monitored because they are a non-point source. Nevertheless, based on the inspection reports, Ice et al. (2004) estimate implementation of the regulations to be 75% (p. 154). Violations of the regulations can result in administrative and/or criminal penalties. Currently, a statewide database for the inspections is planned. Ice et al. (2004) comment that upon completion of the database, New Mexico will "explore opportunities" to test BMP effectiveness (p. 154).

North Dakota

The *Landowner Assistance State Priority Plan* and the *North Dakota Forestry Best Management Practices* define North Dakota's BMP program. The BMP program is tied to the delivery of technical and financial assistance to landowners. Every five years a landowner's Forest Management Plan is reviewed and their property is assessed to see if it is in compliance with Forest Stewardship Program guidelines. The responsibility for BMP monitoring rests with the Staff Forester of the North Dakota Forest Service. Field assessments are performed by the Forest Resource Management Team, which is made up of six employees (including the Staff Forester).

The North Dakota Forest Service also offers financial incentives programs. As an eligibility requirement a landowner must sign an agreement with the NDFS that states that they will maintain the practice for ten years. All of the BMP programs in the state are voluntary. Consequently, a landowner can choose to remove a practice at any time. However, if they do so prior to the completion of the 10-year maintenance period they must pay back the cost-of-practice establishment.

North Dakota relies heavily on cooperating agency personnel and contract foresters to perform BMP monitoring efforts. Currently, the U.S. Forest Service is initiating the Forest Stewardship Program Monitoring efforts, which will allow for data to be more formally collected and provide an avenue for integrating BMP monitoring on a larger scale.

Oregon

The Oregon Department of Forestry (ODF) regulates all forestry operations on Oregon's nonfederal land. Private forests are subject to water protection rules outlined in the *Oregon Forest Practices Act* (adopted in 1971). The *Oregon Forest Practices Act* also applies to state-owned forestlands, but state forests are also subject to an additional aquatic conservation overlay contained in the *Oregon State Forests Northwest Management Plan*. It is clearly mandated in the FPA that monitoring and evaluating water protection rules are necessary in order "to increase the level of confidence of all concerned that the rules will maintain and improve the condition of the riparian vegetation and waters of the state over time" (*Oregon Forest Practice Rules*, January 2006, Chapter 628, p. 42). Additionally, the Board of Forestry is required to meet its statutory

obligation, in which the Board “shall establish best management practices and other rules applying to forest practices as necessary to insure that to the maximum extent practicable non-point source discharges of pollutants resulting from forest operations on forestlands do not impair...water quality” (*Oregon Forest Practices Rules*, January 2006, Chapter 628, p. 87). Therefore, both the state and private forests’ programs have an active BMP program that assesses BMP implementation and effectiveness monitoring for forestry operations. ODF’s *Forest Practices Monitoring Program* (FPMP) “provides scientific information for adapting regulatory policies, management practices, and volunteer efforts on non-federal lands” (ODF 2002 p. 1). The FPMP was established in 1988, updated in 1994, and then revised again in 1998. The FPMP is responsible for monitoring the implementation and effectiveness of water protection rules on an annual basis. Monitoring efforts are conducted with ODF personnel as well as through cooperative agreements with universities, large private landowners, federal researchers, and other organizations. Monitoring data is collected on a project-by-project basis by using specific questions that illustrate issues or concerns with particular BMPs. The questions were drawn from a previous monitoring strategy, *Oregon Plan for Salmon and Watersheds Workplan*, the Forest Practices Advisory Committee final report, and citizen and stakeholder input in 1994 and 2000. The findings and recommendations from the monitoring efforts are then reported to the Board of Forestry.

Because the Board of Forestry has authority to develop and enforce statewide rules, the Board believes that this continued monitoring is necessary to provide feedback about the adequacy of the rules and how to improve them (Ice et al. 2004 p. 154). Since the rules are subject to revisions based on monitoring data and best available science, the rules have undergone many changes with the most recent changes occurring in 1994 and 1995.

There are several current projects on both state and private forestlands that look at BMP compliance and effectiveness. In 1998, for example, the private forests program conducted a comprehensive BMP compliance monitoring study, which was implemented during the 1999 and 2000 field season. The goal of the study was to identify the level of forest operations in compliance with forest practice rules and to identify if adjustments to administration of the program are needed. Units were surveyed by a former Forest Practices Forester as either ‘compliant’ or noncompliant’. A total of 13,506 BMP applications were reviewed on a total of 189 harvest operations. While compliance was relatively high (96.3%), the results of the study will now be used to assist with future monitoring, education, and training to reduce the incidences of noncompliance (Cathcart et al. 2005 p. 1). An example of Oregon’s BMP effectiveness monitoring efforts is the Riparian Function and Stream Temperature effectiveness monitoring study, which evaluates stream temperature and riparian condition before and after timber-harvesting. The study was initiated in 2002 and is scheduled for completion in 2012. Over the ten years, reports will be completed in 2006 (baseline), 2007 (one-year post harvest), 2009 (three-year post harvest), 2011 (five-year post harvest), and a final report and recommendations in 2012.

There are also several watershed studies on state and private forestlands that examine the implementation and effectiveness of water protection rules. The Hinkle Creek Paired Watershed Study and Demonstration Area is a ten year project funded through the Watersheds Research Cooperative in the College of Forestry at Oregon State. The four watersheds in the project area,

which are owned by Roseburg Forest Products, will be harvested in compliance with forest practice rules. Stream discharge and water quality will then be monitored to assess BMP effectiveness. Another watershed monitoring project that evaluates the effects of harvesting activities is the Trask River project. Currently, the study design is being developed. Once implemented, this 15-year study will evaluate the effects of forest management at stream headwaters, as well as evaluate the effects of timber-harvesting downstream.

South Dakota

Best Management Practices for South Dakota were established by the state in 1980. South Dakota revised their BMPs in 1993 and 2003, in which both revisions were then adopted in the *South Dakota Non-point Source Pollution Management Plan*. Despite the fact that BMP compliance is voluntary, timber harvest operators, wood products industries, and land managers have made a commitment to implement BMPs. In fact, in 2001, the Black Hills Forest Resource Association (BHFRA) began a financial and technical partnership with the South Dakota Department of Environment and Natural Resources (DENR) for voluntary monitoring, evaluation, and training for BMP implementation (Everett 2004 p. 1). The first timber sale field audits to evaluate BMP compliance were conducted in 2001.

In 2004, training workshops and field audits were conducted by the BHFRA and DENR, in which seven timber sales were audited for BMP application and effectiveness. A diverse team of private and public sector resource professionals conducted the audits. Using a well-established system of rating criteria, a consensus-based approach was used to evaluate BMP compliance. Based on the 2001 and 2004 trainings and audits, it was recommended that the audits and training occur on a three-year cycle.

Utah

Prior to 2001, timber-harvesting activities in Utah went “largely unchecked due to the lack of information related to the location of these activities” (Gropp 2006 p. 9). In 1982, the state conducted the first statewide assessment of forest practices, in which field surveys were conducted on 55 timber sales. It was concluded that silviculture was not a significant non-point source pollutant because approximately 90% of the timber being harvested was on federal land (Gropp 2006 p. 10). From 1982 to 2002 no field audits were conducted that examined silvicultural impacts and their relationship to non-point source pollution. However, in response to Utah’s *Non Point Source Management Plan for Silvicultural Activities* (1998) and the *Utah Forest Practices Act* (FPA) (2001), the *Forest Water Quality Guidelines (FWQG) Monitoring Program* was developed. The objectives of the *FWQG Monitoring Program* “are to develop and implement a forest water quality monitoring and evaluation program, and to demonstrate the application of the FWQG as being effective in reducing non-point source pollution and protecting forest, soil and water resources” (Gropp 2006 p. 6). This monitoring program functions within a voluntary, non-regulatory framework.

The FPA requires operators to register with and notify the Division of Forestry, Fire and State Lands (FFSL) of their timber harvest plans. This notification of intent (NOI) is the key to Utah’s monitoring efforts, in that it provides the FFSL with contact information and location of timber-

harvesting activities. In addition, the FPA requires the FFSL to provide technical assistance and education to the landowners and operators. Upon receiving an NOI, the FFSL must give landowners and operators information on Utah's FWQG.

During the period 2002-2005, the FFSL conducted post-harvest field audits on 40 sites that evaluated FWQG application and effectiveness. Six teams, each comprised of at least a two-person team (usually an Area Forester or Area Manager and an administrative staff person and/or a Forest Management program manager), carried out the monitoring efforts. Additionally, landowner(s) and operator(s) were encouraged to participate during the audit process. The audits are based primarily on "visual assessments and professional judgment" and decisions are based on "consensus among audit team members" (Gropp 2006 p. 6). The current monitoring direction corresponds directly to the number of NOIs received (i.e., for every NOI received a FWQG audit will be conducted unless permission by the landowner is denied). Thus, the state attempts to conduct field audits for 100% of all timber sales on state and private lands.

It was concluded that the FWQG monitoring process was "a positive and productive approach to dealing with a complex issue" (Gropp 2006 p. 38). Therefore, "It is anticipated that FWQG audits will be conducted on a continuous, on-going basis with accompanying reports being produced on a three-year cycle" (Gropp 2006 p. 11).

Washington

The *Washington Forest Practices Act* was enacted in 1974 to achieve public resource protection and a viable forest industry. The act established the Forest Practices Board which has the responsibility of developing rules to achieve the goals of the act. The original *Forest Practices Rules* were adopted in 1974 and implemented in 1975. The *Forest Practices Rules* apply to all nonfederal forest lands and are regulated by the State of Washington Department of Natural Resources (DNR) to achieve protection of public resources. The rules have been modified several times and the current *Forest Practices Rules* were adopted in July 2001.

The *Forest Practices Rules* are generally very prescriptive in nature to achieve the desired goals and outcomes of the act. The *Forest Practices (FP) Board Manual* provides practical guidance to the landowners, operators, foresters, tribal participants, other interested parties and agency regulators to assist in implementing the rules. Some of these *FP Board Manual* Sections contain a mixture of best management practices (BMPs) elements, practical examples, and instructions to help landowners apply the rules to their ownership on the landscape. Because the FP Rules are so prescriptive, the DNR does not maintain a list of the BMPs that could be used to meet the rule requirements. Therefore we do not have an evaluation process to determine effectiveness of them.

The latest rule adoption included Compliance Monitoring as an element of the FP Rules. The Department conducts compliance monitoring per WAC 222-08-160 (4) which states "*The department shall conduct compliance monitoring that addresses the following key question: 'Are forest practices being conducted in compliance with the rules?' The department shall provide statistically sound, biennial compliance audits and monitoring reports to the board for consideration and support of rule and guidance analysis.*"

In 2006 the Compliance Monitoring Program was implemented to assess how well landowners were implementing the *Forest Practices Rules*. The expectation is that the program will cover all operational rules over time. DNR in collaboration with participants from Washington State departments of Ecology, Fish and Wildlife, along with Tribal volunteers reviewed 97 randomly selected forest practices applications covering 278 forest practice activities. These samples were generated from a population of over 6,000 applications submitted annually. Selection criteria consist of activities related to riparian harvest and roads as these two rule groups have the most potential for impact to public resources.

The results of the 2006 field reviews of the 278 activities reviewed are:

- a. 224 of the 278 site specific activities (81%) are in compliance.

Breakdown of the two rule groups:

- i. 93 of the 126 Riparian activities statewide (74%) are in compliance
- ii. 131 of the 152 Road activities statewide (86%) are in compliance.

All decisions for compliance versus out of compliance are made in the field by the review group using professional judgment based on their understanding of the rule element.

The program is currently reviewing applications to complete this biennial cycle requirements. In July 2007 rules for Small Forest Landowners with 20 acres or less to harvest, and Alternate Plans will be added to the existing list of rules being reviewed. For more information see the Compliance Monitoring website at

<http://www.dnr.wa.gov/forestpractices/compliancemonitoring/>

Wyoming

Wyoming's BMP standards for forestry operations were developed in a cooperative effort between the Wyoming Department of Environmental Quality, the Wyoming State Forestry Division, and the U.S. Environmental Protection Agency. There is no law or regulation that requires compliance with these BMP standards. Although the standards are voluntary, forest managers are committed to full BMP implementation.

Using an interdisciplinary team, field audits were first conducted on twelve timber sites in 2000 and 2001. Each audit rated 42 separate practices, for both BMP application and effectiveness. The results of the 2000-2001 field audits allowed for common mistakes and areas of confusion to be identified. Training was also conducted during this time. The combination of auditing and training has allowed Wyoming to develop a self-monitoring system, in which forest managers are able to highlight common mistakes in BMP application during training sessions. In order to maintain Wyoming's system of continuous improvements, field audits were conducted again in 2004. 42 practices were examined at six timber sites, and each practice was rated on BMP application and effectiveness. The field audits were conducted over the course of one week, with the audit team spending one-half day on each timber sale. As a result of the audit findings, forestry BMPs were updated in 2004, and further training was scheduled for July 2005. The next round of audits is scheduled to occur in 2006 and training in 2007. Additionally, the state's

forestry BMP Handbook, which is used as a training reference, will be updated to accurately reflect the state BMPs by 2007.

Territories and Commonwealths of the Pacific Islands

No information was available for the Pacific Island Territories and Commonwealths.

Conclusion

The purpose of this paper is to provide a preliminary assessment of forestry BMP monitoring efforts by the states represented by the Council of Western State Foresters. The information presented can help us to understand the implementation and effectiveness of forestry BMPs in meeting water quality objectives in the West. In summary, each of the states that have assessed implementation of BMPs (eight out of 17 states) indicated BMP compliance to be relatively high. The implementation rates ranged from 75% to 97%. Additionally, the states that have conducted BMP effectiveness monitoring (nine out of 17 states) have shown that BMPs, when properly implemented, are effective in protecting water resources.

In 2004, the Water Resources Committee of the National Association of State Foresters (NASF) conducted a survey that examines state non-point source pollution control programs for silviculture. This survey compiled information that could be beneficial in looking at methodologies used by states in the west. Also, the future needs for progress in non-point source control programs was assessed in this report. The specific results of the surveys could provide insightful information for further analysis of forestry BMP monitoring efforts in the western U.S.

Literature cited

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Table 1: Brief summary of forestry non-point source control programs for states represented by the CWSF.

State	Does the state have established BMPs for silviculture?	Are these BMPs regulatory?	When were the current BMPs developed and revised?	Has the state done monitoring for BMP implementation?	Has the state done monitoring for BMP effectiveness?	Brief summary of recent BMP monitoring programs.
AK	Y	Y	developed: 2000 revised: 2004	Y	Y	<ul style="list-style-type: none"> BMP compliance monitoring in Alaska is conducted on all current timber harvest operations that are subject to the Forest Resources and Practices Act. Because these monitoring efforts are part of on-going inspections of harvesting operations, monitoring data is collected in a continuous basis using Compliance Monitoring Score Sheets. Upon completion of the score sheets, Field Inspection Reports are then completed.
AZ	N	n/a	n/a	n/a	n/a	<ul style="list-style-type: none"> The state has no forestry BMP guidelines; therefore, a review of forestry BMP implementation and monitoring has never been conducted.
CA	Y	Y	developed: 1974 revised: 2006	Y	Y	<ul style="list-style-type: none"> The Hillslope Monitoring Program ran from 1996-2002. The purpose of the program was to determine if Forest Practice Rules were adequately protecting beneficial uses of water associated with timber operations on nonfederal land. Field inspections were conducted by independent contractors for 295 timber-harvesting plans. The Modified Completion Report monitoring program was implemented from 2001 to 2004. Its purpose was also to assess BMP compliance and effectiveness. Field inspections were conducted by CDF Forest Practice Inspectors for 281 timber-harvesting plans. Currently, the state is developing an Interagency Mitigation Monitoring Program, which will specifically look at watercourse crossings. The pilot program began in July 2006. The Forest Practice Inspection and Enforcement Program, which began in 1975, monitors compliance with BMPs (California Forest Practice Rules) and special mitigations contained in site-specific Timber Harvest Plans. Records are kept of inspections, Notice of Violations, and other enforcement actions.

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CO	Y	N	developed: 1998	N	N	<ul style="list-style-type: none"> To date, the state has not developed a formal program for BMP monitoring. However, Colorado is currently working on developing a statewide BMP audit, which may be initiated in the fall of 2007.
HI	Y	N	developed: 1998	N	N	<ul style="list-style-type: none"> Although forestry BMPs have been in place in Hawaii for a few years, no monitoring programs have been established that evaluate BMP implementation and effectiveness. Contained in <i>Hawaii's Coastal Nonpoint Pollution Control Program Management Plan (CNPCP)</i>, the state proposed to develop mechanisms to ensure that the appropriate BMPs are used in forestry operations. Currently, Hawaii requires BMPs to be incorporated into Forest Stewardship contracts and leases of State lands for forestry operations. Because commercial forestry operations have only recently expanded in Hawaii, the state is gathering more information to determine the appropriate BMPs needed to ensure that the measures in the CNPCP are implemented statewide.
ID	Y	Y	developed: 1975 revised: 2006	Y	Y	<ul style="list-style-type: none"> Forest Practices Water Quality Audits (FPWQ Audits) are the process that Idaho uses to determine if forest practices are being implemented and if they are effective at controlling water pollutants. This monitoring program is the responsibility of the Idaho Department of Environmental Quality. FPWQ Audits began in 1984 and have been conducted every four years, with the most recent audit in 2004. During the intervening years, the Idaho Department of Lands conducts on-going, informal audits.
KS	Y	N	developed: 1995	N	N	<ul style="list-style-type: none"> Kansas has no BMP monitoring program in place.
MT	Y	N	developed: 1987 revised: 2004	Y	Y	<ul style="list-style-type: none"> The Montana Department of Natural Resources and Conservation has been monitoring BMP compliance and effectiveness biannually since 1990. The most recent audit report was completed in 2006.
NE	Y	N	developed: 2000	N	N	<ul style="list-style-type: none"> Nebraska has no BMP monitoring program in place.
NV	Y	N	developed: 1994	N	N	<ul style="list-style-type: none"> Nevada has no BMP monitoring program in place. Currently, Nevada's Division of Environmental Quality is working on a statewide protocol for BMP monitoring; however, no completion date has been set.

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NM	Y	Y	developed: 2002	N	N	<ul style="list-style-type: none"> Timber sale units are inspected upon completion of harvesting. However, the results of the timber sale are not specifically monitored. Nevertheless, based on inspection reports, BMP implementation can be estimated. Currently, a statewide database of inspections is planned, which could allow for BMP effectiveness to be tested; yet no projects are presently being planned.
ND	Y	N	developed: 1997	N	Y	<ul style="list-style-type: none"> Every five years a landowner's Forest Management Plan is reviewed and their property is assessed to see if it is in compliance with the Forest Stewardship Program guidelines. However, no formal monitoring efforts that specifically assess BMP compliance have been made. The state relies heavily on cooperating agency personnel and contract foresters to perform BMP monitoring efforts. Currently, the U.S. Forest Service is initiating the Forest Stewardship Program Monitoring efforts, which will allow for data to be more formally collected and provide an avenue for integrating BMP monitoring on a larger scale.
OR	Y	Y	developed: 1972 revised: 2003	Y	Y	<ul style="list-style-type: none"> The Oregon Department of Forestry's Forest Practices Monitoring Program is responsible for monitoring the implementation and effectiveness of water protection rules on an annual basis. This program was established in 1988, updated in 1994, and then revised again in 1998.
SD	Y	N	developed: 1993 revised: 2004	Y	Y	<ul style="list-style-type: none"> In 2001, the Black Hills Forest Resource Association began a financial and technical partnership with the South Dakota Department of Environment and Natural Resources for voluntary monitoring, evaluation, and BMP implementation training. The first timber sale field audits to evaluate BMP compliance were conducted in 2001. In 2004, training and field audits were conducted on seven timber sales. Based on the 2001 and 2004 trainings and audits, it was recommended that the audits and training occur on a three-year cycle.
UT	Y	N	developed: 2001 revised: n/a	Y	Y	<ul style="list-style-type: none"> In response to Utah's Non Point Source Management Plan for Silvicultural Activities (1998) and the Utah Forest Practices Act (FPA) (2001), the Forest Water Quality

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						Guidelines (FWQG) Monitoring Program was developed. The objectives of the FWQG Monitoring Program are to develop and implement a forest water quality monitoring and evaluation program, and to demonstrate the application of the FWQG as being effective in reducing non-point source pollution. During 2002-2005, the Division of Forestry, Fire and State Lands conducted post-harvest field audits on 40 sites that evaluated FWQG application and effectiveness. It is anticipated that FWQG audits will be conducted on a continuous, on-going basis with accompanying reports being produced on a three-year cycle.
WA	Y	Y	developed: 1974 revised: 2004/05	N	N	The state has recently begun a compliance monitoring program started in 2006. The results of the 2006 field reviews of the 278 activities reviewed are: <ul style="list-style-type: none"> b. 224 of the 278 site specific activities (81%) are in compliance. Breakdown of the two rule groups: <ul style="list-style-type: none"> i. 93 of the 126 Riparian activities statewide (74%) are in compliance ii. 131 of the 152 Road activities statewide (86%) are in compliance. <p>All decisions for compliance verses out of compliance are made in the field by the review group using professional judgment based on their understanding of the rule element.</p> <p>For more information see the Compliance Monitoring website at http://www.dnr.wa.gov/forestpractices/compliancemonitoring/</p>
WY	Y	N	developed: 1998 revised: 2003	Y	Y	<ul style="list-style-type: none"> ▪ Field audits to assess BMP application and effectiveness were first conducted on 12 timber sales in 2000 and 2001. Field audits were conducted again in 2004. The next round of audits is scheduled to occur in 2006.

Y-Yes N-No