ncasi technical bulletin

NATIONAL COUNCIL OF THE PAPER INDUSTRY FOR AIR AND STREAM IMPROVEMENT, INC.
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WESTERN STATES NONPOINT SOURCE PROGRAM REVIEW

TECHNICAL BULLETIN NO. 706

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ncasi

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Since 1979, NCASI has monitored state programs for controlling nonpoint source pollution associated with forest management operations. A comprehensive survey was conducted in 1982 and distributed as Special Report 83-01. In 1992, it was determined that new regional surveys should be conducted to update the earlier effort and address new questions being discussed in relation to the pending reauthorization of the Clean Water Act. This report is the second of four technical bulletins summarizing these surveys and covers the thirteen western states.

This review was designed to answer seven basic questions posed by the industry concerning the current silvicultural nonpoint source control programs in the West. The first question was: "How does forestry compare to other nonpoint sources in terms of extent and nature of effect on water quality?" The survey found that "...forestry practices are amongst the more modest sources..." of nonpoint source pollution. Even in states like Oregon and Washington, with major timber operations and large proportions of the state in forest, other nonpoint source categories (like range, agriculture, and recreation) ranked higher in impacts.

The second question was: "Do all states with substantial commercial forest management activities have regulatory or nonregulatory programs in place to control nonpoint source pollution from forest management operations?" All the Western states have active programs to control nonpoint sources. Eight of these states have developed regulatory programs.

The third question asked was: "What is known about rates of compliance with BMPs?" There are few systematic compliance studies in the West for voluntary programs. Oregon and Washington have found very high compliance levels. Other regulatory programs, such as those in Idaho, Montana, and California, have found somewhat lower levels of compliance, and have modified their programs to address concerns.

The industry's fourth question was: "When BMPs are implemented, do they effectively control NPS pollution from forest

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management operations?" Interdisciplinary team surveys have generally found that the major impediment to water quality protection is lack of compliance with Best Management Practices. There has been extensive testing of forest practices in the West to ensure their effectiveness for water quality protection. A number of states have adopted adaptive management strategies to further test the effectiveness of their BMPs.

Question five was: "In each state with voluntary BMPs, what authority does the state have to control the actions of a logger or landowner who is blatantly disregarding BMPs and causing obvious impacts to water quality?" Five of the thirteen states in the West do not have regulatory forest practice programs. In these states, the federal government manages a large portion of the forest land in compliance with agency standards for environmental protection. Several states have authority under water quality or zoning statutes to control actions on private lands that may be causing water quality problems.

The sixth question was: "What extension/education activities are planned or underway to promote compliance with BMPs and other programs to control NPS pollution from forest management operations?" The authors concluded that many states in the region should consider improving their extension-education programs focused on forestry BMPs and water quality protection. Examples of excellent extension-education programs were found in Washington, Oregon, Montana, and California.

The seventh and final question concerned "...locations and/or site conditions in the region where the potential for nonpoint source pollution is substantially greater than average." State agencies have demonstrated an ability to identify areas of particular concern for their states. Studies are underway to identify high-risk watersheds in California, and erosion hazard ratings are part of the forest practice rules. Idaho has identified stream segments of concern as part of the state water quality antidegradation agreement. Oregon and Washington have both prioritized forest practice activities according to their potential to impact water quality.

This report was prepared by Dr. Paul V. Ellefson and Antony S. Cheng of the University of Minnesota. The Project Manager for this report was Dr. George Ice, at the NCASI West Coast Regional Center in Corvallis, Oregon. Questions or comments on this report should be directed to Dr. Ice at (541) 752-8801.

Very truly yours,

Ronald A. Yeske

Attachment

WESTERN STATES NONPOINT SOURCE PROGRAM REVIEW

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ABSTRACT: This technical bulletin reviews state nonpoint source (NPS) control programs in the thirteen western states. All states were found to have active NPS control programs. State assessments show that forest practices are generally among the more modest sources of NPS pollution, despite the fact that forests cover 31 percent of the region. Exceptions to this general conclusion occur in several sub-state regions in which forestry is a major land use on landforms with high erosion potential. Rates of compliance with Best Management Practices (BMPs) are very high in some states but substantially lower in others. There has been extensive testing of forest practices in the West to ensure their effectiveness. Eight of the 13 western states have regulatory programs to control NPS pollution associated with forest management. Of those without regulatory programs, federal ownership of much of the forest land provides for consideration of water quality protection. Other states have authority through water quality or zoning regulations to protect forest water quality. BMP education and training need to be improved in some states, but there are aggressive programs in Oregon, California, Washington, and Montana.

KEYWORDS: Nonpoint Source (NPS), Best Management Practices (BMPs), Forest Practices Act, Water Quality, Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.

RELATED NCASI PUBLICATIONS:

"Southern Regional Review of State Nonpoint Source Control Programs and Best Management Practices for Forest Management Operations," NCASI Technical Bulletin No. 686 (December 1994).

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

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

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

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WESTERN STATES NONPOINT SOURCE PROGRAM REVIEW

I PROGRAM HIGHLIGHTS

A. Forestry as Pollutant Source

Western states have a notable mixture of extractive and manufacturing sectors, all of which are potential nonpoint sources of water pollutants. Reviews of documents prepared by state governments in response to requirements of the Clean Water Act of 1987 clearly indicate that forestry practices are amongst the more modest sources of such pollutants. Management activities involving agriculture, grazing, mining, and urban runoff are among the more significant origins of water pollutants. Where forestry practices have been identified as significant sources of water pollutants, concern is often with the construction and maintenance of roads. Even where such impacts are considered to be locally severe, state assessments often conclude that such activities have a minimal impact on water quality within broader regional watersheds of a state.

B. Program Operational Status

Most Western state governments have assumed a very vigorous posture toward forestry nonpoint sources of water pollutants. Frequently implemented by a variety of agencies, all the region's states have some form of program designed to address nonpoint sources. Such programs range from education and technical assistance programs to programs involving cost share and regulatory measures. Of the region's 13 states, eight have chosen to address forestry sources of water pollutants via complex regulatory programs. Such programs establish forest practice standards with which private owners of forestland (or timber harvesters) must comply -- or face the imposition of severe penalties. The 1991 cost to state governments of such programs ranges from a modest $83,000 in Montana to over $11 million in California. Although regulatory programs initially were designed to focus on water quality problems, the scope of their regulatory purpose has broadened considerably to include endangered species, scenic beauty, biological diversity, and wildlife generally.

The forest practice regulatory programs of Western state governments are most often implemented by a state's lead forestry agency. The latter typically coordinates program development and implementation with other responsible agencies (e.g., wildlife, fisheries, ecology). However, some states have a number of agencies involved in the administration of regulatory programs focused on forestry practices. In this respect, the state of Montana is notable.

C. Compliance with Standards

Landowner and operator implementation of forestry practices considered necessary for the protection of water quality is an obvious necessity for successful accomplishment of state interest in water resources. A major concern to state governments is the selection of an appropriate program (or mix thereof) that will ensure such implementation.

Forestry practices considered necessary for the protection of water resources are frequently packaged as "Best Management Practices" (BMPs). The latter can be educationally presented to landowners and operators in hopes that the practices will be voluntarily implemented, or they may be applied by landowners when faced with the legal mandates of a forest practices law. When implemented by regulatory means, Western states have experienced compliance rates that are very high. Reforestation standards, for example, are typically accomplished at the 95 to 98 percent level. Landowner and operator compliance with other forest practice standards (e.g., road construction and maintenance, and riparian zone management) is similarly high.

States that have proceeded to implement BMPs via voluntary mechanisms have had mixed experiences -- compliance ranges considerably from state to state and from practice to practice. Judgments about voluntary mechanisms may be premature, however, since relatively few Western states with these types of programs have carried out systematic studies of compliance.

D. Effectiveness of Standards

Compliance with best management practices is no guarantee that state interest in water resources impacted by forestry practices will be met. The forestry practices implemented are, in essence, a proxy for more focused water quality goals that may be of interest to state governments. For example, leaving shade trees along streams is a common practice for maintaining water temperatures that are necessary for fish propagation. Of concern to program administrators is whether, in a field setting, such a practice actually has a positive impact on fish habitat. To address such an issue (and the effectiveness concerns implied therein), scientific (effectiveness) monitoring of best management practices is called for.

Programs to scientifically monitor the effectiveness of state BMPs on water quality in Western states are few in number; hence, the evidence to support or deny the effectiveness of BMPs is not widely available. Where available, administrators are faced with mixed results. However, more intense scientific monitoring programs are on their way toward reality. States that are actively developing such programs include Idaho, Oregon, California, and Washington. The BMPs are based on extensive

watershed research in the region through the USDA Forest Service (i.e., H.J. Andrews Experimental Watershed, Caspar Creek, etc.) and the regions' universities (Oregon State University, University of Washington, University of Idaho, Colorado State University, etc.). Additional watershed research is being provided by major industry efforts by companies (Weyerhaeuser, Boise Cascade, Plum Creek, Simpson Timber Company, etc.). The overall information on BMPs shows that questions about their effectiveness have more to do with the degree of complexity of stream quality issues, rather than whether BMPs are generally effective.

E. State Enforcement Authority

Western state governments have considerable authority to address water pollutants originating from forestry practices. Such authority frequently originates from water quality laws. These laws are implemented by state water quality or pollution control agencies. State authority specifically focused on forestry practices varies considerably within the region. Regulatory programs in eight states have a significant legal basis for imposing forest practice standards on landowners and operators. Even in such states, however, the pattern has been one of a succession of amendments to forest practice laws; amendments that generally broaden and intensify state authority over the forestry practices prescribed by private individuals. For states without regulatory programs, administrators seem satisfied with the authority they have to implement technical assistance and educational programs. Often, the federal government has ownership of a large portion of the forest in western states without a regulatory nonpoint source control program. In other states, watershed conservation zoning or erosion control regulation may be used for forest activities.

F. Extension-Education Programs

Extension-education programs used as a means of informing landowners about best management practices in general, or about legally mandated forestry practice standards specifically, are for the most part poorly organized in their focus on water quality issues in most Western States. Such is not to deny the existence of programs (e.g., Montana, California, Oregon, Washington) that are being effectively implemented by a state's lead forestry agency or Extension Service. Needed, however, is a careful review of the status of such programs generally and the development of strategic options that will enable them to more directly focus on water quality matters.

G. Information Sources

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II REGIONAL LAND USE PATTERNS

The Western Region encompasses over 764 million acres of land area (excluding 365 million acres in Alaska), of which agricultural is a major rural land use (39 percent) (Tables 1 and 2).[1]

TABLE 1 LAND USE IN THE WESTERN REGION, BY TYPE OF USE - 1987

Land Use	Area[a] (thousand acres)	Percent of Total Surface Area
Rural Cropland	66,896	9
Pastureland	12,697	2
Forestland	68,514	9
Rangeland	215,953	28
Minor Uses	18,866	2
SUBTOTAL RURAL	382,926	50
Developed (urban)	13,248	2
Water Area	10,518	1
Federal Land	357,405	47
SUBTOTAL OTHER	381,171	50
TOTAL SURFACE AREA	764,097	100

[a] USDA-Soil Conservation Service National Resource Inventory excludes Alaska.
Source: Summary Report: 1987 National Resources Inventory. USDA-Soil Conservation Service. Statistical Bulletin Number 790. 1989. Washington, DC.

Agricultural uses include cropland, pastureland, rangeland, and related minor uses. Nearly half (47 percent) of the region's land area is owned by the federal government. If the rangeland portion of this ownership category were included in the agricultural land use total, the prominence of agricultural as a regional land use would be even greater. A very modest portion of the region is occupied by urban centers, namely about 13 million acres.

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[1] States included in the Western Region are: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

TABLE 2 RURAL LAND USE IN THE WESTERN REGION -- BY STATE AND TYPE OF USE - 1987

State	Percent of Total Rural Land				
	Cropland	Pastureland	Rangeland	Forestland	Minor Uses
Alaska[a]	-	-	-	-	-
California	21	3	36	31	9
Oregon	16	7	33	42	2
Washington	27	5	20	44	4
SUBREGION AVERAGE	21	5	30	39	5
Arizona	3	1	77	12	7
Colorado	27	3	57	10	3
Hawaii	10	1	26	41	22
Idaho	34	7	35	21	3
Montana	28	5	57	8	2
Nevada	9	3	79	4	5
New Mexico	5	1	80	9	5
Utah	12	4	53	20	11
Wyoming	7	3	84	3	3
SUBREGION AVERAGE	15	3	61	14	7
REGION AVERAGE	17	3	54	20	6

[a] USDA-Soil Conservation Service National Resource Inventory excludes Alaska, Puerto Rico, and the Virgin Islands.

Source: Summary Report: 1987 National Resources Inventory. USDA-Soil Conservation Service. Statistical Bulletin Number 790. 1989. Washington, DC.
Note: Excludes Alaska.

Forests occupy over 352 million acres of the region's surface area -- over 31 percent of the region's total land area (Powell et al. 1993). The region's most heavily forested states are (in descending order of area forested) Alaska, California, Oregon, Montana, Idaho, Colorado and Washington. These states account for nearly 80 percent of the region's forest area, and 70 percent of its land area. Approximately 36 percent (129 million acres) of the region's forest area is classified as timberland (unreserved forest area capable of producing in excess of 20 cubic feet of wood per acre per year of industrial wood in natural stands). Oregon has the largest timberland area (21.6 million acres).

III FOREST RESOURCES

A. Forest Type Groups

Softwood-conifer species dominate the region's unreserved forest landscape, namely 83 percent of the area. Hardwood species occupy a modest but important 45.8 millon acres (Table 3). The forests of the region are often distinct to two major subregions, namely the Rocky Mountains and the Pacific Coast (Powell et al. 1993).

TABLE 3 UNRESERVED FOREST LAND IN THE WESTERN REGION BY FOREST TYPE GROUP 1992

Forest Type Group	Area (thousand acres)	Percent
Douglas-Fir	37,300	12
Ponderosa Pine	27,031	9
Western White Pine	205	-[a]
Fir-Spruce	53,118	17
Hemlock-Sitka Spruce	12,204	4
Larch	2,122	1
Lodgepole Pine	13,531	4
Redwood	1,161	-[a]
Other Softwoods	65,419	21
Western Hardwoods	45,826	15
Pinyon-Juniper	46,239	15
Chaparral	6,082	2
All Forest Type Groups	311,138	100

[a] Less than one percent.

Note: Excludes non-stocked forestland.
Source: Forest Resources of the United States, 1992 by D. S. Powell, J. L. Faulkner, D. R. Darr, Z. Zhu, and D. W. MacCleery. General Technical Report RM-234. 1993. Rocky Mountain Forest and Range Experiment Station. USDA-Forest Service. Fort Collins, CO.

(1) Rocky Mountains. Ponderosa pine is found in all Rocky Mountain states, although nearly half is located in Arizona and New Mexico. Ponderosa pine does well in arid areas and exists in pure stands in the southwest. In the subregion's northern states, Douglas-fir is the dominant forest type (primarily in Idaho and Montana), accounting for 73 percent of such forests nationwide. Lodgepole pine is a pioneer species found primarily in Idaho, Montana, Wyoming, and central Colorado. The species occurs in very dense stands composed almost exclusively of Lodgepole pine.

Spruce-fir forests are common in many parts of the Rocky Mountain subregion that have higher elevations, cooler temperatures, and greater moisture (Idaho, Montana, Wyoming, Utah, Colorado). Important tree species include grand fir, subalpine fir, and Engelmann spruce. In contrast to spruce-fir forests, pinyon-juniper forests are found in dry plateaus and broken tablelands characteristic of lower elevations in the southern part of the subregion. Pinion-juniper forests cover some 46 million acres. Other species within the subregion are western white pine, larch, and hemlock (3 percent of forest area in subregion).

(2) Pacific Coast. Six major conifer forest ecosystems dominate the Pacific Coast subregion (Alaska, California, Hawaii, Oregon, and Washington). Found throughout Washington, Oregon, and California, Douglas-fir is very likely the most important commercial tree species in the subregion. Although often found in pure stands, Douglas-fir can also be part of mixed-species forests that include western hemlock, western red-cedar, Pacific silver fir, noble fir, grand fir, Engelmann spruce, cedars, larch, western white pine, sugar pine, ponderosa pine, red alder, big-leaf maple, black cottonwood, Oregon white oak, and Pacific madrone.

The most prominent forest ecosystem in Alaska is composed of hemlock-Sitka spruce. Sixty-nine percent of such forests are located in coastal Alaska; the remainder are scattered in the coastal fog belts of Oregon and Washington. Common associates of the hemlock-Sitka forest type are western hemlock, mountain hemlock, western red-cedar, Alaska-cedar, Sitka spruce, and lodgepole pine.

Redwoods are the subregion's third most extensive forest ecosystem, occupying significant areas in southwest Oregon (6,000 acres) and Northern California (1.2 million acres). Redwood is among the most rapidly growing tree species in the world, producing up to 400 cubic feet of wood per acre per year.

The most extensive forest type in the Pacific Coast subregion is spruce-fir. This forest type occupies 116 million acres, most of which is in the interior of Alaska or on the western slopes of the Cascade Mountains or Coastal Range of Oregon and Washington. Only 14 million acres of spruce-fir is considered productive from a timber producing perspective; none of forest type is capable of producing more than 180 cubic feet per acre per year. Tree species typically part of spruce-fir forests are white fir, grand fir, subalpine fir, Pacific silver fir, noble fir, Shasta fir, Engelmann spruce, Brewer spruce, and California red fir.

Ponderosa pine forests cover 14 million acres of land in eastern Washington, eastern Oregon, and the interior of

California. Tree species commonly associated with ponderosa pine are Jeffrey pine, sugar pine, white fir, incense-cedar, Douglas-fir, California black oak, grand fir, western larch, western white pine, lodgepole pine, Engelmann spruce, western juniper, Oregon white oak, Coulter pine, knobcone pine, digger pine, cypress, and canyon live oak.

As in the Rocky Mountain subregion, lodgepole pine has an extensive range in the Pacific Coast region. Located mostly on mountains and inland plateaus, the species can be found from southeastern Alaska to southern California.

Several species of hardwood thrive in the Pacific Coast subregion. Found primarily in Oregon and Washington, red alder is the most extensive hardwood type. Other species include big-leaf maple, Oregon white oak, black cottonwood, Pacific madrone, and tanoak.

B. Forest Ownership

Ownership of the region's timberland is dominated by public concerns, especially federal land management agencies (six of ten acres is publicly owned) (Table 4). The federal government is the dominant public owner (nearly 69 million acres) of which the USDA-Forest Service is responsible for 90 percent (63 million acres) of the region's federally-owned timberland.

Table 4 Timberland Ownership in the Western Region, by Ownership - 1992

Ownership Category	Area (thousand acres)	Percent	
Private			
Forest Industry	15,208	31	
Nonindustrial	34,168	69	
Total	49,376	100	
			38
Public			
County and Municipal	432	-[a]	
State	10,284	13	
Federal	68,829	86	
Total	79,545	100	
			62
All Owners	128,921		
			100

[a] Less than one percent.

Source: Forest Resources of the United States, 1992 by D. S. Powell, J. L. Faulkner, D. R. Darr, Z. Zhu, and D. W. MacCleery. General Technical Report RM-234. 1993. Rocky Mountain Forest and Range Experiment Station. USDA-Forest Service. Fort Collins, CO.

Nonindustrial private owners play a major role in the one-third of the region's timberland that is privately owned (Table 4). Such owners are responsible for more than 26 percent of the region's timberland. Forest industry controls a modest 15 million acres (12 percent) of the region's timberland.

C. Landform and Soil Geography

The land forms of the Western Region are characterized by great north-south mountain ranges and vast systems of elevated basins and plateaus (Figure 1). These contrasts are reflected in the region's climatic conditions and, ultimately, in the nature of the vegetation that occurs within the region. The region's major landform systems are the Rocky Mountain system, intermountain plateau system, and the Pacific mountain system (Foth 1990, Thornbury 1965).

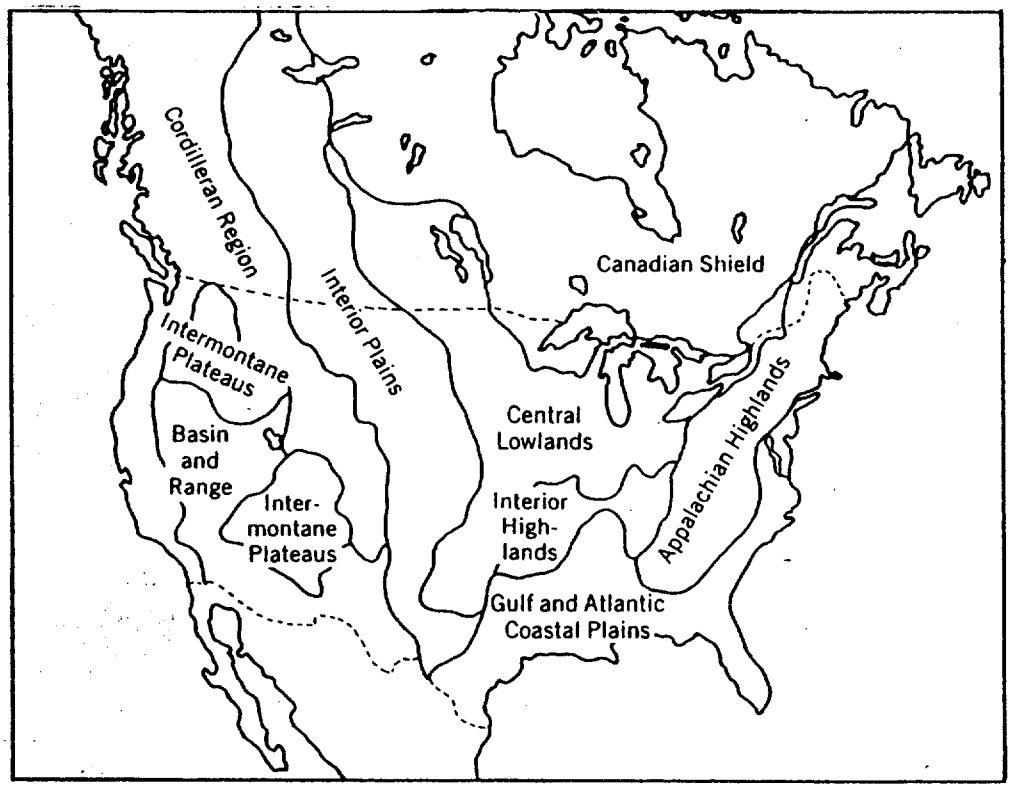

FIGURE 1 PHYSIOGRAPHIC REGIONS OF NORTH AMERICA

Forests in the Rocky Mountain system occur on a wide variety of soils. In the system's mountainous areas, the latter occur in moisture and temperature regimes that vary greatly within short distances and significant changes in altitude. Only at higher elevations are soils moist for any great length of time (90 or more consecutive days). The intermountain plateau system is characterized by arid soils that are seldom moist for as long as 90 consecutive days, and are subject to extreme temperature variations from season to season. Forest intermingled with rangeland in common in the region. Arid and semi-arid climates are the most widespread unifying attributes of the area.

Soils of the Pacific mountain system are characterized by subsurface horizons of clay accumulation that are usually moist for extended periods of time (90 or more consecutive days), and during which temperatures are very suitable for tree growth. Occurring within the system, the Sierra-Cascade mountains are characterized by abrupt eastern escarpments and gentler western slopes that are more humid, and on which is situated great expanses of forests. The latter are important regulators of runoff into the streams and rivers of California, Oregon and Washington.

Beginning with the Olympic mountains in the North, ending in the southern reaches of California, are a series of geologically complex coast range mountains. For the most part, soils in the area are covered with productive forests whose growth is facilitated by often heavy precipitation from marine air masses. To address (in part) highly erosive soils (steep, tectonically active) in its North Coast mountain region, California is an example of a state that has responded with a very strict forest practice regulatory program. Other states in the area that have milder climates and less erosive condition have adopted less rigorous programmatic responses.

D. Erosion Sources

Erosion from forested lands in the Western Region is generally associated with activities that involve road construction and harvesting operations that occur near bodies of water (including stream crossings). Sediment yield from forestland, however, is consistent with the regional average for annual sediment yield from all major land uses (Table 5). It is considerably less a source of sediment than cropland or minor land uses (primarily urban). In heavily forested states like Washington, cropland far exceeds forestland as a source of sediment; it is similarly so in Oregon.

TABLE 5 ESTIMATED ANNUAL SEDIMENT YIELDS FROM RURAL LAND (NON-FEDERAL) IN THE WESTERN REGION, BY STATE AND TYPE OF USE - 1987

State[a]	Tons of Sediment Per Acre Per Year					
	Cropland	Pastureland	Rangeland	Forestland	Minor Uses	All Rural Land
Alaska	-	-	-	-	-	-
California	1.2	0.3	3.3	2.6	0.3	2.3
Oregon	2.9	0.5	1.4	1.0	0.3	1.4
Washington	5.6	0.3	0.6	0.9	0.1	2.1
SUBREGION AVERAGE	3.2	0.4	1.8	1.5	0.2	1.9
Arizona	0.4	0.1	0.6	0.5	0.1	0.6
Colorado	2.2	0.5	2.2	4.3	29.8	3.2
Hawaii	5.6	4.8	3.4	3.0	5.6	4.0
Idaho	4.2	0.3	0.5	1.7	0.5	2.0
Montana	1.9	0.2	0.8	0.8	0.1	1.1
Nevada	0.1	0.0	1.2	1.1	0.5	1.0
New Mexico	1.0	0.2	1.0	1.2	2.5	1.1
Utah	1.0	0.1	1.8	2.6	0.6	1.7
Wyoming	0.7	0.3	1.3	1.3	0.6	1.2
SUBREGION AVERAGE	1.9	0.7	1.4	1.8	4.5	1.8
REGION AVERAGE	2.2	0.6	1.5	1.8	3.4	1.8

[a] USDA-Soil Conservation Service National Resources Inventory excludes Alaska, Puerto Rico, and the Virgin Islands.

Source: Summary Report: 1987 National Resources Inventory. USDA-Soil Conservation Service. Statistical Bulletin Number 790. 1989. Washington, DC.

E. Timber Products Economy

Removals from the region's timber growing stock are significant -- more than 4.5 billion cubic feet (Table 6). Of this total, approximately 83 percent is produced in four states, namely Alaska, California, Oregon, and Washington. Also notable contributors to the region's timber removals are Idaho (333 million cubic feet) and Montana (258 million cubic feet).

Wood products employees in the region (including lumber and wood products and the paper and allied products manufacturing groups) totaled over 263,000 in 1987. The region has more than 9,600 manufacturing establishments which, in total, produced wood products having a 1987 value added of $16.1 billion. Nearly 40 percent of this value added was contributed by the paper and allied products group. The wood-based industry of the region also has a significant wood furniture and fixtures component, especially in California, Washington, Colorado, and Arizona.

TABLE 6 REMOVALS FROM GROWING STOCK IN THE WESTERN REGION - 1991

State	Growth (thousand cubic feet)	Removals (thousand cubic feet)	Removals as Percent of Growth
Alaska	269,651	240,141	89
California	1,085,683	908,025	84
Oregon	1,390,973	1,365,806	98
Washington	1,513,191	1,228,048	81
SUBREGION TOTAL	4,259,498	3,742,020	88
Arizona	120,073	67,264	56
Colorado	297,543	33,857	11
Hawaii	988	0	0
Idaho	728,705	333,015	46
Montana	607,168	258,529	43
Nevada	4,966	615	12
New Mexico	152,908	29,523	19
Utah	64,044	11,494	18
Wyoming	98,358	41,312	42
SUBREGION TOTAL	2,074,753	775,609	37
REGION TOTAL	6,334,251	4,517,629	71

Source: Forest Resources of the United States: 1992 by D.S. Powell, J. L. Faulkner, D. R. Darr, Z. Zhu, and D. W. MacCleery. 1993. General Technical Report RM-234. Rocky Mountain Forest and Range Experiment Station. USDA-Forest Service. Fort Collins, CO.

The region's forests are actively managed by a variety of public and private organizations. Some indication of the intensity of this activity can be gained from the number of private landowner notifications of intent to carry out forestry practices. In California, Idaho, Oregon, and Washington (where 78 percent of the region's softwood lumber was produced in 1991), 34,000 forest practice notifications and applications were submitted to lead state forestry agencies in 1990. In Oregon alone, an average of 88,220 acres of private forestland was harvested annually between 1980 and 1991.

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IV STATE NONPOINT SOURCE PROGRAMS - REGIONAL SUMMARY

State governments can initiate a wide variety of programs to influence forestry practices that impact the range of benefits that are produced by private forests. Regulatory programs are one obvious example. Other approaches includes education extension programs, technical assistance programs, voluntary guidelines, tax incentives, and cost-share programs. From a state agency's perspective, interest often focuses on the relative merits of such programs and the program mixture that will most effectively accomplish desired objectives.

A. Program Types

For the most part, regional physical conditions, importance of forestry in state economies, and past traditions of state

involvement in the forestry activities of private landowners are primary variables affecting the type of programs each state uses to influence such activities. In 1992, key administrators of state forestry programs in Western states were asked to identify the type of programs used to encourage owners of private forestland to (Cheng and Ellefson 1993):

- protect water quality (e.g., streamside buffer strips, road and skid trail layout, construction of stream crossings);
- reforest after timber harvesting (e.g., minimum stocking levels, site preparation, seed trees);
- use appropriate timber harvesting procedures (e.g., clearcut size, logging systems and equipment);
- protect forest from fire, insects and diseases (e.g., slash treatment, smoke management, removal of infected trees);
- protect wildlife and rare plant species (e.g., limiting public access, wildlife habitat management, discouraging plant and animal removal); and
- enhance recreation and aesthetic values (e.g., vegetative buffers along roadways, limits on size of timber harvests).

Educational and technical assistance programs were the most common types of programs used to focus on the forestry activities of private landowners in Western states (Table 7). Second most common were programs involving legally imposed standards and regulations, especially where used as a means of influencing landowner practices that impact water quality and protection of forest resources. The omnipresence of forestry, steep mountain slopes, and an active political public provide a combination that apparently fosters development and perpetuation of comprehensive regulatory programs in many Western states. Tax programs were the least used means of influencing the forestry practices of private landowners in the West.

TABLE 7 STATE PROGRAMS FOCUSED ON MAJOR PRIVATE FORESTRY ACTIVITIES IN THE WESTERN REGION, BY PROGRAM TYPE AND FREQUENCY - 1992

Forest Resource Activity and Type of Program	Number of States with Program
Water Quality Protection	
Educational Programs	11
Technical Assistance	10
Voluntary Guidelines	5
Tax Incentives	1
Fiscal Incentives	6
Legal Regulations	7
Reforestation after Harvest	
Educational Programs	11
Technical Assistance	9
Voluntary Guidelines	5
Tax Incentives	3
Fiscal Incentives	8
Legal Regulations	6
Timber Harvesting Methods	
Educational Programs	11
Technical Assistance	9
Voluntary Guidelines	6
Tax Incentives	0
Fiscal Incentives	3
Legal Regulations	6
Forest Protection	
Educational Programs	12
Technical Assistance	11
Voluntary Guidelines	6
Tax Incentives	0
Fiscal Incentives	6
Legal Regulations	9
Wildlife Management and Protection	
Educational Programs	10
Technical Assistance	8
Voluntary Guidelines	4
Tax Incentives	0
Fiscal Incentives	4
Legal Regulations	6
Recreation and Aesthetics	
Educational Programs	8
Technical Assistance	8
Voluntary Guidelines	4
Tax Incentives	2
Fiscal Incentives	4
Legal Regulations	4
Total Number of States in Region	13

Source: State Programs Directed at the Forestry Practices of Private Forest Landowners: Program Administrators' Assessment of Effectiveness by A. S. Cheng and P. V. Ellefson. Staff Paper Series No. 87. Department of Forest Resources. University of Minnesota. St. Paul, MN. 1993.

B. Program Effectiveness

The ability of various public forestry programs to influence forestry practices applied on private forestland is often a major focus of debate among program administrators, owners of private forestland and interested citizens. The experiences of program managers that are (or have been) actively involved in the administration of a forestry program (or combination of programs) can provide a very useful perspective on the ability of different types of programs to accomplish agreed-to objectives. Future program directions and emphases generally can be influenced by such experiences (Cheng and Ellefson 1993).

In the 13 states that comprise the Western Region, surveyed administrators appear most favorable toward legal regulations and fiscal incentives as ways of influencing forestry practices that affect water quality, reforestation after harvest, and timber harvesting methods (Table 8). Educational programs, technical assistance, and voluntary guidelines are not considered by a majority of administrators to be most effective for any of the three purposes identified here. Especially noteworthy is the least effective ranking given to voluntary guidelines when used to protect water quality and promote reforestation. Given the focus of water quality protection in this report, administrators appear most enamored with legal regulations, tax incentives, and fiscal incentives.

What follows is a state-by-state review of forest practice regulatory programs that are currently being implemented by Western state governments. Special focus is on practices that are undertaken to mitigate the adverse impacts of nonpoint forest sources of water pollutants. Programs in the following states are reviewed: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington, and Wyoming.

C. Information Sources

Cheng, A. S., and P. V. Ellefson. 1993. State Programs Directed at the Forestry Practices of Private Forest Landowners: Program Administrators' Assessment of Effectiveness. Staff Paper Series No. 87. Department of Forest Resources. University of Minnesota. St. Paul, MN.

TABLE 8 PROGRAM ADMINISTRATOR'S RANKING OF PROGRAM ABILITY TO INFLUENCE SELECTED PRIVATE FORESTRY ACTIVITIES IN THE WESTERN REGION, BY ACTIVITY AND PROGRAM TYPE - 1992

Program and Ranking Category	Forestry Activity of Program's Focus (number of states)		
	Water Quality Protection	Reforestation After Harvest	Timber Harvesting Methods
Education Programs			
Most Effective	3	2	3
Effective or Neutral	4	6	5
Least Effective	5	5	5
Technical Assistance			
Most Effective	3	2	5
Effective or Neutral	5	9	6
Least Effective	3	2	2
Voluntary Guidelines			
Most Effective	1	1	5
Effective or Neutral	4	2	6
Least Effective	6	9	3
Tax Incentives			
Most Effective	5	4	3
Effective or Neutral	3	5	6
Least Effective	3	3	3
Fiscal Incentives			
Most Effective	5	9	7
Effective or Neutral	5	2	2
Least Effective	1	2	3
Legal Regulations			
Most Effective	7	7	7
Effective or Neutral	2	1	1
Least Effective	3	5	5

Note: One of 13 states failed to rank voluntary guidelines, tax incentives, and fiscal incentives.

Source: State Programs Directed at the Forestry Practices of Private Forest Landowners: Program Administrators' Assessment of Effectiveness by A. S. Cheng and P. V. Ellefson. Staff Paper Series No. 87. Department of Forest Resources. University of Minnesota. St. Paul, MN. 1993.

V ALASKA

A. Statutes, Regulations, and Programs

The Alaska Forest Resources and Practices Act of 1978 is the primary legal authority for addressing nonpoint forestry sources of water pollution in Alaska. The state Division of Forestry, Alaska Department of Natural Resources, is responsible for implementing provisions of the Act, namely establishing, administering and enforcing forest practice rules. In addition to implementing the regulatory program as authorized by the Act, the Division, in cooperation with the Department of Environmental Conservation and the Department of Fish and Game, also informs landowners and operators about best management practices, carries out program monitoring activities, and conducts education and training workshops to inform landowners and operators about forest practice standards. Responsibility for administering water quality programs in general rests with the Division of Environmental Quality of the Department of Environmental Conservation.

B. Nonpoint Assessment Report

The Division of Environmental Quality assessed nine different potential nonpoint sources of water pollutants. Timber harvest and related activities was among the sources assessed. Of special concern was the effect of harvesting on sedimentation and water temperature, and the possible implications of vegetative debris introduced into streams. The assessment identified five water bodies as impaired by timber harvest, and 49 water bodies as suspected of being impaired. Most of the latter occurred on Native lands, for which notices of violations have been issued.

Water bodies identified as impaired by the assessment do not include all cases where water quality standards are being violated. Restricted funds and personnel limit the ability of the Departments of Natural Resources and Fish and Game to visit all potential pollution sites. As such, waters involving anadromous fish are given priority. In Southeast Alaska and Prince William Sound, water quality monitoring is very limited. In large measure, this is a result of the remoteness of timber harvesting operations in these regions.

C. Nonpoint Management Plan

The Division of Forestry has major responsibility for addressing nonpoint forestry sources of water pollution. This is accomplished primarily via the Alaska Forest Resources and Practices Act. The Act establishes standards for road construction and maintenance, timber harvesting, cleanup and

stabilization, aesthetics, log transfer and storage facilities, slash, reforestation, and insect and disease control. Revisions of the state's forest practices rules will increase regulatory control over forest practices. Increased monitoring activities will enable further assessment of the effectiveness of best management practices and related forestry activities.

D. Forest Practice Rules

Standards for forestry practices are specified in the Alaska Forest Resources and Practices Act (1990). In addition, the Commissioner of the Department of Natural Resources is authorized to adopt regulations necessary to implement the Act. The provisions of the Act and the rules promulgated apply to forestland under state, municipal or private ownership. For federal land, the degree of resource protection must not be less than that established by the Act or subsequently set forth by regulation.

Regulations specified in the Act focus primarily on standards for riparian areas. Examples are:

- private land: no harvesting of timber within 66 feet of a Type A water body (water supply resource); timber harvesting in compliance with slope stability standards within 100 feet of a Type B water body (water recreation resource); and timber harvesting in compliance with slope stability standards in the area within 50 feet of a Type C water body (water required for wildlife and aquatic life).

- state land: harvest of timber prohibited within 100 feet of a high value fisheries water located north of the Alaska Range. South of the latter, harvest is similarly prohibited; plus, harvesting between 100 and 300 feet of such waters must be consistent with the maintenance of important fish and wildlife habitat.

- other public land: harvest of timber prohibited within 100 feet of a high value fishery located south of the Alaska Range. Within 100 feet of a valuable fishery located North of the latter, no harvesting can occur unless the Commissioner approves.

The Act's general provisions define impairment of land or water productivity as activity that results in substantial and prolonged damage to a renewable resource, or substantial or prolonged reduction in ability to produce renewable resources at natural or historic levels.

In addition to the above standard, the Commissioner of the Department of Natural Resources has established regulations that

further direct the manner in which the Act will be implemented. The regulations (1991) address riparian standards, road construction, reforestation, and general administrative procedures including definitions. Aesthetic standards are contained in the latter. Examples standards are:

(1) Riparian standards - In addition to the streamside zone designations specified in the Act, operators must avoid constructing roads that will undercut the toe of slopes that have a high risk of failure. They also must leave low-value and non-merchantable timber where needed to reduce risk of mass wasting, achieve full or partial suspension of yarding operations, fall timber away from streams, and avoid side-casting of displaced soil from road construction. In some cases, riparian area boundaries must be marked by the operator. Among activities specifically not permitted within a riparian area are road building, water body crossing, and felling of hazardous trees.

(2) Road construction - Roads must be located to fit the topography, minimize stream crossings, avoid marshes and muskegs, and be outside of a riparian area unless there is no feasible alternative. Construction must be avoided on slopes greater than 67 percent, or in slide-prone areas. Where such is not possible, measures to prevent erosion must be undertaken (grass seeding, erosion control mats, end-hauling of materials). Limbs and debris from trees felled into fish-bearing waters during road construction must be removed within 48 hours. Operators must minimize drainage from roads by use of cross drains, diversion ditches, culverts, bridges, water bars, or related practices. These will be spaced at least as frequently as 1,000 to 1,500 feet for grades of two to seven percent, and 600 to 800 feet for grades over 15 percent. Temporary bridges must be constructed to pass 25 year flood occurrences; permanent bridges 50 year floods. Culverts must be at least 12 inches in diameter.

(3) Timber harvesting - The logging system must be appropriate to terrain. On state and other public land, and where feasible, a non-harvesting buffer of not less than 330 feet in radius must be maintained around bald eagle nesting trees. Where feasible, trees should not be felled into timber riparian zones, although the Department of Fish and Game may waive such a requirement if material deposited into waters would benefit fish resources. Standards are set forth for cable yarding, tracked versus wheeled harvest systems, and disposal of slash.

(4) Reforestation - landowners must reforest after harvest, except where land is to be converted to another use, or when stands being harvested are significantly composed of insect and disease-killed, fire killed, or wind thrown timber, or similarly damaged trees. In region I (coastal), landowner reforestation plans must be achieved within five years after harvest; the number of vigorous, undamaged, and well-distributed tree

seedlings of commercial tree species must average 300 trees per acre, and must have survived on site for a minimum of two years. In regions II and III (interior), landowner reforestation plans must be achieved within five years after harvest; an average of 450 trees per acre must have survived on site for a minimum of two years. No more than 10 percent of a harvested area may be below these stocking levels. Landowners must prepare and submit a regeneration survey and report.

(5) General provisions - On state and other public lands adjacent to areas of substantial importance to tourism or recreation, the visual impact of timber harvesting must be minimized through modifications in sale design and post-harvest clean-up of logging debris.

E. Special Rules

Forest practice operations are also subject to compliance with the following rules and regulations: waste-water disposal (18 Alaska Administrative Code 72); solid waste management (18 AAC 60); drinking water (18 AAC 80); and water quality standards (18 AAC 70). Forest practices are strictly scrutinized under the Alaska Fish and Game Code and the Alaska Coastal Management Program. Under the Fish and Game Code, all activities which cross streams or interfere with stream segments designated as anadromous fish habitat require written approval from the Department of Fish and Game. The Coastal Management Program has established standards and procedures for review of various land use projects, including timber harvesting.

F. Program or Rule Changes (since 1980)

The Alaska Forest Resources and Practices Act was amended in 1990. As a result, the rules and regulations adopted pursuant to establishment of the Act have undergone dramatic revisions. After a year of interagency review, public review, and rewrites, the final forest practices rules took effect in 1993. Notable changes in the forest practices program will be increased monitoring activities, and more intense review of forest practices proposed for riparian management zones.

G. Compliance and Effectiveness

Development of a comprehensive monitoring program was initiated in 1990. The program's purpose is to gauge the effectiveness of best management practices and to determine landowner and operator compliance with specified forestry practice standards. Planned program development activities include: planning monitoring program design; establishing inspection criteria; developing inspection forms; installing computer systems for analysis and record keeping; conducting field evaluations; compiling data; and completing evaluation

reports. Until the new forest practices standards are adopted, monitoring resources will not be fully activated.

H. Information Sources

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VI ARIZONA

A. Statutes, Regulations, and Programs

The Division of Forestry, Department of Lands, provides technical assistance to private landowners to promote water quality management objectives. The Division does not administer regulatory standards focused on private forestry activities. The Arizona Department of Environmental Quality is the state's lead agency for nonpoint source pollution programs.

B. Nonpoint Assessment Report

State, federal and local forest management agencies have determined that grazing within forest areas is the primary cause of watershed degradation. Although the impact of timber harvesting and associated road construction may be locally severe, these activities are viewed as having a minimal impact on the quality of water flowing from the state's eight regional water basins.

C. Nonpoint Management Plan

Implementation of Arizona's nonpoint source pollution control plan is primarily a responsibility of the Arizona Department of Environmental Quality. Via a contractual arrangement, the Department requested the USDA-Forest Service (Southwestern Region) to develop Best Management Practices (BMPs) that could be used by federal, state, and private organizations involved in forestry activities. The Division of Forestry has major responsibility for applying such practices on state lands and for informing private landowners about such practices. Because of its extensive ownership of forestland within the state, actions to address nonpoint sources of water pollutants in Arizona are, in essence, a responsibility of the USDA-Forest Service.

D. Best Management Practices

Best Management Practices (BMPs) recommended by the Division of Forestry for application on state and private forests are described in the USDA-Forest Service Soil and Water Conservation Practices Handbook (FSH 25092.22). Some of the more important categories of suggested practices are:

- pesticide management activities: monitoring, timing of application, streamside application, cleaning and disposal of containers.
- recreation management: sanitation facilities, refuse disposal, location of riding stock facilities, management of off-road vehicle use.
- timber management: time period of operation, protection of extremely unstable lands, streamside management, harvest engineering, road and skid trail erosion prevention, erosion control structure maintenance.
- watershed management: protection of wetlands and riparian areas, slope limitations for equipment use, hazardous substance management, cumulative effects analysis.
- wildlife and fisheries management: control of sedimentation in streams and rivers.
- fire suppression and fuel management: formulating fire management plans (sensitivity to water quality), emergency rehabilitation of watersheds.

E. Special Rules and Rule Changes (since 1980)

The state of Arizona does not have any special rules pertaining to water quality impacting forestry practices that might be applied by forest landowners or timber operators. There have been no major changes in programs or BMPs in Arizona since 1980.

F. Compliance and Effectiveness

The Division of Forestry has not monitored compliance with forestry BMPs.

G. Special Issues

Most forestland in Arizona is in federal public ownership (e.g., National Forest System, National Park System). As such, special issues pertaining to the management of nonpoint sources of pollutants from private forestland are minimal.

H. Information Sources

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VII CALIFORNIA

A. Statutes, Regulations, and Programs

Management of nonpoint sources of water pollutants originating from forestry activities in California is addressed primarily by authority specified in the California Forest Practices Act of 1973 (California Public Resources Code, Division 4, Chapter 8). The Act provides the California Board of Forestry with authority to promulgate rules and regulations that standardize the application of forestry practices on private forestland. The Board relies on the State Department of Forestry and Fire Protection to administer and enforce the Act and the rules subsequently promulgated.

The Forest Practice Rules include restrictions on the size, location, and spacing of clearcuts; identify watercourse and lake protection measures based on water class and slope; and restrict tractor logging and road construction on steep, erodible slopes. Erosion control measures are based on a site's Erosion Hazard Rating, which is a function of soil, slope, and precipitation. The nonpoint source control elements of the program are based not only on the rules of the Act, but also on the entire process of notification, review, and professional assessment.

Prior to a harvesting operation, a written Timber Harvest Plan (THP) must be developed by a Registered Professional Forester (RPF). The THP contains a description of the plan area; information on yarding, regeneration and erosion control methods; and stream protection, road building and erosion hazard rating, among others. A public notice of intent to harvest must be distributed, and plans are reviewed by interagency, multi-disciplinary teams. Pre-harvest inspections and review team recommendations are commonly employed. The THP preparation and review serve as the functional equivalent of an environmental impact statement under the California Environmental Quality Act.

In addition to the RPF program, there is a program for Licensed Timber Operators (LTOs). A newsletter and other mailings are used to inform RPFs and LTOs about changes in the forest practice rules. The State university system and a professional foresters organization provide extensive training and workshops. Other professional organizations (e.g., Watershed Management Council) are active in California.

Forestry practices of private landowners are also regulated in the multi-state Tahoe region by the Tahoe Regional Planning Agency. In addition, certain county governments in California, such as the California Coastal Commission, have specified forest practices standards that must be met by private owners of forestland.

B. Nonpoint Assessment Report

The California Water Resources Control Board rated the State's waters according to the degree to which they complied with U.S. Environmental Protection Agency water quality standards. The State's waters were categorized as to whether they fully supported such standards (good quality; supports all beneficial uses), fully supported but were threatened (at least one beneficial use was threatened), partially supported (impaired or not expected to meet standards), or did not fully support the standards (severely impaired, need serious attention). The agency's assessment devoted attention only to "not fully supported" waters.

Overall, the most important nonpoint sources in California are considered to be agricultural drains and irrigation return flows, unknown sources, natural sources, and silvicultural practices. Water quality protection in California is provided through regional water quality control boards. In the Nonpoint Source Assessment Report, some regional boards were identified as having found review of the THPs as an important board function (North Coast, Central Valley, and Lahontan). Only the North Coast Water Quality Control Board identified silviculture among its most important nonpoint sources. Sediment is recognized as the major water quality impact related to forest operations, although a surprisingly large portion of all nonpoint source impacts are attributed to excess nutrients.

California's nonpoint assessment report specifically identified silvicultural practices as a contributor to impairment of water quality within the "not fully supported" category as follows: 74 acres (0.06 percent) of a total of 130,779 acres of bays and harbors; zero acres out of 304,594 acres of estuaries; zero square miles out of 19,755 square miles of ground water; zero acres out of 645,900 acres of lakes; zero miles out of 5,282 miles of ocean and open bays; 1,453 miles out of 12,077 miles of rivers and streams; zero acres out of 533,180 acres of saline

lakes; and zero acres out of 240,362 acres of wetlands. For purposes of statewide comparison, the state of California has more than 462,000 acres of estuaries, harbors, and bays, and over 203,000 miles of rivers and streams (including perennial and intermittent).

For bays, harbors, rivers, and streams, the most common nonpoint sources of pollutants in the "not fully supported" category were: agricultural sources and urban runoff into bays and harbors; and agriculture sources into rivers and streams. Of the more than 12,000 miles of California rivers and streams considered to be severely impaired and in need of immediate attention (i.e., not full supported), over 42 percent were impaired because of agricultural nonpoint sources.

As part of California's clean water strategy, major nonpoint sources were identified for the state's 32 groundwater basins. The latter were ranked from highest to lowest in statewide water resource value. In none of the state's 32 basins was silvicultural (or forestry) identified as a major nonpoint source of water pollutants.

C. Nonpoint Management Plan

California has established a number of legal and institutional frameworks for addressing nonpoint sources of water pollutants generally, and forestry sources specifically. Among the agencies responsible for managing the State's nonpoint water quality programs are the California Water Resources Control Board, regional water boards, California Coastal Commission, Tahoe Regional Planning Agency, and the Department of Forestry and Fire Protection. The latter is responsible for implementing the State's Forest Practices Act, a major mechanism for addressing nonpoint forest sources of water pollutants originating from private and public (State) forestland. National forests, which make up a significant portion of California wildlands, are strictly regulated by the USDA-Forest Service under a memorandum of understanding with the California Water Resources Board.

The nonpoint source management plan identifies new elements of the silvicultural program which support technical studies on: methods of assessing cumulative effects; long- and short-term effects of timber operations in sensitive areas; development of compatible watershed databases for key agencies; and surveillance monitoring of selected timber harvest plans.

D. Forest Practice Rules

Standards for forestry practices have been set forth by a number of state government entities in California. The most prominent source of such standards is the California Forest

Practice Act of 1973 (as amended), and the rules subsequently promulgated by the State Board of Forestry. Other authorities specifying forest practice standards are the Tahoe Regional Planning Agency, California Coastal Commission, and (in some cases) county governments. Special county rules must be approved by the State's Board of Forestry.

The California Forest Practice Act sets forth definitions and standards. Examples of important definitions are:

- timber land -- land (other than land owned by the federal government) that is capable of growing a crop of trees of any species used to produce lumber and other forest products, including Christmas trees.

- timber owner -- any person who owns commercial timber, timberland, cutover land or timber rights, including Christmas tree rights.

- timber operations -- cutting or removal of timber and other solid wood products from timberlands for commercial purposes, together with all the work incidental to such cutting and removal.

- stocking -- measure of the degree to which space is occupied by well-distributed countable trees.

In addition to specifying a number of procedural requirements, the Act specifies forest practice standards, including the following examples:

(1) Reforestation standards - Five years after completion of timber harvesting operations, a harvested area must have a tree count of 300 per acre; 150 per acre for lower productivity sites. The count is computed as follows: trees less than four inches in diameter count as one; trees four, but not more than 12, inches in diameter count as three; and trees over 12 inches in diameter count as six. In addition, the average residual basal area (measured in stems one inch in diameter or larger) must be at least 85 square feet (50 square feet for lower productivity sites).

(2) Protection of streams - Effects of erosion on waterways must be minimized by installation of drainage facilities and soil stabilization treatments, and by planned abandonment of roads. Drainage facilities, soil stabilization treatments on skid trails, roads, and landings must be maintained for a period of at least one year (not more than three) after submission of a harvest completion report.

(3) Conversion of timberlands - conversion of timberland to nontimber uses is prohibited unless in the public interest. The latter would include (but not be limited to) situations where conversion would not have an adverse affect on the ability of adjacent timberland to grow timber, and where soils, slopes and watershed conditions are suitable for non-timberland uses.

In addition to the forest practice standards set forth in the Act, the State Board of Forestry has promulgated a number of rules concerning the conduct of forestry practices. The major categories addressed by the rules are: definitions, application, forest district boundaries, district rules, and general administration. Among the more than 150 definitions contained in the rules are the following:

- crop trees -- any number of trees which can be harvested commercially.

- erosion controls -- drainage facilities, soil stabilization treatments, road and landing abandonment, treatment of watercourse crossings, and any other features or actions to reduce surface erosion, gullying, channel erosion, and mass erosion.

- feasible -- capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technical factors.

- harvest method -- process used to cut and remove timber. May have as its silvicultural objective either stand regeneration or intermediate treatments.

- water course and lake protection zone -- strip of soil and vegetation along both sides of a watercourse, or around a lake, where additional practices may be required for protection of water quality, the beneficial uses of water, and other forest resources.

The rules promulgated by the Board are specific to each of three administrative districts, namely the Coast Forest District, Northern Forest District, and Southern Forest District. Each district's rules address: silvicultural methods, harvesting practices and erosion control, site preparation, watercourse and lake protection, hazard reduction, fire protection, forest insect and disease protection practices, and logging roads and landings. For purposes of example, consider example rules promulgated for the Northern Forest District.

(4) Silvicultural methods - Five years after harvesting, an area must have an average tree point count of 300 per acre on site I, II, and III lands, or 150 on site IV lands. Clearcuts must not exceed 80 acres on areas of low erosion hazard, and 40 acres on areas of high erosion hazard. Successive clearcuts within same ownership must be separated by not less than 300 feet. For intermediate cuts, 100 square feet of basal area per acre must be left on site I lands, and progressively less basal area on lower site lands.

(5) Harvesting practice and erosion control - Tractor operations must not be conducted on slopes over 65 percent. Water breaks must be installed no later than the beginning of the winter period of the current year's operations. Water breaks are to be installed according to road or trail gradient and estimated soil hazard rating. For example, an operation involving a gradient of 26-50 percent and a high hazard rating must have water breaks installed at least every 75 feet. Road or trail crossings of a watercourse must allow for unrestricted passage of fish and water.

(6) Site preparation - Heavy equipment must not be used for site preparation when soils are saturated. Broadcast burning must not fully consume the largest organic debris, which retains soil on slopes and stabilizes watercourse banks.

(7) Watercourse and lake protection - Depending on the water class (I - domestic supply or fish; II - aquatic organisms present; III - no aquatic life; and IV - man-made watercourse) and side slope class (slope adjacent to watercourse or lake), watercourse and lake protection zones of varying width are required, as are specified management practices (A through I, often multiple). For example, Class I water with a side slope of 30 to 50 percent must have a 100 foot protection zone (each side of a stream), which must be managed as follows:

- clearly identify protection zone with paint or flagging prior to harvesting operations;
- mark residual and harvest trees within protection zone prior to harvest; and
- after harvesting, 50 percent of the overstory and 50 percent of the understory must be left standing for purposes of protecting water temperature.

(8) Hazard reduction - Logging slash must be treated within specified times. Snags must be felled when located on ridgetops and within specified distances of roads, railroads, and structures inhabited by humans. Snags must be retained where they are visible nesting sites for eagles, hawks, owls, waterfowl, and rare or endangered species. Habitat requirements for specific nesting birds must be met (e.g., minimum no-cutting zone of eight acres around golden eagle nests).

(9) Logging roads and landings - Operators must use existing roads where feasible; where not, minimize road mileage and fit roads to the topography. During timber operations, the road running surface must be treated (rock, water, asphalt, chemical) to prevent erosion. Landings must be minimal in number, size and width, and never larger than one-half acre unless approved by the administering agency.

E. Special Rules

In addition to rules established by the California Forest Practices Act and the State Board of Forestry, the Tahoe Regional Planning Agency has also set forth standards for the conduct of forestry activities. The standards are promulgated under the agency's tree removal ordinance and apply to the Tahoe Lake Region of California and Nevada. The standards apply to all persons cutting trees six inches in diameter or larger. Example categories of practices are:

- Cutting and acceptable stocking: Stumps must be kept to a height of six inches or less. Stocking standards range from 420 trees less than 4 inches in diameter per acre to 100 trees over 12 inches in diameter.

- Stream environmental zones: Vehicles are not allowed in designated stream zones. Stream crossings are limited to improved crossing structures and facilities.

- Tree removal methods: Depending on land capability district, limits on tree removal can range from aerial methods to conventional ground methods.

- Slash disposal: Slash must be disposed of within two years of tree removal.

- Substantial tree removal: Special standards apply when substantial tree removal is involved, namely harvest of more than five acres, or removal of more than 100 live trees six inches in diameter.

- Other tree removal standard categories: Hazardous tree removal, removal for forest health and diversity, removal for solar access, removal in ski areas, and removal for purposes of enhancing scenic view points along roadways.

The California Coastal Commission also promulgates regulations pertaining to forestry practices of private landowners. For example, prescriptions for silvicultural methods include:

For initial entry into an even-aged stand, leave a well distributed timber stand after cutting and logging operations have been completed on the cut area of at least 40 percent by number of those trees 18 inches and more DBH present prior to commencement of current timber operations, and at least 50 percent by number of those over 12 inches DBH, but less than 18 inches DBH.

As a result of a court ruling, selected counties in California are also given expressed authority to develop specific forest practice standards subject to approval of the State Board of Forestry. Such standards are in addition to existing forest practices rules as called for by the California Forest Practices Act.

F. Program or Rule Changes (since 1980)

Forest practices rules promulgated by the Board of Forestry have been changed a number of times since 1980. The total number of rule changes are especially voluminous. Highlights of some rule changes are as follows:

1982:
- rules for estimating surface soil erosion from timber operations
- rules for felling and yarding of timber
- rules for stocking sampling procedures
- rules for logging roads and landing construction
- rules for watercourse and lake protection

1983:
- rules for timber harvest plan preparation and review teams
- regulatory authority granted to Monterey County and Santa Clara County
- wildlife protection standards

1984:
- rules for minimum stocking for site class IV and V forestland
- rules for Coastal Zone conversions
- regulatory authority granted to San Mateo, Santa Cruz, and Marin Counties

1985:
- review period waiver established
- rules for transition silvicultural method
- allowing registered professional foresters to prescribe best management practices in lieu of certain rules

1987:
- rules for site preparation and maintenance of erosion control structures
- rules for even-aged management of eucalyptus in Southern District

1988:
- rules requiring notification of Department of the start of timber operations

1991:
- wildlife rules for retention of snags and for species of special concern
- new watercourse rule modification
- new cumulative effect planning rules

1994:
- sensitive watershed rules for nomination, screening, and classification of sensitive watersheds and mitigation needs
- sustainable yield rules
- late successional forest rules

G. Compliance and Effectiveness

The California Department of Forestry and Fire Protection conducts surveys to measure landowner compliance with reforestation and stocking requirements. The actual surveys are carried out by forestry consulting organizations under contract to the Department. Overall operator or landowner compliance with specified forest practice standards is very high.

In the Northern Forest District, 99 percent of the sampled areas met or exceeded the stocking requirements specified by the rules. Stocking averaged 89 percent among three sampled types of prescriptions (i.e., shelterwood, alternative, selection). For all three prescriptions, there was an average of at least 697 trees per acre, and an average basal area of 87.4 square feet per acre.

Eighty-two percent of the plots sampled in the Coast Forest District met the stocking requirements specified by the forest practice rules. On the average, the survey indicated well-stocked stands, with a mean of over 400 trees per acre, and an average basal area of 92 square feet per acre for all prescription methods.

Similarly high compliance rates were found in the Southern Forest District. A mean of 92 percent of the sampled plots were stocked according to forest practices rules, with no significant variation between silvicultural prescriptions. For all

ownerships and prescriptions, there were an average of 617 trees per acre, with an average basal area of 108.5 square feet per acre (conifers only).

In addition to assessment of compliance rates with forest practice standards specified in rules, numerous other silvicultural nonpoint source control activities have been subject to review and evaluation. For example:

- Soil Erosion Study. A report in 1983 summarized research conducted by the California Division of Forestry that was undertaken to identify sources and practices that contributed to accelerated erosion. Monitoring was conducted from 1976-1979 on 63 plots. The study found that most (77 percent) of the erosion was from mass failures, and that most of these failures were associated with roads and landings.

- Casper Creek Study. Since 1961, the California Division of Forestry and the USDA-Forest Service have conducted research in Casper Creek (Jackson State Demonstration Forest) on the cumulative impacts of forest management on water quality. In 1982, a study began to monitor nested basins in the North and South Forks of Casper Creek. The study (currently underway) is designed to assess cumulative impacts of multiple small harvest units.

- Critical Site Study. The California Division of Forestry contracted with the USDA-Forest Service to determine site conditions that lead to erosion. An unbiased sample of forestry activities was selected and assessed (655 timber harvest plans in Northwestern California). Discriminate functions were developed to assess susceptibility of sites to mass wasting. Important variables were slope steepness, horizontal curvature, hue of subsoil, and parent material strength. The information is used by the California Division of Forestry to assess the risk of harvest sites for erosion.

- Forest Practice Rules Assessment. As part of the conditional certification by the Water Resources Control Board of the Board of Forestry as the agency to regulate silvicultural nonpoint source pollution, a multi-disciplinary team was established to assess effectiveness of the Board's forest practice rules. The team toured 100 sites for which timber harvest plans had been approved and operations conducted. The team made the following observations:

    - team found a high degree of variability in protection afforded to water and resources on California private forestlands.

- periodic assessments should be carried out to review protection provided by rules and processes.
- best feasible protection measures were used on 58 percent of sites visited. Improvement was needed in specific rules, assignment of responsibility, enforcement, training and monitoring.
- noncompliance was the single most important impediment to achieving adequate resource protection.
- actual forest practices as currently conducted under the rules and processes did not provide the best feasible protection of beneficial uses of water. However, the framework established by the rules and process is capable of providing the best protection if some adjustments are made, and if all parties begin taking advantage of the opportunities available within the framework.

(1) LSA Program Review - A March, 1990, report by LSA Associates concluded that "... public support for the forest practices program has eroded to a degree that threatens its operational viability. In too many circles, the program and its administration by the California Division of Forestry are perceived as generally failing to adequately regulate the actions of the timber industry. The Board and, to a lessor extent, the California Division of Forestry, are perceived as overly sympathetic to the corporate goals behind industry forestry actions and insensitive to the public resource obligation of the industrial land owners."

The California Division of Forestry and Fire Protection is currently involved in a series of watershed studies collectively known as the "Watershed Program." Eleven projects are actively underway (additional projects are being recommended for 1993):

- Calwater Project: delineating planning watersheds within the State Water Resources Control Board system of Hydrographic Subareas (HSAs) for cumulative watershed effects analysis. Watershed will be a layer in the state GIS.

- Designation of Proposed Sensitive Watersheds: locating watersheds where standard best management practices may not be adequate.

- Inventory of Highly Erosive Watersheds: identifying watersheds with high erosion rates or the potential for high erosion rates.

- Best Management Assessment Effectiveness Committee: identifying methods of assessing BMP effectiveness.

- Range Water Quality Assessment: summarizing information on water quality problems associated with rangeland practices.

- Inventory of Small Community Domestic Water Resources: identifying community water sources with five or more connections to be used in forest planning.

- Mixed Ownership Protocols: using pilot projects in the French Creek tributary to the Scott River and the Mokelumne River, determining how cooperative watershed management agreements can be developed for mixed ownership watersheds.

- Geographic Information Systems as a Tool for Analyzing Cumulative Watershed Effects: companion to Mixed Ownership Protocol study.

- Assessment of Indices for Measuring the Conditions of Cold Water Fish Habitat: investigating potential indicators of stream habitat quality.

- Casper Creek Watershed Study: intensive research to determine cumulative impacts of roads and harvesting on sediment transport, surface and subsurface runoff, stream biology, and water quality.

- Watershed Problems and needs assessment Project: evaluating current watershed assessment methods.

H. Special Issues

One of the more prominent issues confronting the application of forest practices in California is cumulative effects. In California, cumulative effects must be considered because of the relationship between the Forest Practices Act and the state's Environmental Quality Act. Rules already prohibit large, continuous clearcuts. Re-growth must occur before adjacent clearcuts can be installed. California was the first state to require that cumulative effects of forest operations be assessed as part of a timber harvest plan (THP). The LSA Associates report and other reviews identified the cumulative effects assessment as a significant weakness of the forest practices program.

In 1991, new rules were implemented addressing cumulative effects. The new rule and guidelines provide guidance on the scope of the required assessment, and provide on-site indicators of cumulative effects. Workshops have been held in conjunction

with the California Licensed Foresters Association to assist foresters in fulfilling the cumulative effects assessment needed for THPs. The California Division of Forestry and Fire Protection is also sponsoring cooperative watershed planning projects in mixed ownership watersheds as an initial test of how to resolve management planning problems for such watersheds. The objectives of these studies (Scott River Basin and Mokelumne Watershed) are to assess current and future land use practices, understand cumulative watershed effects, develop cooperative planning methods, identify impact mitigation techniques, and establish on-going monitoring programs.

Emergency rules were issued by the Board of Forestry (effective November 11, 1991) that limit the proportion of watershed that can be harvested. The rules were designed, in part, to protect watershed values. At least two lawsuits have been filed against the Board of Forestry on this matter.

Currently, the Forest Practices staff of the Department of Forestry and Fire Protection Forest Practices is in the process of developing an extensive water quality monitoring program to determine the cumulative effects of multiple forest practices on water quality. Funding to do so ($240,000) was appropriated by the state legislature from general revenue funds. Review of forest practices applications (i.e., Timber Harvesting Plans) must include an analysis of how each individual operation may contribute to cumulative water polluting effects. A more systematic method of programmatically addressing cumulative effects may be necessary, once the monitoring system is in place.

In a 1992 review of the California Forest Practices Act, the Institute of Ecology (Green 1992) concluded that the Act had:

> ... a significant impact on improving protection of non-timber resources. Specifically, the Act and the rules promulgated under it have altered forest management strategies with respect to non-timber resources, stream protection efforts, and road placement, and have changed the role of the Registered Professional Forester.

The Institute also found that since the rules and procedures were modified to conform to the states Environmental Quality Act, "... most of the substantive and procedural requirements instituted by the Board of Forestry have focused on environmental protection."

Despite the very positive finding of the Institute of Ecology, there continues to be low public confidence in the state's forest practices regulatory program (LSA Associates 1990). Significant numbers of THPs (mostly in the North Coast region) are tied up in court cases which have resulted in

indeterminate delays and costs. Public dissatisfaction with forest practices programs in the state was recently expressed in a June, 1990, environmental referendum which was narrowly defeated. The state is currently considering additional environmental legislation.

California will probably always have a high level of conflict over the management of forests, in large measure because of the high value of the timber resources involved, terrain that has a high erosion hazard, and a large environmentally-sensitive population that is mostly independent of the need for a timber-based economy. Aesthetic and visual impacts of forest management have a strong influence on public attitudes in the State. When such attitudes are combined with industrial forestry perceptions of being placed in an adverse competitive position because of high costs associated with restrictive forest practice rules, the State and its forestry community is placed in a position where it has a very difficult time finding common ground on matters of forestry.

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VIII COLORADO

A. Statutes, Regulations, and Programs

The Colorado Forest Service administers a number of programs for purposes of protecting water quality and managing nonpoint source pollutants originating from forest management activities. These include educational and training programs, technical assistance programs, tax incentives, and fiscal incentive programs for private forest landowners. The State does not have a regulatory program focused on forestry practices that potentially could affect water quality and quantity. The Division of Water Quality Control of the State's Department of Health is the State's lead agency for nonpoint source pollution programs.

B. Nonpoint Assessment Report

The Division of Water Quality Control rated the State's waters according to numeric criteria for sediment, salinity, and phosphorous. Of the seven river basins assessed by the Division (Platte, Republican, Arkansas, Rio Grande, San Juan, Colorado, and Green River), silvicultural activities were clearly cited as contributors to nonpoint source pollution in only four basins. In the Platte River Basin, silvicultural activities affected 15 of the basin's 659.7 miles of stream; in the Colorado Basin, 28 miles of the basin's 1,082 miles stream were so affected. For all basins, mineral extraction and agricultural practices were found to be the dominant source of nonpoint water pollutants.

C. Nonpoint Management Plan

The State's nonpoint source management plan focuses primarily on agricultural sources of water pollutants. However, forestry is addressed under three headings, namely general forest management, soil stabilization on forestlands, and riparian and sensitive area stabilization. Stated intentions of directing action toward these categories include: increase vigor and reproduction of forest vegetation, accumulate litter and mulch to reduce erosion and sedimentation, maintain natural beauty and visual quality, and minimize impacts within riparian areas (including wetlands)

D. Best Management Practices

Colorado has not adopted special rules or a separate set of formal Best Management Practices (BMPs) that apply to private forest management activities carried out within the State. However, the State has adopted BMPs that have been developed by other agencies, notably the USDA-Forest Service and the USDA-Soil Conservation Service. The categories of BMPs having actual or potential application to forestry activities are:

- riparian area stabilization: use vegetation or structures to stabilize and protect banks of streams or excavated channels against scour and erosion.

- conservation cover: maintain residue or establish a permanent crop cover to increase infiltration of water and protect soil from erosion.

- general forest management: manage forestland at an intensity that will maintain or improve the quality and quantity of desirable forest vegetation to insure protection of soil and water resources.

- soil stabilization on forestlands: undertake soil stabilization practices on forestland to reduce soil

erosion and prevent sediments, organic debris, and applied chemicals from entering ground or surface water.

For each category of BMPs identified, information of the following nature is presented: purpose of the BMP, conditions where the practice applies, specifications for BMPs, and references (publications) where specifications are described.

E. Compliance and Effectiveness

The Colorado Forest Service has not monitored compliance with forestry BMPs.

F. Special Issues

Most forestland in Colorado is administered by federal land managing agencies (e.g., USDA-Forest Service, USDI-National Park Service, USDI-Bureau of Land Management). In many cases, these agencies have specific programs focused on implementation of forestry BMPs. State responsibility is focused on the modest State and private forestland within the State.

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IX HAWAII

A. Statutes, Regulations, and Programs

Technical assistance and educational and training programs designed to promote water quality protection on private forestland are administered by the Hawaii Department of Land and Natural Resources. In addition, the Department has authority

(Section 183-41, Hawaii Revised Statutes) to establish forest and water reserve zones and to promulgate (if necessary) land-use regulations for these zones. Water quality programs in general are the responsibility of the State Department of Health.

B. Nonpoint Assessment Report

The Environmental Planning Office of the Hawaii Department of Health assessed the status of nonpoint source pollutants in 1990 and 1992. The initial assessment was developed from interviews with knowledgeable persons, on-site investigations, and reviews of research publications. Where monitoring data was limited, best professional judgments were used to identify and rate sources of water pollutants. Agriculture and urban runoff were identified as the most significant nonpoint sources. Silviculture sources ranked number three of eight sources identified. Forest management activities and road construction activities were specifically identified as potential sources of water pollutants. Of concern was the lack of adequate reforestation, extensive damage to trees by feral pigs, and poor planning, construction, and maintenance of roads. Evidence suggested that 60 percent of the sediment generated in forested areas originated from roads.

The Environmental Planning Office prepared a second assessment of nonpoint sources in 1992. Silvicultural and forestry-related sources were not identified in the text of the assessment. They were, however, identified as a category (in tables) for which no data were available to determine the extent of their contribution to water pollutants.

C. Nonpoint Management Plan

Hawaii's nonpoint source pollution control plan consists of five components, namely: assistance programs; public information and education; priority projects; monitoring; and certain activities of the Hawaii Technical Committee on Nonpoint Source Pollution Control. The plan's successful implementation depends on the cooperation and assistance of existing agencies, including the USDA-Forest Service's Institute of Pacific Islands Forestry; USDA-Soil Conservation Service; State cooperative extension service; soil and water conservation districts; and various units of the State Department of Land and Natural Resources (Board of Land and Natural Resources), Division of Forestry and Wildlife, Division of Land Management. A priority nonpoint source management project for 1990-1994 is the management of feral animals in forested watersheds.

D. Best Management Practices

Best Management Practices (BMPs) for various nonpoint sources of water pollutants are described in Hawaii's nonpoint

assessment report. The major categories applicable to forestry activities include the following:

- access roads: design and construct properly so as to minimize erosion and sedimentation;
- critical areas planting: plant vines, shrubs, legumes, or trees on highly erodible areas;
- debris basin: construct barriers or dams across suitable locations in waterways to form a sediment basin;
- diversions: construct diversion channels to guide the flow of water to locations that reduce erosion rates;
- field windbreaks: plant shrubs and trees to reduce wind erosion and enhance natural beauty of area;
- grassed waterway: seed selected water courses to prevent erosion;
- mulching: apply plant residues or other appropriate plant material in appropriate locations so as to prevent erosion;
- streambank protection: use vegetation or structural means to stabilize banks of streams and lakes; and
- tree planting: establish or reinforce forests to protect watersheds.

E. Forest Practice Rules

Hawaii does not have separate and special rules specifically focused on private forestry practices that could potentially be significant nonpoint sources of water pollutants. However, authority is granted the Department of Land and Natural Resources (Forest Reservations, Water Development, and Zoning Chap. 183, Subtitle 4, Hawaii Statutes) to oversee the establishment and administration of forest and water reserve zones in each of the State's counties. Within such zones, the Department has the authority to specify permitted land uses, including grazing, recreation and the growth of commercial timber. Once such zones have been designated, the Department may promulgate regulations that control the extent, manner, and times of permitted uses, and may prohibit unlimited cutting of forest growth, soil mining, or other activities detrimental to good conservation practices.

In addition, administrative rules permit the Department of Land and Natural Resources to classify subzones within the "conservation" land classification zone (other zones are agriculture, rural and urban). The subzone relevant to forestry is the resource subzone, where objectives are to ensure sustained use of natural resources. Administrative rules specify general standards, conditions and guidelines for directing the use and management of land within conservation districts and resource subzones. None specifically refer to forestry practices, although some refer to road construction and to revegetation of cleared areas.

F. Special Rules and Rule Changes (since 1980)

There are no special forest practice rules that apply to water-quality impacting forest management practices that might be applied by forest landowners or timber harvesters in Hawaii. There have been no significant program or rule changes focused on private forestry in Hawaii since 1980.

G. Compliance and Effectiveness

Since Hawaii has no formal rules or special BMPs focused on private forestry activities, assessments of compliance and effectiveness have not been undertaken.

H. Special Issues

Timber harvesting takes place on such a small scale in Hawaii that it is not perceived to be a significant nonpoint source of water pollutants. Agriculture and development (both rural and urban) activities are viewed as a much larger threat to the quality of the State's waters.

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X IDAHO

A. Statutes, Regulations, and Programs

Management of forestry nonpoint sources of water pollutants is carried out primarily via authority granted by the Idaho Forest Practices Act of 1974. The Act is administered by the Idaho Board of Land Commissioners and the Idaho Department of Lands. The Board and the Department are responsible for establishing, administering and enforcing forest practice standards. Responsibility for assessing the effectiveness rests with the Department of Lands and the Department of Health and Welfare. The latter is ultimately responsible for enforcing water quality standards.

In addition to the Idaho Forest Practices Act, the State adopted (1989) an Anti-degradation Policy whose purpose is to maintain and protect the level of water quality necessary to protect existing stream uses, and to allow lowered water quality only upon the existence of certain very important economic or social conditions. The forestry component of the program is administered jointly by the Idaho Department of Lands and the Division of Environmental Quality of the State Department of Health and Welfare. For a stream segment of concern, a local working committee is given responsibility for inspecting the stream, observing characteristics supporting beneficial uses, and developing consensus on Best Management Practices (BMPs) to be applied for purposes of protecting the stream. Local committees are comprised of members of the forest industry, affected public and private landowners, representatives of State lead agencies, members of conservation groups, and private citizens. Monitoring of streams is undertaken jointly by local working committees, the Idaho Department of Lands, and the Division of Environmental Quality.

Two-hundred-six streams have been formally designated as stream segments of concern. As of 1991, 66 of these streams were judged as requiring the attention of local working committees; 24 local working committees were subsequently convened to address forestry BMP needs for the streams in question. The other 140 segments were designated as in need of agriculture, grazing, or mining BMP development. The Idaho Department of Lands is responsible for BMP development on streams not classified as streams of concern.

As of 1991, the anti-degradation policy had made three major contributions, namely: it engaged the public in water quality issues (identification of stream segments of concern); it lead to development of BMP practices for especially sensitive waters; and it enabled the State to identify truly outstanding water resources (Turner and O'Laughlin 1991).

B. Nonpoint Assessment Report

The Division of Environmental Quality assessed the impacts of nonpoint sources on surface and groundwater. The assessment was based largely on the judgment of natural resource professionals (monitoring data were available for less than 20 percent of the waters assessed). Approximately 50 percent of Idaho's streams (16,000 miles) were assessed for nonpoint source impacts. Agriculture was reported as the primary nonpoint source actively impacting beneficial uses of streams and lakes (over-grazing, irrigated agricultural, and non-irrigated agriculture adversely impacted 50 percent of the assessed waters). The second most water-impacting category was hydrological modifications (e.g., road building, stream modifications), which adversely impacted 30 percent of assessed waters. Other nonpoint sources were mining, construction, and forest practices (northern part of State). Several streams were specifically identified as being adversely impacted by forest road construction and stream crossings.

C. Nonpoint Management Plan

The Idaho Forest Practices Act (and adopted rules) is the primary administrative means for managing water pollutants originating from forestry activities. The management plan identifies a number of opportunities for program improvement: additional information and education to operators and landowners regarding BMPs; additional administrative support for information and education programs; additional technical assistance regarding stream class mapping, soil hazard mapping, and problem road inventory and repair; greater technology transfer, especially information regarding BMP effectiveness and a water quality information base; and more demonstration projects and cooperative research efforts. The Idaho Department of Lands and Division of Environmental Quality will continue as the lead agencies for water quality programs and nonpoint source pollution control focused on forestry activities.

D. Forest Practice Rules

The Idaho Forest Practices Act authorizes the Idaho Board of Land Commissioners to establish standards for the application of forestry practice. Although the Act specifies forest practice standards, it also establishes criteria that the Board is to use as a basis for further development of standards. For example:

- provide for harvesting that will maintain the productivity of forestland, minimize soil and debris entering streams, and protect fish and wildlife habitat;

- provide for road construction that will ensure forest productivity, water quality, and fish and wildlife habitat;

- provide for reforestation, including minimum number of trees per acre and maximum time allowed after harvest for establishment of tree species;

- provide for use of chemicals or fertilizers in such a manner that public health and wildlife will not be endangered; and

- provide for management of slash resulting from tree harvest so as to reduce risk of fire, insects and diseases.

The Idaho Forest Practices Act contains a number of important definitions, including:

- forestland -- State and private land growing forest trees that are capable of furnishing raw material for use in the manufacture of lumber or other forest products.

- Landowner -- person, partnership, corporation, or association that holds an ownership interest in forestland, including the State.

- forest practice -- harvesting of trees; road construction; reforestation; use of chemicals; and management of slash.

- best management practices -- practices determined to be the most effective and practical means of preventing or reducing the amount of nonpoint pollution generated by forest practices.

The forest practice rules promulgated by the Idaho Board of Land Commissioners are organized into the following major categories: definitions, general rules (administration), timber harvesting, road construction and maintenance, reforestation, chemicals, slash management, and practices in stream segments of concern. Among the more than 70 definitions established by the rules are the following examples:

- forest regions -- two regions of forestland: one being north of the Salmon River and one being south of the Salmon River.

- emergency forest practice -- forest practice initiated during or immediately after a fire, flood, windthrow, earthquake, or other catastrophic event

to minimize damage to forestland, timber, or public resources.

- stream classifications --

  Class I: used for domestic water supply and are important for spawning, rearing, or migration of fish (are consider Class I upstream from point of domestic conversion for a minimum distance of 1,320 feet).

  Class II: used by only a few, if any, fish for spawning or rearing. Usually headwater streams or minor drainages. Principle value lies in influence on water quality or quantity downstream in Class I streams.

- stream protection zone -- area encompassed by a slope distance of 75 feet on either side of the ordinary highwater marks of a Class I stream.

Among the forest practice rules established by the Board are the following examples:

(1) Timber harvesting - On slopes exceeding 45 percent and located immediately adjacent to Class I and II streams, tracked and wheeled skidding must not occur unless operation can be accomplished without accelerated erosion. Skid trails must not be constructed on slopes of greater than 30 percent where soils are saturated, highly erodible or geologically unstable. Whenever possible, trees must be felled, bucked and limbed away from Class I streams. Debris must be continuously removed from such streams. Hardwood trees, shrubs and grasses should be left along Class I streams in order to maintain the integrity of the soil near a stream. Seventy-five percent of current shade over Class I streams should be left. Standing trees (including conifers) must be left within 50 feet of each side of a Class I stream in specified numbers per 1000 feet of stream. For example, 200 trees up to 8 inches in diameter for streams 10 to 20 feet wide; 21 trees 12 to 20 inches in diameter for streams 10 to 20 feet wide.

(2) Road construction and maintenance - Roads should not be wider than required to accommodate expected use. Road surface must be maintained to minimize erosion.

(3) Reforestation - Other than when exempt, forestland must be reforested within 5 years after harvest. Acceptable stocking and spacing is specified for ponderosa pine and mixed forest types i.e., 150 3-inch or less ponderosa trees per acre, spaced 17 by 17 feet; and 105 3- to 5-inch ponderosa trees per acre, spaced 21 by 21 feet). The following classes of land are exempt from the

reforestation standards: noncommercial forestland; forestland to be converted to a non-forest use; ownerships of less than 10 acres; and forest practices on large ownerships that will affect a total of 10 acres or less during a period of five consecutive years.

(4) Chemical use - For aerial application, operators must leave a minimum of 100 feet untreated on each side of Class I streams and flowing Class II streams (50 feet for application of pelletized fertilizer). For ground application, operators must leave 25 feet untreated on each side of Class I streams and flowing class II streams. Daily accounts of chemical applications must be kept and maintained for three years (except where application involves less than 20 acres).

(5) Slash management - The administering agency must make a determination of potential fire hazard reduction measures. Such determination must be made within 10 days after agency receives landowner or operator's notice of intent to carry out a forest practice.

(6) Practices bordering stream segments of concern - In consultation with the administering agency, the operator or landowner may be required to exceed specified forest practice standards in stream segments of concern. Stream segments of concern are specific stream areas needing special attention as determined through the Anti-degradation Agreement of 1989.

E. Special Rules

The Anti-degradation Agreement of 1989 serves as a programmatic framework to address nonpoint forestry sources of water pollution in Idaho. However, there are no special rules included in the agreement.

F. Program and Rule Changes (since 1980)

Amendments have been made in the Idaho forest practices rules. These include the development of leave tree requirements for recruitment of large woody debris for streams. The State's most significant recent developments have been the 1989 Anti-degradation Agreement and compliance/effectiveness monitoring.

G. Compliance and Effectiveness

The Idaho Department of Lands has conducted both formal and informal reviews of compliance with forest practice standards and the effectiveness of such standards. Formal audits by forest practice foresters entail working directly with operators and landowners to implement site-specific best management practices and to suggest modifications of practices during the process of

reviewing forest practice notifications. In 1991, inspections were carried out as follows:

Total Inspection Reports	2,766
Total Practices Inspected	1,937
Total High Hazard Inspection Reports	1,435
Total High Hazard Practices Inspected	938
Total Stream Segment of Concern Reports	402
Total Segment of Concern Practices Inspected	265

Compliance with forest practice standards is also assessed by on-site inspections. Since personnel are not available to inspect all practices, inspection priorities are as follows (in descending order): complaint; request from operator or landowner; operator compliance history; stream segment of concern; Class I streams; unstable soils-steep slopes-Class II streams; large operations; and random selection. The magnitude of compliance generally, and the severity of non-compliance in 1991, is as follows:

Number of Unsatisfactory Inspection Reports	643
Notice of Violations Issued	47
Cease and Repair Orders Issued	21
Stop Work Orders Issued	8
FPA Rehabilitation Account Used	2
Legal Action Taken	1

In response to the State's 1989 nonpoint source management program (which identified forest access and haul roads near stream channels as the most significant source of sediment in waterways), the Idaho Department of Health and Welfare carried out a study to more clearly identify the nature of existing road problems, and ways that such problems might be alleviated. Focus was on 45 road problems in the Clearwater basin. As a result of the analysis, 7 road segments were placed on a high priority list, 10 on a second priority list, and 18 on a third priority list. After further analyses, 15 roads were identified for rehabilitation. Mitigation measures were applied in the following order: full vegetation of fillslopes; full vegetation of cutslopes; cutslope gradient decreased 10 percent; cutslope gradient decreased 20 percent; road tread graveled; and road tread paved.

The effectiveness of Best Management Practices (BMPs) and forest practices rules is also being further addressed by local technical working committees as part of the State's anti-degradation program.

The USDA-Forest Service annually monitors forest practices (and subsequently issues reports) occurring on National Forests located within Idaho. Based on these monitoring activities, the agency adjusts timber harvesting activities accordingly.

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XI MONTANA

A. Statutes, Regulations, and Programs

Montana has a number of statutes and programs that address water pollutants originating from forestry activities carried out on private forestland. They include:

Streamside Management Act of 1991. Administered by the Department of State Lands, the law defines a streamside zone (50 feet on each side of a stream, lake or other body of water) and prohibits certain activities in such zones, including broadcast burning, operation of wheeled or tracked equipment, clearcutting, handling of hazardous materials, sidecasting of road material, and deposit of slash.

Protection of Forest Resources Act of 1989 (Montana Code Annotated 76-13-101; adopted December 31, 1989; amended Oct 1, 1991) (also known as Best Management Practices Notification Law). Administered by the Department of State Lands, the law requires landowners to inform the Department of their intent to harvest timber. Having made known their intent, the law requires the Department to provide operators and landowners with information about Best Management Practices (BMPs), and, if necessary, carry-out an on-site consultation with the operator or landowner.

Natural Streambed and Land Preservation Act of 1975 (Montana Code Annotated 75-7-101) (310 Permit Program). Administered by the board of supervisors of the conservation district in which a project will take place, the law requires a permit for any activity that alters or modifies the bed or bank of a stream.

Montana Stream Protection Act. Administered by the Department of Fish, Wildlife and Parks, the law requires a permit before agencies of any federal, State, country or city government can undertake any activities that would affect the natural existing shape and form of any stream or its bank or tributaries.

Montana also has laws regarding the management of timber slash and debris. These laws require persons to reduce hazardous material along certain rights-of-way, and to enter into a fire

hazard reduction agreement with the Department of State Lands before cutting any forest product.

B. Nonpoint Assessment Report

The Water Quality Bureau of the Department of Health and Environmental Sciences assessed Montana's surface water quality in 1990 and 1992. In both cases, the focus of attention was on waters that were not fully supportive of beneficial uses, which represent one percent of the State's stream miles and one percent of lake area. State waters are classified as fully supporting (good quality; supports all beneficial uses), fully supportive but threatened (at least one beneficial use was threatened), partially supported (not expected to meet standards), and not fully supportive (severely impaired, needs serious attention).

Silviculture was considered a minor or moderate source of impairment to water quality standards on 1,919 miles of streams in 1992; for only two miles of stream was silviculture considered a major impairment. This total (less the latter 2 miles) was determined to be caused by: harvesting, restoration, residue management -- 12 percent; road construction and maintenance -- 15 percent; and general silvicultural practices -- 72 percent. Silvicultural as a nonpoint source represented approximately 6 percent of the "not fully supported" miles of stream, and only 0.2 percent of the total miles of all streams in Montana. Agriculture sources accounted for over 55 percent (61 miles) of the severely impaired stream miles.

Silviculture was considered a minor or moderate source of impairment to 38,972 acres of lakes in 1992. This was approximately four percent of the total lake area considered to be severely impaired (not fully supportive), or 0.03 percent of total lake area in Montana.

C. Nonpoint Management Plan

Montana's silvicultural nonpoint source program is comprised of five primary components: development of a network of agencies to address nonpoint problems; adopt rules under the Streamside Management Act of 1991 to protect forest riparian areas; adopt, upgrade, implement and monitor BMPs; conduct BMP education programs for private landowners; and complete water quality demonstration projects on severely impaired streams.

D. Best Management Practices

Forestry BMPs have been adopted by the Montana Board of Land Commissioners. The Protection of Forest Resources Act of 1989 (as amended) requires that landowners be provided with information on BMPs for forestry. The Montana Extension Service in cooperation with the Montana Department of State Lands

developed a BMP manual which addresses management activities concerning roads, streamside management, timber harvesting, hazardous substances, and stream crossings. Examples of BMPs suggested to landowners include:

(1) Roads - Using comprehensive road planning that involves multiple landowners, minimize the number of roads in a forested watershed. Fit roads to the topography by locating roads on natural benches and following natural contours. After road construction, stabilize erodible, exposed soils by seeding, rip-rapping, benching, mulching, or other suitable means prior to fall or spring runoff. Route road drainage through streamside management zones, filtration fields, or other settling structures. Grade road surfaces only as often as necessary to maintain a stable running surface and to retain the original drainage surface.

(2) Streamside management zones - Designate streamside management zones of at least 50 feet in width (include additional width to protect adjacent wetlands). Use directional felling for harvest operations; avoid falling trees in streams or wetlands. Keep slash out of water bodies by removing limbs and tops well above the stream high-water mark. Leave snags, defective, and sub-merchantable trees in streamside management zones for wildlife habitat. Leave some vigorous mature trees in the zone to prevent cold-air ponding and rises in water temperature.

(3) Timber harvesting - Use logging systems that best fit the topography, soil type, and season. Avoid multi-landowner practices that, when combined, will lead to detrimental cumulative effects to waters flowing from a watershed. Minimize size and number of landings; avoid landing locations requiring skidding across drainage bottoms. Avoid skid trails greater than 30 percent in slope. Waterbars should be placed on skid trails according to slope and soil type (ranging from every 75 to 400 feet). Carry-out brush piling when soils are frozen or dry enough to minimize soil compaction and displacement. Broadcast burning (in areas other than streamside management zones) and or herbicide application are preferred methods of site preparation, especially on slopes greater than 40 percent. Rapid reforestation is encouraged.

(4) Hazardous substances - Hazardous substances (oil, grease, fuel) should not be stored or mixed in areas below the high-water mark of streams or lakes. Contingency plans for handing hazardous substance spills should be developed. Chemical treatments within streamside management zones should be by hand and applied to specific targets. Leave a 25 foot buffer strip along streams and lakes when applying chemicals by hand, 50 feet when applying by air. Apply chemicals during appropriate weather (generally calm and dry).

(5) Stream crossings - Cross streams at right angles to main channel. Use culverts with a minimum diameter of 15 inches for permanent stream crossings. Time stream crossing construction activities to protect fisheries and water quality. Ditch culverts should be drained into vegetated areas, not directly into streams. Avoid unimproved stream crossings. In addition to these voluntary BMPs, there are regulatory rules (see below).

E. Forest Practice Rules

Forest practice standards have been established by the Streamside Management Act of 1991 and apply to a zone at least 50 feet on either side of a stream, lake, or other body of water. Harvesting can occur within the zone if it does not violate any of the activities prohibited by the standards. The standards apply to all private, State, and federal land. The law explicitly prohibits the following practices, and amplifies such intent in promulgated rules:

- broadcast burning;
- operating wheeled or tracked vehicles, except on established roads;
- forest practice of clearcutting;
- constructing roads, except when necessary to cross a stream or wetland;
- side-casting road material into stream, wetland, or watercourse;
- depositing slash into a stream or other body of water; and
- handling, storing, applying, or disposing of hazardous or toxic material in a manner that pollutes waters or may cause injury to humans, animals, or plants.

The Natural Streambed and Land Preservation Act of 1975 also establishes rules that affect forestry practices. Administered by the boards of supervisors of conservation districts, the Act establishes a number of important definitions including:

- project -- a physical alteration or modification of a stream which results in the State of the stream to be in contradiction to the purposes of said statute.

- stream -- any natural perennial-flowing stream or water, its bed and immediate banks.

The Act does not contain specific standards; such have been specified in rules promulgated by the Department of Natural Resources and Conservation (Montana Administrative Code 36-2.2(2)-S240). A proposed project may be disapproved unless reasonable efforts have been made to (examples):

- minimize stream channel alteration;
- ensure that anticipated water flows will pass without creating harmful problems upstream or downstream;
- minimize effects on fish and aquatic habitat;
- minimize turbidity as a result of material used or ground cover removed;
- minimize effects on natural beauty of area; and
- insure that streambed gravel will not be used in the project unless no reasonable alternative exists.

In addition to the above rules, the Department of Natural Resources has developed model rules to assist soil conservation districts as they work to implement the Act and the Department promulgated rules. The model rules specify in greater detail the projects which are subject to the law. For example: bridges and culverts; brush removal operations by mechanical, spraying or other means; grazing and tree cutting on erosive sites; and recreational activities on erosive sites. As for construction standards, "stream bank vegetation shall be protected except where its removal is absolutely necessary for completion of the work." In addition, the district may limit the period of construction as necessary to minimize conflict with fish migration and spawning and recreational use.

F. Program or Rule Changes (since 1980)

Adoption of a notification system for timber harvesting operations (1989), and adoption streamside management measures (1991), are major developments since 1980. The current best management practices, regulations, and administrative procedures pursuant to these Acts are all new, or in the final stages of development. Montana has implemented a continuing BMP compliance and effectiveness monitoring program and has strong support from the Montana Loggers Association to increase BMP compliance.

G. Compliance and Effectiveness

The Department of State Lands carried out a field audit of the application of forestry BMPs in 1990. The audit teams (composed of six persons of various disciplines and representations) evaluated 1,780 practices for best management practices (BMPs) application. The results were as follows: 78 percent met or exceeded BMPs; 14 percent minor departures; 6 percent major departures; and 2 percent gross departures. In addition, 1,778 BMPs were evaluated for effectiveness. The results were as follows: 80 percent adequate protection; 11 percent minor/temporary impacts; 7 percent major temporary, minor prolonged; and one percent major prolonged.

At the request of the Montana Legislature, a second audit of forestry BMP applications was undertaken in 1992 (Table 9). The

audit teams evaluated up to 58 practices on 46 sites, for a total of 2,029 practices rated for BMP application. Eighty-seven percent of all the practices met BMP requirements; 78 percent of the high risk BMPs met application requirements. Most sites had at least one minor departure; 20 to 46 sites had at least one major departure. While the average for all ownerships was six departures per site, nonindustrial private landowners averaged 11 departures per site.

TABLE 9 APPLICATION OF BEST MANAGEMENT PRACTICES IN MONTANA TO ALL RATED PRACTICES, BY OWNERSHIP GROUP AND RATING CATEGORY - 1992

Ownership Category	Practices Rated	Percent of Practices Rated as:			
		Meets or Exceed	Minor Departures	Major Departures	Gross Neglect
State	218	97	3	0	0
Federal	734	88	9	2	<1
Industrial	738	91	7	2	0
Nonindustrial Private	339	70	13	10	7
All Ownerships	2,029	87	8	3	1

Source: Forestry Best Management Practices Implementation Monitoring: Final Report 1992 Forestry BMP Audits. Forestry Division. Montana Department of State Lands. Missoula, MT. 1992.

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XII NEVADA

A. Statutes, Regulations, and Programs

Nonpoint forestry sources of water pollution are addressed in the Nevada Forest Practices Act of 1955 as amended (Nevada Revised Statutes Sections 528.010-528.120). Rules and regulations adopted under the Act are administered and enforced by the Division of Forestry of the Nevada Department of Conservation and Natural Resources. The Department's Division of Environmental Protection has responsibility for the State's water quality programs.

B. Nonpoint Assessment Report

The Division of Environmental Protection assessed surface water quality occurring in various river basins within the State. As of late 1989, three of the State's 14 basins had been assessed and one basin had been assessed in a preliminary fashion. In the three assessed basins (located in eastern and central Nevada),

the following conclusions were reached regarding silvicultural practices as a nonpoint source:

> Carson River Basin: silviculture activity is limited in basin .... not believed to contribute significant sediment loads to rivers .... sediment loads may reach rivers as runoff from access roads during storm events.
>
> Walker River Basin: silvicultural activity limited .... commercial forestland located in extreme southwest portion of basin .... localized problems may occur .... due to limited activity, significant impacts on water quality are not evident.
>
> Humboldt River Basin: limited silvicultural activity .... effect on water quality is suspected to be minimal.

The Truckee basin was given a preliminary assessment; silvicultural nonpoint sources of pollutants were not addressed. Assessments are being carried out on the remaining basins with the State.

C. Nonpoint Management Plan

Nevada's nonpoint source pollution control plan focuses on major components such as completion of assessment, securing agency coordination, developing education programs, establishing watershed priorities, developing a monitoring program, and establishing a data management system. Although a plan for silvicultural sources is not separately identified, mention is made of the use of Nevada Forest Practices Act and the best management practices and the permitting process established by the Act. Although forest practices are regulated by the State's forest practices law, State policy is to implement best management practices by voluntary means. Voluntary application is to be encouraged by education, technical assistance, demonstration, and financial assistance programs offered by local, State and federal agencies. The latter are especially significant since over 85 percent of the State's land is owned by the federal government.

D. Best Management Practices

Nevada's nonpoint source pollution control plan identifies a number of Best Management Practices (BMPs) for managing silvicultural sources of water pollutants. However, the BMPs are stated in a very general fashion (two or three word phrases). For example: critical areas stabilization, terrace basins, spreader, crushed stone, runoff interceptor trench, diversion dike, siltation berm, access road, brush management, and dust control.

E. Forest Practice Rules

Forest practice rules have been adopted by the Nevada State Board of Forestry; they apply to all nonfederal timberlands within the State. The Board states that the "rules are not intended to result in taking of private property for public use without payment of just compensation." The rules address the following: definition of terms, appropriate silvicultural methods, proper logging practices, erosion control measures, stream and lake protection, hazard reduction measures, fire protection, insect and disease protection, and practices exempt from the rules.

The rules define appropriate terms, including:

- stream and lake protection zone -- strip of land on each side of perennial streams, lakes and those portions of intermittent streams which support fish at any time of the year, and downstream therefrom. The width of the zone shall be determined by on-the-ground investigation.

- timber operations -- cutting or removal (or both) of timber or other solid wood products .... together with all the work incidental thereto, including construction and maintenance of roads, fuel-breaks, firebreaks, stream crossings, landing skid trails, beds for felling of trees, and fire hazard abatement

The rules specify required and prohibited actions, examples of which are:

(1) Silvicultural methods - Timber harvesting must be conducted using one of seven silvicultural methods from which landowners and operators can select, and which must be specified in a timber harvesting plan to be filed with the State Forester. Selection of clear-cutting as a method implies that clear-cut areas are to be less than 40 acres in any one block, not contiguous to previously cleared area in same ownership, less than 600 feet in width, and be irregular in shape so as to follow contours and blend with general landscape. All non-commercial riparian vegetation found along streams and lakes and within meadows and wet areas must be retained and protected. Trees should be retained on areas designated as wildlife migration corridors, holding areas, or key ranges. Live trees with visible evidence of use as nest sites by eagles or ospreys should be retained if at all possible; or should be felled only when trees are not being actively used for nest sites (normally August 15 to February 1).

(2) Logging practices - Tractor logging shall not be conducted on areas having average slopes greater than 50 percent. Harvesting must not be conducted when, due to excess moisture,

unreasonable soil compaction or accelerated erosion is likely to occur. Logging equipment must not be serviced in a manner that grease, oil, or fuel passes into lakes or streams.

(3) Erosion control - Prior to removal of logging equipment, water breaks must be installed, natural water courses opened, and seeding (or similar measures) undertaken. Depending on slope and erosion potential (specified in rules), maximum distance between waterbreaks ranges from 25 to 300 feet.

(4) Stream and lake protection - Within stream and lake protection zones, enough trees or shrubs must be left so that 50 percent or more of the shade-producing canopy occurring before timber harvesting remains after harvesting for protection of stream (lake) wildlife habitat. Logging skid trails must cross live streams at a prepared crossing; stream beds must not be used as landings, roads, or skid trails. Trees cut within 50 feet of a stream must be felled at right angles away from the stream so as to minimize erosion.

(5) Hazard Reduction - Piled slash can be burned only after first wet fall or winter weather; no broadcast burning is permitted in stream and lake protection zones. Consideration should be given to leaving snags which exhibit wildlife values for eagles, hawks, owls, and rare and endangered species. However, snags should be removed when located within 300 feet of main ridge tops and within 200 feet of public roads over one mile long.

F. Special Rules

A very modest portion of the State's forests are regulated by the actions of the Tahoe Regional Planning Agency (see California sections).

G. Program or Rule Changes (since 1980)

Significant changes in the forest program or rules focused on nonpoint sources of water pollutants have not occurred since 1980.

H. Compliance and Effectiveness

The Division of Forestry has not undertaken a comprehensive assessment of landowner and operator compliance with the State's forest practice rules.

I. Special Issues

Land conversion from forest to nonforest uses is implicitly discouraged by law. Harvesting on steep slopes is of special

concern since forest soils in Nevada are frequently very unstable.

J. Information Sources

Board of Forestry. n.d. Amended Forest Practices Rules. Standard Forest Practice Rules. Articles 1 through 10. Carson City, NV.

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XIII NEW MEXICO

A. Statutes, Regulations, and Programs

Forestry nonpoint sources of water pollutants in New Mexico are addressed by forest practice regulations adopted pursuant to the State's Forest Conservation Act. The regulatory program is administered by the Division of Forestry and Resources Conservation of the New Mexico Department of Energy, Minerals, and Natural Resources. Responsibility for administering water quality programs generally within the State rests with the New Mexico Water Quality Control Commission. The later's authority stems from the New Mexico Water Quality Control Act of 1978.

B. Nonpoint Assessment Report

The Water Quality Control Commission assessed the State's surface waters via various means including intense surveys, water quality monitoring, and individual stream and lake assessments. The State's waters were categorized according to their ability to support various assigned uses, namely: fully supported (good quality; supports all uses), fully supported but threatened (at least one beneficial use threatened), partially supported (not expected to meet standards associated with specified use), and not fully supported (severely impaired, need serious attention). The agency focused on waters that were considered to be severely impaired, i.e. "not fully supported." For the latter, individual

lakes and streams were identified and assessed; a probable source of pollution was then identified.

Silvicultural nonpoint sources of pollutants were identified as having an impact on 121 miles of severely impaired rivers within the State. Silviculture was considered to have a major impact on 17 miles of such rivers and a moderate impact on the remaining 104 miles. Silvicultural sources accounted for only two percent of the total mileage of severely impaired streams; and this is only 0.1 percent of the total miles of all streams and rivers in the State. Agricultural sources accounted for over 53 percent of New Mexico's severely impaired stream miles.

Silvicultural nonpoint sources of pollutants were identified by the Commission as contributing in a minor or moderate way to 2,719 acres of lakes designated as severely impaired. This was approximately one percent of the State's lake area designated as severely impaired, and 0.25 percent of the total lake area within the State. Agricultural sources accounted for about 38 percent of New Mexico's severely impaired lake water area.

C. Nonpoint Management Plan

New Mexico's nonpoint source management plan involves three major components:

- Required statutory or regulatory programs. The State's Forest Practices Act is identified as an example of a required program.

- Incentive programs. Federal and State cost-share programs to be used in assisting private landowners apply Best Management Practices (BMPs).

- Educational and technical assistance programs. Technology transfer programs offered by the New Mexico Cooperative Extension Service and by the USDA-Soil Conservation Service.

The State is also participating with the USDA-Forest Service in reducing nonpoint sources of water pollutants from four targeted watersheds.

D. Forest Practice Rules

Forest practice rules have been adopted by the Division of Forestry and Resources Conservation of the NM Department of Energy, Minerals and Natural Resources (December 19, 1989). The rules are part of a broader set of rules that implement New Mexico's Forest Practices Act. The rules address a number of subjects, including: State authority to regulate; purpose of regulations; applications; definitions; harvest permit

requirements; treatment of slash; reduction of erosion; reseeding; tree utilization; revocation of permit; and fire restrictions. The regulations apply to all persons, associations, corporations, and other legal and government entities engaged in harvest activities on non-municipal or non-federal lands. Rules apply to harvest of commercial forest species in an area of 25 acres or more, or a combination of areas that total 25 acres or more. Harvests on less than 25 acres are exempt from the rules.

The rules contain a number of important definitions, examples of which are:

- cutting unit -- area of 25 acres or more but not more than 300 acres (areas more than 300 acres must be divided into two or more cutting units).

- excessive slope -- slopes of greater than 40 percent over a continuous ground distance of 80 years or more.

- harvest -- any and all activities related to removing a commercial forest species from its natural state, including (but not limited to) construction of haul roads and skid trails, cutting and severing or pushing over of standing trees, skidding or removal of trees to landings, and transportation from cutting site or landing.

- water bar -- drainage structure (ditch, mounded earth, staked log) installed on a road or skid trail at an approximate 30 degree down-slope angle which diverts surface water runoff into adjacent undisturbed areas.

- commercial forest species -- ten species identified.

The rules specify a number of requirements and prohibitions, including:

(1) Regeneration - A regeneration plan must designate an acceptable method of regeneration. A plan will not be considered acceptable unless there will exist at least 300 viable, healthy trees of commercial forest species per acre within five years after planned cessation of harvesting.

(2) Slash treatment - Slash will be treated so that none stands higher than three feet above ground level within 30 days after competition of harvest, or no longer than 360 days after beginning of harvest.

(3) Reduction of erosion - Water bars must be installed 30 days after completion of harvesting. Such bars must be placed on all haul roads and skid trails and at such intervals that erosion is prevented. Minimum interval is 25 feet on 25 to 40 percent slopes; maximum interval is 150 feet on zero to 4.9 percent slope. No longer than 180 days after harvesting is complete, all haul roads, skid roads, and areas of exposed soil must be reseeded.

Voluntary forest practice guidelines have also been developed cooperatively by a number of private and public organizations in New Mexico. Examples of the BMPs suggested to landowners include:

(4) Silvicultural and related practices - General description of various types of reforestation (e.g., natural seeding, artificial seeding, planting), including site preparation techniques, care and planting of seedlings, and appropriate spacing of trees. Also descriptions of thinning methods and opportunities for pruning in pre-commercial stands.

(5) Timber harvesting - Guidelines for various approaches to harvesting, including patch cutting systems, seed tree systems, and selections systems. Advantages, disadvantages and means of implementing systems are presented.

(6) Skid trails, landings, and logging roads - Suggestions for minimizing soil erosion from skid trails (e.g., make trails as narrow as possible, seed closed trails), landings (e.g., minimize skiding distance to landings), and logging roads (e.g., plan road location in advance, provide for proper drainage).

(7) Wildlife considerations - Retain den trees, snags occupied by birds, mast-producing trees, and fruit trees. Establish additional wildlife openings and appropriate edge effects as opportunities occur. Promote a diversity of vegetation to provide a variety of food and cover for wildlife.

(8) Recreation and Aesthetics - Provide for a diversity of age classes and forest types for scenic purposes. Restrict cutting in areas of scenic, recreational or historic importance. Remove logging debris after harvest in areas visible from trails, roads, and recreation areas.

E. Special Rules and Rule Changes (since 1980)

New Mexico does not have special rules that are in addition to forest practice rules that apply to private forestry practices. The forest practice regulations were revised in 1989.

F. Compliance and Effectiveness

The Division of Forestry and Resource Conservation has prepared a commercial harvest and field inspection form that is to be completed by district forestry inspectors once a harvesting operation is complete on private forestland. The form requires inspection foresters to determine, for example, if slash was properly treated, roads and skid trails water barred, and reseeding of landings and skid trails properly conducted. Unfortunately, the Division has not compiled summaries of the gathered information.

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XIV OREGON

A. Statutes, Regulations, and Programs

The Oregon Forest Practice Act of 1971 regulates forest practices on private lands (Oregon Revised Statutes Sections 527.610 et seq.) Water quality is extensively addressed through the rules and standards adopted pursuant to the Act. The forest practice program is implemented by the Oregon Department of Forestry. The Department of Environmental Quality works closely with forest practices program staff in administering and enforcing water quality standards pertaining to forest practices. Stream habitat protection assistance is also provided by the Oregon Department of Fish and Wildlife. In addition to the regulatory program, the Oregon Department of Forestry administers education, training, and technical assistance programs for landowners and operators.

B. Nonpoint Assessment Report

The Water Quality Division of the Department of Environmental Quality assessed Oregon's surface waters via a combination of means, including observation, professional judgment, and evaluation of data from monitoring programs (actual sampling). The State's waters were categorized according to their ability to meet standards appropriate to various designated uses. The categories were: fully supported (good quality water; supports all beneficial uses), fully supported but threatened (at least one beneficial use was threatened), partially supported (impaired or not expected to meet standards), or did not fully support designated use (severely impaired, need serious attention). The agency devoted special attention to severely impaired waters ("not fully supported").

There are approximately 90,000 miles of river (1988 State estimate; EPA estimate 114,000 miles) in Oregon. The State's Water Quality Division assessed approximately 29,109 miles of this total and designated 27 percent (7,755 miles) as severely impaired. Forestry was identified as a pollutant source on 7,580 miles of these severely impaired river miles (designated use not fully supported) (1988 assessment), or approximately 27 percent of the stream miles assessed. Range, agriculture, and recreation were identified as causes of pollutants in an even greater number of miles of severely impaired rivers.

Nonpoint sources of pollutants in Oregon's lakes were also assessed by the Water Quality Division. Of the more than 600,000 acres of lake area (approximately 6,000 lakes), 505,000 acres were assessed, of which two percent were judged as being severely impaired (not fully supported). Forestry is suspected as a

source of pollutants for 2,755 acres of the lake area designated as severely impaired.

The Water Quality Division also assessed estuaries, groundwater, and wetlands. The assessments either failed to identify forestry as a nonpoint source of pollutants for those waters, or forestry uses were of such a modest scale that judgments about potential impacts were not possible.

C. Nonpoint Management Plan

The statewide 1991 program for managing forestry nonpoint sources of water pollutants focuses on five major topics:

- Expand existing nonpoint source control programs. Special focus on the application of management actions to known sources of water quality problems.
- Increase program monitoring and evaluation. Special focus on baseline water quality monitoring and evaluation of best management practice effectiveness.
- Resolve uncertainties about water quality in selected streams and lakes. Special focus on water bodies and stream segments in which pollution problems are uncertain because of different information sources (situation in more than 100 streams and lakes).
- Incorporate cumulative effects assessments into watershed management evaluations.
- Expand capability of procedures and models to predict nonpoint forest source pollution loads originating from forestry operations.

The 1991 program also addresses a number of actions involving recreational activities in forested areas, e.g., destruction of vegetation along stream banks and impact of off-road vehicles.

The State's 1992 water quality assessment identifies a number of actions to be taken in order to reduce the incidence of nonpoint forestry sources of water pollutants. Some of the actions are procedural (e.g., the Department of Environmental Quality petitioning the Department of Forestry to investigate water pollution complaints), and others involve program substance. Examples of the application of forestry BMPs to be undertaken are:

- Revising the water-body classification system so as to better recognize the importance of smaller streams and the protection of their riparian zones.
- Modifying forest practice rules so as to better prevent landslides.

- Evaluating the effectiveness of current water quality criteria as a means of assessing water quality on forestlands.
- Analyzing cumulative effects of forest practices on air, soil, water, fish, and wildlife.

D. Forest Practice Rules

Forest practice standards are set forth in the Oregon Forest Practices Act and in the forest practice rules subsequently promulgated by the State Board of Forestry. Among the categories of forest practice standards covered are reforestation, road construction and maintenance, harvesting, application of chemicals, and disposal of slash. Practices are regulated on both private and State lands. Equivalent protection is secured on federal lands via agreements between the Oregon Department of Forestry and the USDA-Forest Service and USDI-Bureau of Land Management.

Oregon's regulatory process emphasizes prevention of problems via a notification process and pre-operation inspections. The intent is to target risky operations for pre-harvest inspection so as to avoid nonpoint source problems. The Department of Forestry has developed a system for ranking potential problems in need of special attention.

Oregon's Forest Practice Act (amended effective September 28, 1992) establishes a number of procedures, processes and definitions, including the following:

- forestland -- land which is used for the growing and harvesting of forest tree species, regardless of how the land is zoned or taxed, or how any State, or local statute, ordinance, rule, or regulation is applied.

- landowner -- any individual, combination of individuals, partnerships, corporations or associations that hold an ownership interest in forestland.

- operator -- any person, including a landowner or timber owner, who conducts any commercial activity relating to the growing or harvesting of forest tree species.

- forest practice -- any operation conducted on or pertaining to forestland, including (but not limited to): reforestation, road construction and maintenance, harvesting, application of chemicals, and disposal of slash.

- visually sensitive corridor -- forestland located within the area extending 150 feet from the outermost right of way boundary of a scenic highway (specific highways designated in law).

- clearcut -- harvest unit in Western Oregon that leaves fewer than 50 trees per acre that are well distributed and that measure at least 11 inches in diameter, or 40 square feet of basal area per acre. In Eastern Oregon, clear-cut is a harvest unit that leaves fewer than 15 trees per acre that are well-distributed and measure at least 10 inches in diameter.

The amended Forest Practices Act establishes specific standards for clearcuts, regeneration, and wildlife activities. Example standards are:

(1) Clearcuts: Clearcuts must not exceed 120 acres in size within a single ownership. Furthermore, at least a 300-foot buffer must be left between clearcuts, unless or until prior clearcuts meet specified reforestation standards.

(2) Reforestation: Clearcuts are considered to be reforested when: (a) there exists at least 200 seedlings per acre; (b) resultant reproduction is at least four feet tall; (c) at least 48 months have elapsed since planting; and (d) the reproduction is "free to grow" as defined by the Board.

(3) Wildlife habitat: In clearcut harvest units exceeding 10 acres in size, operators must leave two snags and two green trees per acre. These must be at least 30 feet in height, 11 inches in diameter, and 50 percent of the leave trees should be conifers. In addition, two downed logs or downed trees must be left. They must be at least 16 feet long, 12 inches in diameter, and 50 percent of them must be conifers.

(4) Scenic highway corridors: For specified State and interstate highways, visually sensitive corridors 150 feet from the outermost right of way boundary of a highway must be designated. For harvest operations within such corridors, at least 50 healthy trees of at least 11 inches in diameter (or 40 square feet of basal area) must be temporarily left on each acre. When the average height of the understory reaches 10 feet and there exists 250 stems of reproduction per acre, the temporary overstory may be removed. Harvest debris must be removed from the site within 30 days of the completion of harvest or within 60 days of cessation of active harvest activity. Reforestation must be completed by the end of the first planting season after harvest. A minimum of 400 trees per acre must be planted. From the 150-foot corridor out to 300 feet, at least

300 trees per acre must average 10 feet tall before the visual corridor can be removed.

(5) Water-quality protecting best management standards: Although most of this technical bulletin is current through 1992, the following section covering riparian zone rules was added to reflect changes in the Oregon Forest Practice Act effective September, 1994:

The goal of the riparian rules for Oregon's Forest Practices Act is to create Stream Management Zones (SMZs) with conditions typical of 80 to 200 year-old stands. There are nine stream classes based on three use classifications: Fish (F); Domestic (D); or None (N); and three average annual flow sizes (in cfs): 2 (S); 2-10 (M); and >10 (L).

A basic rule is to retain all trees within 20 feet of the High Water Level (HWL), all trees leaning over the channel, and understory within 10 feet of the HWL except, for small type-N streams, where non-merchantable conifers and understory within 10 feet of the HWL are retained. The width of riparian management area ranges from 20 feet for small domestic water supply streams to 100 feet for large fish-bearing streams. Within these riparian management areas are prescriptions for streamside tree retention based on basal area requirements. Basal area requirements range up to 350 ft^2 per 1000 feet of stream for large type-F streams in some regions. Basal area requirements are adjusted for different management practices. The new rules also require that for large, fish-bearing streams, 40 live conifers per 1000 feet be retained (11" dbh or greater). Less conifer retention is required for D and N streams and for smaller streams. If the basal area targets for conifers exceed the goals, then excess conifers can be harvested. In some situations, hardwoods and snags can count toward the basal area requirements. These detailed rules require 59 pages to describe their application. A unique feature of the Oregon riparian rules is a provision for some credit for active stream enhancement to improve type-F streams.

Protection for streams during aerial spray operations include: a 60-foot buffer for type-F/D streams, lakes, significant wetlands, or other standing open water for herbicides, and a 100 foot buffer for type-D and domestic water supply type-F streams with fertilizers.

For the Northwest Oregon Region, examples of forest practice rules promulgated prior to the September 28, 1992, amendments to the Oregon Forest Practices Act are as follows (adopted on June 24, 1991).

(6) Chemical application: Daily records of chemical applications must be kept for a period of three years. Chemicals

applied from the ground must not be applied within 10 feet of a Class I stream; from the air not less than 60 feet from the stream. No untreated strip is required when applying fertilizers.

(7) Disposal of slash: Reduce slash by effective felling, increased utilization, and relogging when markets exist. Must not burn slash in a riparian area of a Class I water.

(8) Reforestation: Forestland to be reforested must be capable of a mean annual production of at least 50 cubic feet per acre at culmination of mean annual increment. (New rules will require stocking levels consistent with the September 28, 1992, amendments to the Act).

(9) Road construction and maintenance: Roads must be properly located so as to minimize stream crossings and avoid marshes, meadows, and riparian areas; must involve water crossing structures that are adequate for fish passage, have a minimal impact on water quality, and withstand the 25-year frequency storm; must be constructed with minimal machine activity in streams beds (approval is required for machine activity in Class I waters); and must be properly maintained, especially culvert inlets and outlets.

(10) Harvesting: Trees left for future harvest must be protected from damage. Landings must be of minimum size and are to be located on areas of stable soil. Except where a safety or fire hazard, all snags and down timber should be left in the aquatic and riparian areas of Class I waters. In order to provide shade, wildlife habitat, soil stabilization, and water filtering, operators must leave sufficient vegetation in Class I waters to provide 75 percent of the pre-operation shade over aquatic areas, and 50 percent of pre-operation canopy in riparian management areas. Conifers must be retained in riparian management areas of Class I waters at rates varying according to average stream width, which in turn determines riparian management width and conifers per 1,000 feet. For example, a 20 foot wide stream must have a riparian management width of 60 feet, which must have at least 12 conifers per 1,000 feet of stream. Conifers to be left on riparian areas must be a minimum of 8 inches in diameter.

(11) Sensitive wildlife habitat: Special rules are to be applied for osprey and great blue heron nesting sites, and for northern spotted owl nesting sites.

The September 28, 1992, amendments to the Oregon Forest Practices Act also include a number of additional and new forest practice standards, including notification of down-stream holders of water rights about pesticide application; application of certain forest practice standards to areas within urban growth

boundaries; and special written plans for certain types of operations on high risk sites.

E. Special Rules

Oregon has a number of laws and related rules that address various aspects of forestry operations, including fire management, transportation, land use, and air pollutant management. Such laws and rules are administered by local as well as State agencies. However, the Oregon Forest Practices Act is the primary State vehicle for addressing forestry practices that may be nonpoint sources of water pollutants.

F. Program or Rule Changes (since 1980)

The Oregon Forest Practice Act has been amended several times since 1980 to address concerns about landslides; three of these changes were very significant (1983, 1987 and 1992). In 1987, 82 major storms caused hundreds of landslides on the Oregon coast from Bandon to Mapleton. A Soils Task Force report recommended rule changes to address landslides. After much discussion, new regulations to minimize landslides were adopted in 1983. Some additional rules for operation in high risk areas were adopted in 1985.

The 1987 amendment called for sweeping changes in the forest practices rules and the administration of the regulatory program, including restructuring the Board of Forestry (the rule-making body established to implement the intent of the law). The 12-member board was reduced to seven, with no more than three members having a large financial interest in forestry. The amendment also required the new Board of Forestry to adopt specific rules to protect air, water, soil, and fish and wildlife resources. Buffer zones were established for Class I streams.

The 1992 amendment to the Act established -- in statute -- new standards for forest practices and resource protection. Including forestry practice standards in law was a major departure from previous procedure, wherein administrative rule-making was used to formally establish forest practice standards. The standards set forth in law included:

- clearcuts -- 120 acre maximum size limit, with 300 acre buffer between cuts;
- scenic values -- 150 foot buffers for designated scenic highways;
- reforestation -- increased stocking and "green-up" standards;
- stream classification -- reclassifying streams and designating protection standards; and

- wildlife protection -- leaving two snags or live trees of certain sizes, and leaving two downed trees of certain sizes per acre after a forest practice operation.

G. Compliance and Effectiveness

Landowner compliance with reforestation standards is annually assessed by the Department of Forestry. Since 1980, reforestation compliance rates have been very high, typically exceeding 95 percent (Table 10). The Department is in the process of developing a comprehensive scientific resource monitoring program. It will be used to determine if forest practice rules and standards are effective in protecting public resources during forest practices operations.

TABLE 10 COMPLIANCE WITH REFORESTATION STANDARDS SPECIFIED BY OREGON'S FOREST PRACTICES REGULATORY PROGRAM -- 1980-1989

Year	Area Requiring Compliance (acres)	Area in Compliance (acres)	Area Not in Compliance (acres)	Compliance Rate (percent)
1980	73,011	69,083	3,928	95
1981	87,340	85,316	2,024	97
1982	95,224	91,967	3,257	98
1983	98,070	96,148	1,922	98
1984	90,244	87,708	2,541	97
1985	87,646	86,121	1,525	98
1986	87,115	84,882	2,233	97
1987	88,789	86,931	1,858	98
1988	83,112	81,605	1,507	98
1989	90,343	87,991	2,353	97

Source: Annual Reforestation Report: 1991 by Oregon Department of Forestry. Salem, OR. 1992.

The Department of Forestry also has under way a number specific monitoring-type projects which are part of the Department's forest practices strategic plan. Among the project subjects being carried out within the framework of the latter are water classification and protection, clearcut harvesting, soil and site productivity, landslides, urban growth boundaries, scenic values in visually sensitive corridors, reforestation, land use changes, improving administration, forestry impacts on anadromous fisheries, water quality and watershed management, harvesting and cumulative effects, public participation, stream restoration, biodiversity, application of chemicals, and review of forest practice rules.

H. Special Issues

Significant timber harvesting activity, instability of many mountain slopes, and expanding use of forested watersheds for various purposes, have all led to a growing concern over the cumulative effects of multiple forestry activities. Efforts are being made to better understand cumulative effects via information to be gathered from a comprehensive monitoring program. If cumulative effects are determined to be a major forestry problem in Oregon, further rules will most likely be promulgated to deal with the matter. Court action has also caused the State to develop Total Maximum Daily Load limits for both point and nonpoint sources in stream segments not meeting water quality standards. Forest management has become involved in "load allocation" efforts, the first being in the Tualatin River Watershed, near Portland.

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XV UTAH

A. Statutes, Regulations, and Programs

The Utah Division of State Lands and Forestry is responsible for programs that address water quality issues on private forestlands. Although small in scope and modest in size, these programs include: education, training, technical assistance, voluntary guidelines, and fiscal incentives. Responsibility for administering water quality programs generally within the State rests with the Division of Water Quality of the State Department of Environmental Quality.

B. Nonpoint Assessment Report

The Division of Water Quality assessed the State's waters for purposes of targeting pollution abatement measures. Focusing on sources of sediment, nutrients, and salinity, the Division concluded that silvicultural sources (along with mining and general road construction) were relatively minor sources of pollutant that occurred only in localized areas. Sixty percent of nonpoint source pollutants originated from natural or

background sources. Of the remaining portion, 70 percent are estimated to originate from agricultural activities.

C. Nonpoint Management Plan

Utah's plan for addressing nonpoint sources of water pollution in general involves implementation of the following programs: education, technical assistance, financial assistance, regulatory programs, demonstration projects, technology transfer, and monitoring and evaluation. Sources of pollutants originating from federal lands will be managed by programs implemented by the appropriate federal land management agency.

Since the State's assessment judged forestry activities to be such a minor source of water pollutants, the plan for forestry is to have responsible State and federal agencies work with the Division of Water Quality as needed on a case-by-case basis. This will involve: enforcement of existing laws, research on Best Management Practices (BMPs), technical assistance for BMP implementation and training, hydrologic modification seminars, demonstration projects, and public information and education.

D. Best Management Practices

Utah has not developed a formal set of BMPs for use by forest landowners or timber harvesters. The modest amount of harvesting that occurs on private forestlands apparently does not warrant the establishment of a formal program or a detailed set of forest practice guidelines. State service foresters are able to consult as necessary with individual landowners and operators, providing them with site-specific advice on BMPs and related forest practice matters.

The Division of State Lands and Forestry incorporates, as appropriate, forest practice standards in contracts for the sale of timber from State lands.

The State's nonpoint source management plan identifies broad categories of BMPs for two pollutants sources, namely agriculture and urban sources. Some of the agricultural BMPs have potential application to forestry, e.g., conservation cover, pesticide management, riparian area management, and stabilization.

E. Forest Practice Rules

The only major regulatory programs focused on forestry in Utah involve the control and management of fire, and the transportation of wood and related products. The latter involves requirements for proof of ownership of forest products that are in transit on State roads and highways.

F. Compliance and Effectiveness

State forestry program staff do not formally measure compliance with best management practices. Adherence to prescribed site-specific or project-specific best management practices is judged via individual contacts with landowners or operators.

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XVI WASHINGTON

A. Statutes, Regulations, and Programs

Forestry practices in Washington are regulated by authority of the Washington Forest Practices Act of 1974. Rules and regulations pertaining to performance standards and best Management Practices (BMPs) are promulgated by the Forest Practices Board (Chapter 222 of Washington Administrative Code). The Division of Forest Practices of the State Department of Natural Resources is responsible for implementing the Act, including the rules and regulations promulgated by the Board. Other State departments, such as Wildlife, Fisheries, and Ecology, assist in promulgating rules and administering the Act. Responsibility for administering water quality programs generally within the State rests with the Department of Ecology.

The Department of Natural Resources administers education, information, technical assistance, and cost-share programs that are designed to assist private forest landowners in the protection of water quality when carrying out forest practice operations. Other agencies involved in non-regulatory programs include the Cooperative Extension Service, USDA-Soil Conservation Service, and local soil and water conservation districts.

B. Nonpoint Assessment Report

The Washington Department of Ecology assessed the extent to which nonpoint sources of pollutants impaired or threatened four major categories of waters, namely coastal waters, estuaries, rivers, and lakes. An impaired water body is one which does not meet the State's criteria for its designated beneficial use, and which requires control of nonpoint pollutant sources in order to meet such criteria. A threatened water body is one which meets State criteria for its designated use, but is in danger of failing to do so because of nonpoint pollution sources. Silvicultural nonpoint sources were further classified as harvesting-reforestation, forest management, and road construction. The assessment was based on information from site-specific monitoring and qualitative professional judgments.

(1) Estuaries: Of the State's 2,943 square miles of estuaries (2,114 were assessed), silvicultural sources were considered a major, moderate, or minor pollutant source for approximately 22 square miles of impaired estuaries, and were not identified as a source for threatened estuaries. Among the more significant nonpoint sources of pollutants were pastureland (60 square miles) and on-site waste water systems (68 square miles).

(2) Rivers: Of the State's 40,492 miles of rivers (4,740 were assessed), silvicultural sources were considered a major, moderate, or minor pollutant source for approximately 413 miles of impaired rivers and 25 miles of threatened rivers. Among the more significant nonpoint sources were agriculture (2,750 miles), natural sources (825 miles), hydromodification (846 miles), urban runoff (458 miles), and land disposal (444 miles).

(3) Lakes: Of the State's 613,582 acres of lake water (156,518 were assessed), silvicultural sources were considered a major, moderate, or minor pollutant source for approximately 175 acres of threatened lakes, and were not identified as a source for impaired lakes. Agricultural crop production (66,208 acres), urban runoff (33,684 acres), and natural sources (33,104 acres) were major nonpoint sources for impaired lakes, while urban runoff (32,893 acres), natural causes (35,822 acres), and agriculturae generally (26,747 acres) were major sources for threatened lakes.

C. Nonpoint Management Plan

The Department of Ecology designated four levels of program priorities for addressing nonpoint sources of water pollutants in the State. Among the 19 actions called for are: development of a statewide education program focused on nonpoint sources of water pollutants; improved liaison with the USDA-Forest Service and USDA-Soil Conservation Service; coordination of State programs involving forest practices; accelerated implementation of the Timber, Fish and Wildlife Agreement; and support for implementation and evaluation of groundwater BMPs.

The forest practices regulatory program authorized by the Washington Forest Practices Act is identified as a major programmatic means for addressing water quality issues involving forestry practices. The Act's implementing regulations are jointly promulgated by the Department of Ecology and the Forest Practices Board. The management plan specifically addresses the application of BMPs for road construction, maintenance, and abandonment; forest management in general (especially timber harvesting and activities in riparian areas), and forest practices on unstable slopes. The application of BMPs is strategically guided by adaptive management. The latter involves a process of updating and refining regulations and management practices in response to new information gained from research, monitoring and evaluation. This allows implementation to proceed in the face of technological uncertainty.

D. Forest Practice Rules

Forest practice standards are set forth in (a) the Washington Forest Practices Law; (b) the rules and regulations adopted by the Washington Forest Practices Board and State Department of Ecology (adopted November 1, 1987; proposed changes June 25, 1992); and (c) the Manual of the Forest Practices Board. Standards described by the law and the regulations are mandatory, while those set forth in the Manual are advisory.

The forest practices law establishes a number of policies, procedures, and definitions. Among the latter are:

- forest practice -- any activity conducted on forest land and relating to growing, harvesting, or processing timber, including: road and trail construction, harvesting, precommercial thinning, reforestation, fertilization, disease and insect management, and brush control. Does not include preparatory work such as flagging or removal of incidental vegetation (ferns, mistletoe, herbs).

- operator -- any person engaging in forest practices, except an employee with wages as a sole compensation.

- public resources -- water, fish, and wildlife.

Although focusing primarily on procedural matters, reforestation standards are specified in the forest practices law, namely: "after completion of a logging operation, satisfactory reforestation as defined by the rules and regulations promulgated by the board shall be completed within three years." A longer period may be authorized if seedlings are not available; a period of up to five years may be allowed with approval of the Department of Natural Resources; and a period of 10 years may be allowed on low-productivity forestlands. Upon competition of harvesting, landowners and operators are required to file a reforestation report; a Department inspection shall occur 12 months thereafter.

The rules promulgated by the Forest Practices Board and the Department of Ecology set forth statements of procedure, policy, organization and enforcement. Forest landowners are required to submit written applications before beginning any forestry operations. Forest practices are organized into classes, with longer review periods for practices that have greater potential for damaging public resources. The five classes and example forest practice standards are as follows:

Class I practices: activities determined to have no direct potential for damaging a public resource. Example practices are culture and harvest of Christmas trees, construction of landings less than one acre in size, and removal of less than 5,000 board feet of timber.

Class II practices: activities determined to have a less than ordinary potential to damage a public resource. Examples practices are construction of advance fire trails, and certain operations occurring on slopes of more than 40 percent (e.g., salvage logging, construction of more than 600 feet of road, harvest on less than 40 acres).

Class III practices: activities not identified as Class I, II, or IV practices. Examples are practices carried out on lands containing cultural, historic, or archeological resources; replacement of bridges over type 1, 2, 3 and certain type 4 waters; and harvest or salvage of timber except where classified as a I, II or IV forest practice.

Class IV practices: activities determined to have potential for a substantial impact on the environment. Example practices are aerial application of pesticides in areas of domestic water supply; harvesting within the boundaries of a State or national

park; and harvesting in areas known to be habitat to endangered or threatened species.

Water quality related forest practice rules are adopted by both the Forest Practices Board and the Department of Ecology. The intent being to ensure that compliance with forest practice regulations also achieves compliance with water quality laws.

How a forest practice is classified determines the type of administrative response required from landowners (operators) and administering agencies. For example, Class I practices can be commenced without notifications or applications, while Class IV practices require preparation of an environmental checklist (comply with State Environmental Policy Act) prior to commencement.

In addition to classifying forest practices, the rules organize the types of water that could potentially be impacted by a forest practice, namely:

Type 1 water: all waters, within their ordinary high-water mark, as inventoried to be "shorelines of the State."

Type 2 water: natural waters (not classified as Type 1) which have a high use and are important for domestic water use, pubic recreation, fisheries, and are generally highly significant for protection of water quality.

Type 3 water: natural waters (not classified as Type 1 or 2) which have a slight use and are moderately important for domestic water use, public recreation, fisheries, and have moderate value for protection of water quality.

Type 4 waters: natural waters (not classified as Type 1, 2 or 3) whose significance lies in their influence on water quality downstream.

Type 5 waters: all other natural waters.

Building on definitions in the forest practices law, the rules set forth a number of additional definitions. Examples are:

- riparian management zone -- specified area alongside type 1, 2 and 3 waters.
- plantable area -- area capable of supporting commercial stands of timber, excluding land devoted to permanent roads, utility rights-of-way, and certain portions of riparian management zones.

- notice to comply -- notice (issued by administering agency) requiring initiation of actions necessary to prevent or correct damage to public resources as a result of a forest practice.

- erodible soils -- soil exposed or displaced by a forest practice operation, that would be readily moved by water.

Although the rules establish polices and procedures, they also establish standards for the following forestry activities: road construction and maintenance, timber harvesting, reforestation, and forest chemicals. Consider the following examples:

- Road construction and maintenance: Regarding road location, roads should be minimized along narrow canyons and along riparian management zones, wet meadows, and marshes; number of stream crossings should also be minimized. Roads should be designed with subgrade widths averaging not more than 32 feet for double lane roads and 20 feet for single lane roads. Cross drains, culverts, water bars, driveable dips, or diversion ditches must be installed on all forest roads in order to minimize erosion. Such structures are to be spaced from 1,000 feet to 1,500 feet when grades are zero to 7 percent; 800 feet to 1,000 feet when grades are 8 percent to 15 percent; and 600 feet to 800 feet when grades exceed 15 percent. During road construction, merchantable timber must be removed; loose stumps, logs and wood chunks (greater than 5 cubic feet) must not be buried in road sites. All culverts installed in forest roads must be of a size that is adequate to carry a 50-year flood. However, no culvert can be smaller than 24 inches for anadromous fish streams; 18 inches for resident game fish streams; and 12 inches for all other water crossings. For maintenance purposes, oil can be applied to road surfaces only when temperatures are above 55 degrees.

- Timber harvesting: Logging systems must be appropriate to terrain, soils, and timber type. Depending on region (State is divided into Western and Eastern Washington zones) and water type, riparian management zones must be 25 to 100 feet in width, and must -- after harvesting -- contain a specified number of trees, 50 percent of which must be live and undamaged. In addition, the trees must be randomly distributed. The rules specify the number, size, species, and ratio of deciduous to conifer leave trees. For example, for type 3 waters with 5 feet or more of open water in Western Washington, the streamside management zone must be 50 feet wide and have a ratio of 2 conifer to 1 deciduous leave trees, all of which must

be 12 inches in size or larger. Furthermore, there must be 75 leave trees per 1,000 feet of stream (each side) in gravel or cobble conditions; 25 leave trees in boulder or bedrock conditions. For controlling water temperature in type 1, 2 and 3 waters, sufficient merchantable timber must be left to retain 50 percent of the summer mid-day shade of the water surface. In some circumstances, 75 percent of the pre-logging shade is the standard. Where practical on established big game winter ranges, cutting units must be dispersed to provide cover and increase edge effect.

- Reforestation: Reforestation standards are established for Eastern and Western Washington. In the latter, acceptable stocking has occurred when there exist 190 well-distributed, vigorous, undamaged seedlings per acre of commercial species. Competing vegetation must be controlled to allow establishment, survival, and growth of the seedlings. For artificial regeneration, satisfactory reforestation has occurred in a clearcut area when the stocking standards have been met at the end of 3 years. For artificial regeneration to occur, there must be 8 individually marked, well-distributed and undamaged tree per acre; no harvested area can be more than 400 feet from a seed tree. Upon completion of planting, a landowner or operator must file a reforestation report at which time the administering agency has 12 months within which to inspect the reforestation efforts.

- Forest chemicals: Unless an alternative is approved by the administering agency, chemicals shall be applied by hand in riparian management zones. When so doing, a 10 foot buffer strip must be left on each side of type 1 and 2 waters and flowing type 3 waters. Where aerial application is permitted, operators must keep a daily record of spraying operations. Such records must be kept on file for 3 years.

The Forest Practices Board Manual presents additional advisory information about forest practices. The manual supplements and clarifies the standards contained in the rules. Subjects addressed by the Manual include: stream temperature sensitivity determinations, shade requirement procedures, critical wildlife habitat management activities, measurement of stream physical conditions (e.g., channel width, stream flow), recommended culvert sizes, and guidelines for locating landings, clearing slash, determining stocking levels, and calculating widths of riparian management zones.

E. Special Rules

The 1992 amendments to the forest practice rules administratively address cumulative effects of forest practices. The rules require a statewide inventory of watershed units followed by a prioritization process and a threshold analysis. Watersheds will be ranked according to the potential for negative impact from forest practices. For each watershed, the Department of Natural Resources will analyze the threshold levels of resource conditions based on scientific methods (e.g., sediment load, stream temperature, soil loss, soil chemistry). Best management prescriptions will be developed for each watershed based on priority and threshold analysis.

The rules also address timber harvesting and forest road construction in and around wetlands. Wetlands will be defined and categorized and best management standards will be prescribed for each wetland category. Prescribed standards include use of low-impact logging systems and the use of buffer areas around wetland when building roads. Also to be implemented is an application-permit process for projects involving drain-and-fill of wetlands.

F. Program or Rules Changes (since 1980)

Since first adopted in 1975, the forest practices rules have been amended in 1977, 1982, 1986, and 1992. Details of the rule changes are extensive. For example, rules regarding timber harvesting in riparian management zones were established for each stream type. Requirements include management zone areas, minimum leave tree distribution, minimum felling and bucking standards near stream waters, yarding and skidding systems prescriptions, landing cleanup, and slash disposal. New 1992 rules require the Department of Natural Resources to establish site-specific BMPs for each designated watershed unit within the State. Greater restrictions are established for forest practices near wetlands.

G. Compliance and Effectiveness

In 1987, various forestry interests in Washington finalized a Timber, Fish and Wildlife Agreement (TFW). The intent of this agreement was to specify and ultimately achieve legitimate goals that all interests had for water quality, wildlife, fisheries, timber, and cultural and archeological resources. An especially important part of the agreement concerns adaptive management, namely implementation of forestry practices while continually monitoring, assessing, and subsequently modifying such practices. An especially important part of adaptive management is a strong monitoring program. For purposes of facilitating development of the latter, the Cooperative Monitoring, Evaluation and Research Committee (CMER) of the Timber, Fish and Wildlife Agreement Committee was established.

Among the many monitoring activities undertaken by the CMER was a late-1991 forest practice compliance survey. The compliance study was organized according to forest management practices. Among the compliance problems identified as affecting water quality were the following:

- Roads: Soil erosion from unprotected cuts and fills, and noncompliance with special conditions imposed by the Department.

- Road maintenance: An average of 44 percent of the roads surveyed did not meet minimum standards (e.g., ditch maintenance, culvert maintenance, placement of water bars, improper drainage control in general).

- Timber harvesting in Riparian Management Zones (RMZs): Sixty-seven percent of the operations in riparian management zones did not comply with regulations. Noncompliance with rules in wetlands was lower.

- Water crossings: Ninety-two percent of water crossings met regulations.

The Department of Natural Resources also conducts periodic random samples of individual forest practices to determine compliance with rules and regulations, especially reforestation standards. With regard to the latter, compliance is generally high for all landowner groups -- industrial forestlands typically having the highest compliance rates (98 percent or more). In 1991, private landowner compliance generally was 86 percent.

Several subcommittees in TFW are directly testing and monitoring the effectiveness of the Forest Practice Rules. The Water Quality Steering Committee has conducted work on stream temperature protection, water quality and fertilizers, aerial application of herbicides and stream protection, and roads and forest sediment. Results are used to modify the rules if necessary. Other committees are working on fish habitat, landslides, and wildlife issues.

H. Special Issues

A result of negotiations among groups representing the timber industry, Indian tribes, environmental organizations, landowners, and government agencies, the Timber, Fish and Wildlife Agreement Committee (TFW) was established in 1986. The Committee is an imaginative approach to administration of important elements of the State's forest practices program, especially scientific analysis, monitoring, public input and rule-making. Whether TFW committees can meet challenges has yet to be determined.

In response to growing concern over the quality of the State's ground water, the Department of Ecology developed a ground water management strategy in 1987. The strategy is based on the premise that preventive actions are more cost-effective than undertaking corrective actions. Among the recommendations for implementing the strategy is the development of ground water protecting best management practices that emphasis nonpoint source controls. Such may eventually have implications for forestry practices.

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XVII WYOMING

A. Statutes, Regulations, and Programs

State forestry programs in Wyoming are administered by the Division of Forestry and the Division of Water Quality of the State Department of Environmental Quality. These agencies administer education, training, technical assistance, voluntary guidelines, and fiscal incentives programs directed at the forestry practices of private forest landowners and timber harvesters.

B. Nonpoint Assessment Report

The Division of Water Quality assessment of water quality in Wyoming focused on 14 major watersheds. Of the 6,013 miles of river assessed (23,600 miles total in State) by the Division, the following river miles were determined to be impacted by forestry activities:

- timber harvesting/restoration -- 86 miles
- forest management -- 6 miles
- timber related road construction -- 167

Such activities impacted a total of 259 miles (one percent) of the State's river length. In addition, timber harvesting/restoration was determined to adversely impact 31 acres of lake in Wyoming. Major sources of non-forestry caused water pollutants were irrigated cropland management, and range and pasture land management

C. Nonpoint Management Plan

The nonpoint source pollution control program in Wyoming is structured to address nonpoint source pollution through voluntary (non-regulatory) changes in management practices. The State divisions of Forestry and Water Quality, and the USDA-Soil Conservation Service have been designated as lead agencies for helping landowners and operators in their efforts to apply forestry Best Management Practices (BMPs).

D. Best Management Practices

The State Division of Forestry has adopted silvicultural BMPs which supplement the Wyoming Nonpoint Source Management Plan. They are suggested to timber operators and forest landowners as guides for the application of forestry practices. The BMPs are derived almost in total from the Soil and Water Conservation Practices Handbook (FSH 2509.22) which is implemented by the USDA-Forest Service (Regions 1 and 4). Among the many definitions presented to support the implementation of the practices are:

- best management practices -- methods, measures, or practices selected by an agency to meet its nonpoint source pollution control needs.

- riparian ecosystem -- transition between the aquatic ecosystem and the adjacent terrestrial ecosystem; identified by soil characteristics or distinctive vegetation communities that require free or unbound water.

- significant disturbance -- disturbance of surface resources, including soil, water and vegetation, which has the potential to measurably impact water quality.

- mitigate -- to avoid, offset or lessen real or potential impacts or effects of forestry activities thorough the application of additional controls or actions.

- natural water quality -- quality of water which would exist without measurable effects or measurable influence of man's activities.

Wyoming's BMPs are grouped as follows: planning; harvesting, thinning, slash treatment and re-vegetation; roads; pesticides, herbicides, fertilizers and chemicals; and fire management. The format for describing each practice is as follows: name of practice, objective, condition where applicable, explanation, concerns, technical support, and references. Examples of BMPs are as follows:

(1) Planning: For purposes of minimizing road building and harvesting activities in riparian areas, designate such areas in advance. Riparian buffer width will vary with adjacent slope, ranging from 100 feet for 0 to 20 percent slopes to 520 feet for slopes greater than 50 percent. Planning of silvicultural activities should promote the occurrence of reforestation within 5 years after harvest. Contingency plans for spills of oil and hazardous substances must be established.

(2) Harvesting, thinning, slash treatment: Tractor operations should be excluded from wetlands, bogs, and wet meadows. Log landings should not be located on slopes exceeding 10 percent. Preventive measures to control erosion from harvested areas should be employed, including covering areas with wood chips, straw mulch, and seeding. To control erosion, heavy equipment operation should be limited to slopes less than 40 percent.

(3) Roads: Roads and trails should be located and designed so they drain naturally; such implies appropriate use of outsloping or insloping with cross drainage and grade changes. To minimize erosion, erosion control measures must be in place prior to seasonal precipitation. Appropriate erosion control measures include: seeding drainage ditches with suitable grass and legumes; use of chemical additives on roadway surfaces; application of mulches, rip-rap, erosion mats and terracing on cuts, fills, and ditches; and use of catch basins and anchored straw bales. Erosion should be minimized by restricting the timing of construction during excessive moisture periods. Use appropriately designed culverts, temporary bridges, low water crossings, or fords when crossing streams.

(4) Pesticides, herbicides, fertilizers and chemicals: A buffer of 150 feet or more should be used around surface waters when applying chemicals.

(5) Fire management: For prescribed burns, employ appropriate erosion control practices including advanced planning, water bars on fire breaks, and debris removal from stream. Prescribed burning should not be carried out within 150 feet of an active stream.

E. Forest Practice or Special Rules

Wyoming does not have rules pertaining to the application of water-quality impacting forestry practices that might be applied by private landowners or timber harvesters.

F. Compliance and Effectiveness

State initiated surveys assessing compliance with BMPs have not been carried out in Wyoming.

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