Five Rivers Landscape Management Project

Final Environmental Impact Statement

Waldport Ranger District
Siuslaw National Forest
Lincoln and Lane Counties, Oregon

Lead Agency:	**USDA Forest Service**
Responsible Official:	**Gloria D. Brown, Forest Supervisor** Siuslaw National Forest 4077 Research Way (P.O. Box 1148, 97339) Corvallis, OR 97333
For Information Contact:	**Doris Tai, District Ranger** **Paul Thomas, Project Team Leader** Waldport Ranger District 1049 SW Pacific Hwy. (P.O. Box 400) Waldport, OR 97394 (541) 563-3211
E-mail address:	dtai@fs.fed.us pgthomas@fs.fed.us

Abstract: The Waldport Ranger District proposes management actions in the Five Rivers watershed in response to direction in the Northwest Forest Plan, the Siuslaw Forest Plan as amended, and recommendations in the Lobster-Five Rivers Watershed Analysis. Public comments on the draft were considered in developing this final environmental impact statement. The proposed actions, designed to restore terrestrial and aquatic habitats in the Five Rivers watershed, include designating 12 management study areas as part of a learning design; commercial thinning older plantations; reopening some temporary and system roads, building temporary roads, and closing and decommissioning system roads; precommercial thinning of younger plantations; planting shade-tolerant conifer and various hardwood trees in riparian areas; maintaining existing meadows and plantations in early-seral conditions; and issuing a special-use permit for building and maintaining a private road. Three alternatives were fully developed and considered: Alternative 1, the actions described, including road building, reopening, and repair; Alternative 2, the actions described, but without road building, reopening, or repair; and Alternative 3, no action. Alternative 1 is the Forest Service's preferred alternative.

Cover design: Graphics, Dan White; Photos, Bernard Bormann (landscape), George Moeller (scientist and managers), Dave Pilz (people and fungi), Jack Sleeper (riparian planting).

Why is this project needed, and what evidence established these needs? CHAPTER 1

Chapter titles are framed as questions intended to focus the writing and to alert readers to judge whether the answers provided are adequate. For readers accustomed to earlier environmental documents, chapter 1 is equivalent to the "Purpose and Need for Action" section.

Note: This EIS and its appendices contain information that differs from or was not in the draft EIS. The changes respond to new information, public comment, advice from regulatory agencies, and corrections. For example, chapter 2 contains additional material that responds to public preference for more specific information on the alternatives. Chapter 3 contains information requested by the public and regulatory agencies about existing road and water-quality conditions, existing road maintenance and costs, and updates the biological assessment. Chapter 4 contains added material about sedimentation from roads, water quality, public and management access, economics, and updates discussions on bald eagles, northern spotted owls, and marbled murrelets. Additional tables provide more-specific information by subwatershed, and effects on aquatic conservation objectives and environmental justice were also added. Appendices 1 through 5 of the draft are now A through E. Appendices A through C have been modified to include additional or more-specific information requested by the public.

The Planning Area

The area included in the Five Rivers Landscape Management Project lies within the Five Rivers-Lobster Creek fifth-field watershed of the Alsea River basin. The planning area is about 34 air miles southwest of Corvallis and 40 air miles northwest of Eugene, Oregon (map 1); it includes eight subwatersheds and covers about 37,000 acres. About 13% of the planning area is privately owned, and the rest is managed by the U.S. Forest Service.

The Proposed Project

The Five Rivers Landscape Management Project is a package of associated terrestrial and watershed restoration projects. They include commercially thinning plantations now less than 50 years old, decommissioning roads, placing large conifer trees--up to 36 inches in diameter at breast height--in streams, and planting conifers and hardwoods in riparian areas. A management study, designed to compare management strategies, is part of the proposal.

The Problems To Be Addressed

Based on available information, and direction from the Northwest Forest Plan (the Plan), previous Forest Supervisor Jim Furnish identified the following problems (USDA 1999):

- ✓ Not enough is known for people to agree on a single approach to meet the goals of the Northwest Forest Plan, partly a result of ineffective past monitoring strategies. Especially poorly known is how plantations, riparian zones, and roads can be efficiently managed together through time. Thus, he saw a need to speed learning by comparing a variety of strategies for achieving late-successional conditions and aquatic conservation.
- ✓ The shortage of late-successional habitat in the Pacific Northwest limits recovery of old-growth-dependent species such as the northern spotted owl and the marbled murrelet. Thus, he saw a need to speed development of late-successional habitat in late-successional and riparian reserves.
- ✓ The shortage of properly functioning aquatic habitat in the Oregon Coast Range limits recovery of cold-water species such as coho salmon. Thus, he saw a need to improve watershed function.
- ✓ The Northwest Forest Plan called for substantial timber production from the matrix lands, but murrelets are almost always found in surveyed mature forest on the Siuslaw matrix lands, which are then redesignated as late-successional reserves. Thus, he saw the need to simultaneously produce timber from plantations and meet late-successional objectives on matrix lands.

Evidence Used by the Forest Supervisor in Deciding to Address These Problems

The record of decision (USDA, USDI 1994b) for the Northwest Forest Plan--based on physical, biological, and societal evidence provided in the Forest Ecosystem Management Assessment Team report (USDA, USDI, et al. 1993) and described in the Plan's environmental impact statement (USDA, USDI 1994a)--is intended to provide for:

- ⇨ Healthy forest ecosystems, including protecting riparian areas and waters;
- ⇨ A suitable supply of timber and other forest products to help maintain local and regional economies predictably over the long term; and
- ⇨ Adaptive management--described as a process of action-based planning, monitoring, researching, evaluating, and adjusting--to improve future land management decisions.

The Plan identified concern for northern spotted owls, marbled murrelets, and anadromous fish in the Oregon Coast Range Province (which includes the Siuslaw National Forest) because of its isolation and harvest history (chapters 3 and 4; p. 21). The record of decision, which amended the Siuslaw Forest Plan, allocated federal lands in the Five Rivers watershed into one or more of the following:

- ⇨ Late-successional reserve;
- ⇨ Riparian reserve; or
- ⇨ Matrix (lands not included in the other two allocations).

The Plan identified specific environmental conditions and appropriate commodities and amenities to be produced and maintained in each land allocation. It also outlined the rules and limits governing possible activities for achieving desired conditions in each allocation.

The Assessment Report for Federal Lands in and Adjacent to the Oregon Coast Province (USDA 1995a) shows the planning area in the central interior block (block 6). The mature conifer stands in block 6 have been extensively clearcut, and few patches of functional late-successional forest remain. The central interior block once supported the largest unfragmented patches of late-successional forest in the Province. The Report recommends managing to accelerate successional development and to aggregate small patches into larger ones.

The Report describes the in-stream fish habitat on federal lands throughout the Province as being in marginal to poor condition. It recommends specific actions to improve fish habitat on federal land by:

- ⇨ Stabilizing, decommissioning, or obliterating roads;
- ⇨ Restoring immediate habitat conditions by adding large wood to streams; and
- ⇨ Restoring long-term habitat by reestablishing natural riparian areas through actions such as riparian planting.

For needing to learn

The need to learn, for individuals and society as a whole, is strongest when uncertainty exists about how events will unfold. The current extent and intensity of debate among managers, scientists, and citizens over outcomes of land-management strategies provide strong evidence that sufficient uncertainty exists among knowledgeable and concerned people to warrant investing in learning. Three examples contributing to this evidence supporting the proposed action are:

- ⇨ The current high density of Siuslaw Forest roads continues to fuel debate over their long-term management, primarily related to the values associated with using and maintaining them versus their adverse effects on the aquatic and terrestrial environment.
- ⇨ Debate also surrounds the question of whether the plantations will ever reach old-growth conditions, with or without thinning and underplanting.
- ⇨ Another hotly debated issue is whether anything that people do to improve streams for salmon and steelhead is likely to increase the population faster than just letting Mother Nature take over.

The diversity of views held by the debaters can be represented in a limited number of pathways that can be compared, to illuminate the debate and lead to improved practices.

For needing late-successional habitat

Late-successional reserves were designed into the Northwest Forest Plan to protect and enhance these forest ecosystems, which are required habitat for many species. Riparian reserve objectives include protecting and enhancing habitat for terrestrial plants and animals, as well as providing connectivity corridors between late-successional reserves. The Late Successional Reserve Assessment, Oregon Coast Province Southern Portion (USDA, USDI 1997), identified the following landscape changes in the Five Rivers watershed:

- ⇨ The dominant patch size has decreased from jumbo patches (larger than 10,000 acres) to medium-sized patches (100 to 1,000 acres).

- ⇨ The number of medium-sized, mature patches has increased by six times over that found in the mid-1900s.
- ⇨ The largest percentage reduction in late-seral vegetation on federal lands in the Province is in the central interior Alsea disturbance block, which includes the Five Rivers watershed.

The Lobster-Five Rivers Watershed Analysis (USDA 1997a) reported that:

- ⇨ Most of the subwatersheds contain less than 40% mature forest.
- ⇨ Fewer than 15% of the mature forest stands function as interior forest habitat.
- ⇨ Coarse woody debris in plantations is less than one-third of the amounts found in natural stands of similar age.
- ⇨ More than 40% of the planning area is in plantations.
- ⇨ Plantations were intended to be and have been managed for intensive wood-fiber production.

For needing to restore watershed health

The Plan's Aquatic Conservation Strategy is intended to restore and maintain the health of watersheds and the aquatic ecosystems they contain. The Lobster-Five Rivers watershed analysis identified the following adverse effects on the watershed:

- ⇨ Concentrations of fine sediments are higher than historically, impairing the function of riffles, pools, and winter rearing areas.
- ⇨ The amount of large wood in streams is generally low, less than 80 pieces per mile.
- ⇨ Forest and county roads inhibit large wood transport.
- ⇨ The water quality of four streams (Green River, Crab Creek, Buck Creek, and Five Rivers) are considered impaired because they exceed the 64-degree temperature standard established by the Oregon Department of Environmental Quality.

For needing commodities

Based on societal needs outlined in the Forest Ecosystem Management Assessment Team's (FEMAT) report (USDA, USDI, et al. 1993), the Plan designates producing timber and other products to be important objectives for the matrix lands. The standards and guides for these lands are designed to provide important ecological functions and to maintain structural components like logs, snags, and large green trees. Outside of riparian reserves, the matrix lands also provide opportunities to maintain some early-successional habitat in the watershed.

What alternatives were developed to meet the identified needs? CHAPTER 2

In chapter 2, we describe three alternative proposals for resolving the problems and meeting the needs identified in chapter 1; it is equivalent to the traditional section, "Alternatives Including the Proposed Action". (The "we" in the previous sentence and throughout the document is our interdisciplinary team).

We designed these alternatives based in part on priorities and recommendations identified in the Forest's late-successional reserve assessment for LSR RO268 and the Lobster-Five Rivers watershed analysis. We also evaluated the project activities--commercial thinning, in-stream and riparian restoration, and road decommissioning--and their placement, based on the histories and current conditions of those sites. For example, we collected information about past harvesting practices, such as clearcutting trees, broadcast-burning harvested areas, and felling all of the snags; silvicultural practices, such as planting a single tree species at 400 trees per acre; and the age and current attributes of managed stands for the sites where actions are proposed. This collection of site information helped us to identify stands suitable for or in need of thinning and other actions--such as underplanting, adding coarse wood, and creating snags--to help maintain stand health or accelerate developing late-successional characteristics.

We evaluated stream characteristics--such as gradient, connectivity to flood plains, in-stream large wood, shading, and numbers of conifers in the riparian zone--to help identify areas for restoration. Actions for restoring aquatic habitat include placing large wood in streams to improve hydrologic function and planting trees in the riparian zone to increase future shade and large-wood sources. Several factors helped us identify roads for decommissioning: the need to reduce adverse effects to fish habitat and water quality by reducing reliance on valley-bottom and mid-slope roads, maintaining future access to managed stands, providing public access, and reducing road maintenance or rebuilding costs because funds for maintaining the current road system are lacking.

In addition to meeting the identified needs, the range of alternatives considered reflects concerns raised during public scoping for this project; public comments on the draft EIS (appendix D); and public involvement with recent Waldport Ranger District projects, such as Big Blue and Drift Home, including resolution of appeals or concerns raised during monitoring of District projects. The merits (including the effectiveness) of commercial thinning to accelerate developing late-successional forests is a common debate affecting projects with this activity. Part of this debate includes reopening closed or decommissioned roads and building new temporary roads to support commercial thinning operations. One respondent continues to question why the Siuslaw National Forest does not develop timber sales that harvest mature timber from the remaining matrix lands. Industrial timber landowners and rural residents are concerned about maintaining legal access to their lands, as well as convenient routes to multiple communities under all conditions. Also, the need to close or decommission roads as the appropriate response to declining road maintenance funds or to restore watershed health is questioned by some Forest users and encouraged by others, including some regulatory agencies.

Alternatives Considered But Eliminated from Detailed Study

With the uncertainty about how commercially thinned managed stands will function as late-successional forest habitat in the long term, researchers have developed and implemented scientific studies, such as how stands respond to commercial thinning and underplanting. Although many studies, either completed or in progress, are intended to evaluate the response of individual stands to a particular treatment, no studies in the Oregon Coast Range currently evaluate the outcomes of different treatments at the landscape scale. Pacific Northwest Research Station scientists, in cooperation with our interdisciplinary team (Team), have designed a management study to evaluate the response of the landscape to different approaches. Alternatives 1 and 2 were developed to include this management study.

The Team considered an alternative without a management study. Although monitoring is intended as part of all management actions, past projects and monitoring were planned and conducted at scales more conducive for learning and adapting at a site-specific scale. Although lessons learned at this scale have been applied to later projects, data could not be extrapolated with confidence at the landscape scale. As with earlier projects, proposed actions without the study would meet some Plan objectives, but they would not be likely to produce the new knowledge at the landscape scale needed by resource managers to meet the need identified for learning. The Forest Supervisor therefore directed the Team not to develop an action alternative without the management study.

The commercial harvest of mature timber from matrix lands in the Five Rivers area has been proposed by several people from the public, private, and agency sectors. The Lobster-Five Rivers watershed analysis recognized and identified subwatersheds where commercial harvest of mature timber would be consistent with the Plan. Currently, 845 acres of mature timber in the Five Rivers Landscape Management Project are designated matrix. Preliminary evaluation of these stands and experience with similar stands in the watershed indicate that if they were surveyed for marbled murrelets, more than 90% are likely to be identified as occupied. Current standards require that occupied stands, along with all suitable habitat within a one-half mile radius, be designated as late-successional reserve. If any of the remaining matrix lands contained mature timber, the controversy associated with harvesting mature timber--along with required protection measures for other listed species and survey-and-manage species--would likely delay or prevent any proposed timber harvest if the lands were included in a landscape-scale project. Harvesting mature timber in matrix lands was therefore not fully developed in the alternatives.

The Siuslaw Access and Travel Management Guide (USDA 1994) was developed in response to declining road maintenance funds. A key component of the guide was a mechanism to establish funding priorities and maintenance levels under which road maintenance funds would be expended. The guide presumed that projects, such as commercial thinning, would generate or provide sufficient funds to maintain roads required to access a given project. Although the guide identified roads on which appropriated road maintenance funds could be expended, it made no decisions about nor was it designed to determine the continued need for roads to be maintained with other funds. Late-successional reserve assessments and watershed analysis were developed to help identify resource management priorities and activities on the landscape. Because the access and travel management guide was prepared before these documents were available, it does not reflect the resource needs identified by those documents. Therefore, an alternative to develop resource actions based solely on the location of the existing primary and secondary road system was not fully developed.

Alternatives Considered in Detail

> Based on public comments on the draft EIS, we made three modifications to Alternatives 1 and 2: the segment of road 32 identified for decommissioning will be maintained as an ATM road until a natural event causes it to fail or unless Lane County accepts a public road easement to maintain the road; road 3505--including the Summers Creek road segment (1.6 miles)--will be maintained under its current status as an ATM road, rather than decommissioned; and 5 miles of stream adjacent to private property in the Lower Buck and Upper Buck subwatersheds were added to the hydrologic restoration efforts. The Forest Supervisor and Team believe that, at this planning scale, these modifications are minor and do not constitute developing another alternative. Other numbers different from those in the draft EIS either respond to public comments asking for additional clarity or reflect minor corrections.

The action alternatives propose similar types of activities but represent different management approaches; thus, the same design criteria apply to both alternatives. Design criteria (appendix B) outline the practices to be used and their timing and duration when planned actions and activities are implemented. We believe that mitigation measures for all proposed actions are covered by the design criteria, with one exception. To mitigate for the absence of snags, a result of past actions, snags will be created by topping trees in natural stands adjacent to commercially thinned plantations. This mitigation measure is the only one added to the action alternatives or design criteria after they were developed.

Alternative 1: Active landscape management with temporary roads (Forest Service's Preferred Alternative)

Actions included in this alternative are designed to address the problems identified by the Forest Supervisor. The actions incorporate the standards and guides established by the Siuslaw Forest Plan, as amended by the Northwest Forest Plan; the design criteria; and monitoring protocols outlined in appendix B. Selecting this alternative would result in the following management actions:

To speed learning, the following actions from the Five Rivers Landscape Management Study Plan (appendix A) are proposed:

- ✓ Designate 12 management study areas as part of the learning design (maps 2 and 3);
- ✓ Install, monitor, and compare three different management pathways in the 12 study areas:
    - ☑ *Passive management*: Stands will not be thinned, and only some stream restoration will be implemented. Roads will be permanently closed (decommissioned).
    - ☑ *Pulsed management*: Stands will be thinned to very wide spacing and streams restored; treatments will be completed in one, short-term pulse. Roads will be closed, reversibly, for 20 to 30 years, followed by another management pulse.
    - ☑ *Continuous management*: Management actions will be distributed through time, and thinning and stream restoration will thus be less intense than with pulsed management. Roads will be opened and maintained more frequently.

To speed the development of late-successional habitat in late-successional and riparian reserves, the following actions are proposed:

Silvicultural treatments and associated actions

- ✓ Commercially thin about 2,670 acres of plantations in reserves including about 1,650 acres in riparian reserve (maps 2, 6, and appendix C-3);
- ✓ Reopen about 5.0 miles of system roads in reserves--including about 2.8 miles in riparian reserve--and about 1.7 miles of system roads in matrix by repairing 14 road-failure sites (maps 3, 7, and appendix C-3);
- ✓ Temporarily reopen about 6.2 miles of existing operator spur roads in reserves--including about 3.4 miles in riparian reserve--and about 3.4 miles of existing operator spurs in matrix by removing vegetation and minor slides from 52 roads (maps 3, 7, and appendix C-3);
- ✓ Build about 0.9 miles of new temporary road in reserves--including about 0.3 miles in riparian reserve--and 0.1 miles in matrix (maps 3, 7);
- ✓ Create about 1,240 snags in natural stands adjacent to commercially thinned plantations, as mitigation for past harvest practices (appendix C-2);
- ✓ Develop future snags in thinned portions of plantations by inoculating about 6,500 trees with native fungi including 20% mitigation for past harvest practices (appendix C-2);
- ✓ Increase the coarse wood component in commercially thinned plantations in late-successional reserves by leaving about 25,000 plantation trees on the ground, to mitigate for past harvest practices (appendix C-2);
- ✓ Plant a mixture of shade-tolerant conifers and hardwoods on about 1,600 acres of existing plantations;
- ✓ Develop future snags in unthinned portions of plantations by inoculating about 4,200 trees with native fungi to enhance the snag component of late-successional reserve (appendix C-2);
- ✓ Precommercially thin about 2,032 acres of young plantations in reserves, through service contracts including about 1,250 acres in riparian reserve (map 6); and
- ✓ Maintain about 40 acres of existing meadows in early-seral condition to provide minimum diversity of seral conditions in late-successional reserve (map 2).

To improve watershed function, the following actions are proposed in addition to the silvicultural treatments:

System road actions

- ✓ Decommission about 49 miles of road including about 29.6 miles in riparian reserve (maps 3, 7);
- ✓ Close about 76 miles of road to vehicular traffic including about 29.9 miles in riparian reserve (maps 3, 7);

Hydrologic function and water-quality actions

- ✓ Place about 1,050 large conifers (up to 36 inches in diameter at breast height) and root wads along about 16 miles of stream on federal land and 7 miles of stream adjacent to private land (map 2);
- ✓ Plant about 200 acres of shade-tolerant conifers and various hardwoods along alder- or meadow-dominated riparian areas (map 2);

Road special-use permit

- ✓ Issue a special-use permit for building and maintaining a 0.5-mile road on or near a ridge top--including about 0.3 mile in riparian reserve--to access private land as mitigation for loss of access by decommissioning a 4.8-mile valley-bottom road that is completely in riparian reserve (maps 3, 7).

> Note: The decommissioning mileage used here reflects maintaining road 3505--including the Summers Creek road segment (1.6 miles)--as an ATM road. The mileages for decommissioning under Alternatives 1 and 2 in the draft EIS are incorrect because they failed to include the mileage for the Summers Creek segment.

To provide timber and other products and amenities in matrix lands, the following actions are proposed:

- ✓ Commercially thin about 560 acres of plantations (maps 2, 6, and appendix C-3);
- ✓ Precommercially thin about 334 acres of plantations (map 6);
- ✓ Maintain about 11 acres of existing meadows in early-seral condition (map 2);
- ✓ Create and maintain 14 acres of early-seral habitat in matrix portions of commercially thinned plantations to mitigate the loss of 14 acres of existing meadow habitat from riparian planting (map 2).

Most actions would be completed in 10 to 15 years, with most commercial timber-sale contracts awarded in the first 5 years.

The actions of Alternative 1 are summarized by subwatershed in Table 1. Refer to appendix C for specific plantation information about silvicultural prescriptions and commercial thinning.

Table 1. Description of Alternative 1 by subwatershed

Actions	Cascade	Crab	Green River	Lower Buck	Lower Five	Middle Five	Upper Buck	Upper Five
Commercial thinning (acres)								
Total commercial thin	211	747	469	472	211	233	367	520
Commercial thin, skyline	163	702	406	459	211	233	334	438
Commercial thin, helicopter	48	45	63	13	0	0	33	82
Comm. thin inside study	125	369	257	150	126	71	104	0
Comm. thin outside study	86	378	212	322	85	162	263	520
System (classified) roads (miles)								
Reopen roads	0	2.01	0.89	0.95	2.12	0	0.76	0
Close roads	0.50	16.70	7.90	11.30	11.20	8.90	7.70	11.80
Decommission roads	13.50	5.70	15.80	1.30	2.80	1.40	3.30	5.30
Temporary (unclassified) Roads (miles)								
New roads	0.08	0.20	0.07	0.17	0.15	0.07	0	0.28
Reopen roads	0.25	1.06	1.11	2.09	0.40	1.56	1.50	1.62
Hydrologic function and water quality								
Large wood in streams (miles): Federal	0	3.0	5.9	0.1	0	0.6	1.9	4.6
Private	0	2.0	0	3.7	0	0	1.3	0
Trees required for large wood less than or equal to 36 inches in diameter at breast height (number)	0	233	201	234	0	10	163	209
Riparian planting (acres)	2	26	56	0	34	16	18	48
Snag and coarse wood creation (trees)								
Mature tree topping	148	225	329	141	63	69	112	156
Trees inoculated in commercial thinning, including 20% mitigation	359	1,569	798	991	443	489	773	1,092
Trees inoculated in unthinned portion of plantations (enhancement)	192	739	958	804	260	275	316	706
Trees felled for coarse wood	4,260	4,255	4,530	3,620	1,055	1,745	3,000	2,600
Other actions								
Precommercial thinning area (acres)	97	391	141	277	460	194	162	644
Area maintained in early-seral condition (acres)	5.7	20.7	5.2	4.0	0	29.9	0	0
Stand underplanting (acres)	135	435	359	160	63	96	194	146
New road building to maintain private-land access (miles)	0	0	0.5	0	0	0	0	0

See Map 2

See Map 2

See Map 3

See Map 3

Alternative 2: Active landscape management without temporary or repaired roads

Actions under Alternative 2 are designed to meet the same needs as for Alternative 1, and they incorporate the same standards, guides, design criteria, and monitoring. Management actions would be the same for both alternatives, except that Alternative 2 would not include building temporary roads in plantations or repairing roads accessing plantations or roads closed by slides or washouts. About 15 miles of roads behind slides and washouts would be abandoned. As a result, five plantations totaling 109 acres would not be thinned because helicopter logging would not be feasible. In addition, snags and coarse wood would not be created in these five stands. The affected stands are in the Crab (stands 305 and 323), Lower Buck (250), Lower Five (122), and Upper Buck (425) subwatersheds. The Forest Supervisor asked the Team to develop this alternative so that citizens who want no new temporary roads built and no failed roads reopened could compare effects of the two alternatives. Selecting this alternative would result in the following management actions:

To speed learning, the actions proposed are identical to those in Alternative 1.

To speed the development of late-successional habitat in late-successional and riparian reserves, the following actions are proposed:

Silvicultural treatments and associated actions

- ✓ Commercially thin about 2,591 acres of plantations in reserves including about 1,600 acres in riparian reserve (maps 4, 6, and appendix C-4);
- ✓ Create about 1,190 snags in natural stands adjacent to commercially thinned plantations, as mitigation for past harvest practices (appendix C-2);
- ✓ Develop future snags in thinned portions of plantations by inoculating about 6,300 trees with native fungi, including 20% mitigation for past harvest practices (appendix C-2);
- ✓ Increase the coarse wood component in commercially thinned plantations in late-successional reserves by leaving about 24,700 plantation trees on the ground, to mitigate for past harvest practices (appendix C-2);
- ✓ Plant a mixture of shade-tolerant conifers and hardwoods on about 1,550 acres of existing plantations;
- ✓ Develop future snags in unthinned portions of plantations by inoculating about 4,100 trees with native fungi to enhance the snag component of late-successional reserve (appendix C-2);
- ✓ Precommercially thin about 2,032 acres of younger plantations in reserves, through service contracts, including about 1,250 acres in riparian reserve (map 6); and
- ✓ Maintain about 40 acres of existing meadows in early-seral condition to provide minimum diversity of seral conditions in late-successional reserve (map 4).

To improve watershed function, the following actions are proposed in addition to the silvicultural treatments:

System road actions

- ✓ Decommission about 49 miles of road including about 29.6 miles in riparian reserve (maps 5, 8);

- ✓ Close about 61 miles of road to vehicular traffic including about 23.6 miles in riparian reserve (maps 5, 8);
- ✓ Abandon about 15 miles of road behind 14 road-failure sites including about 6.3 miles in riparian reserve (maps 5, 8);

Hydrologic function and water-quality actions

- ✓ Place about 1,050 large conifers (up to 36 inches in diameter at breast height) and root wads along about 16 miles of stream on federal land and 7 miles of stream adjacent to private land (map 4);
- ✓ Plant about 200 acres of shade-tolerant conifers and various hardwoods along alder- or meadow-dominated riparian areas (map 4);

Road special-use permit

- ✓ Issue a special-use permit for building and maintaining a 0.5-mile road on or near a ridge top--including about 0.3 mile in riparian reserve--to access private land as mitigation for loss of access by decommissioning a 4.8-mile valley-bottom road that is completely in riparian reserve (maps 5, 8).

To provide timber and other products and amenities in matrix lands, the following actions are proposed:

- ✓ Commercially thin about 530 acres of plantations (maps 4, 6, and appendix C-4);
- ✓ Precommercially thin about 334 acres of plantations (map 6);
- ✓ Maintain about 11 acres of existing meadows in early-seral condition (map 4);
- ✓ Create and maintain 14 acres of early-seral habitat in matrix portions of commercially thinned plantations to mitigate the loss of 14 acres of existing meadow habitat from riparian planting (map 4).

Most actions would be completed in 10 to 15 years, with most commercial timber-sale contracts awarded in the first 5 years.

Table 2 summarizes the actions of Alternative 2 by subwatershed. Refer to appendix C for specific plantation information about silvicultural prescriptions and commercial thinning.

Table 2. Description of Alternative 2 by subwatershed

Actions	Cascade	Crab	Green River	Lower Buck	Lower Five	Middle Five	Upper Buck	Upper Five
Commercial thinning (acres)								
Total commercial thin	211	706	469	461	189	233	332	520
Commercial thin, skyline	115	139	200	90	94	95	95	129
Commercial thin, helicopter	96	567	269	371	95	138	237	391
Comm. thin inside study	125	333	257	148	104	71	104	0
Comm. thin outside study	86	373	212	313	85	162	228	520
System (classified) roads (miles)								
Abandon roads	0	1.8	1.5	2.2	7.3	0	2.5	0
Close roads	0.5	14.9	6.4	9.2	4.0	8.9	5.2	11.8
Decommission roads	13.5	5.7	15.8	1.3	2.8	1.4	3.3	5.3
Temporary (unclassified) Roads (miles)								
New roads	0	0	0	0	0	0	0	0
Reopen	0	0	0	0	0	0	0	0
Hydrologic function and water quality								
Large wood in streams (miles): Federal	0	3.0	5.9	0.1	0	0.6	1.9	4.6
Private	0	2.0	0	3.7	0	0	1.3	0
Trees required for large wood less than or equal to 36 inches in diameter at breast height (number)	0	233	201	234	0	10	163	209
Riparian planting (acres)	2	26	56	0	34	16	18	48
Snag and coarse wood creation (trees)								
Mature tree topping	148	200	329	136	56	69	99	156
Trees inoculated in commercial thinning, including 20% mitigation	359	1,483	798	968	397	489	697	1,092
Trees inoculated in unthinned portion of plantations (enhancement)	192	696	958	785	237	277	252	706
Trees felled for coarse wood	4,260	4,050	4,530	3,565	945	1,745	3,000	2,600
Other actions								
Precommercial thinning (acres)	97	391	141	277	460	194	162	644
Area maintained in early-seral condition (acres)	5.7	20.7	5.2	4.0	0	29.9	0	0
Stand underplanting (acres)	135	431	359	160	62	96	159	146
New road building to maintain private-land access (miles)	0	0	0.5	0	0	0	0	0

Alternative 3: No action

The no-action alternative is required by Council of Environmental Quality regulations (40CFR 1502.14(d)). This alternative would provide baseline information for understanding changes associated with the action alternatives and expected environmental responses as a result of past management actions. Selecting this alternative would continue the following resource management actions:

- ✓ Forest management would rely on natural processes to develop late-seral forests and restore watersheds;
- ✓ No plantations would be commercially thinned (no timber harvest) under this alternative;
- ✓ Current management trajectory of plantations would be abandoned and not replaced with a management strategy to accelerate developing late-seral forest conditions;
- ✓ Primary and secondary roads identified in the Siuslaw's ATM Guide would be maintained;
- ✓ Other roads would be evaluated and managed by reacting to individual events such as slides, road slippage, or culvert failures that make a road impassable or affect natural resources; and
- ✓ No additional projects would be proposed or evaluated for 10 years.

Because the existing environment is not static, environmental consequences from selecting this alternative are expected. Depending on the kind and frequency of disturbances and gradual change in vegetation and animal populations, these lands would move toward old-growth conditions.

Comparison of Alternatives

Key quantitative differences--based on our **estimates**--of Alternatives 1, 2, and 3 are compared in table 3. To conserve space, the logging-system volumes and sale values for the alternatives are shown in the section on late-successional habitat. These numbers are totals and include late-successional and riparian reserves and matrix quantities. How well the alternatives address the issues is compared in table 4. Effects of the three alternatives on water quality, based on changes from existing conditions, are compared in table 5. Maps 6, 7, and 8 follow and show where managed stand and road actions are, in relation to riparian reserve.

See Map 4

See Map 4

See Map 5

See Map 5

Table 3. Comparing the key quantitative differences of Alternatives 1, 2, and 3

Issue, objective, and outcome	Alternative 1	Alternative 2	Alternative 3 (no action)
Learn from a variety of strategies for achieving late-successional forest conditions and aquatic conservation:			
Plantation in Pathway A (acres)	1,057	1,057	0
Area treated in Pathway B (acres)	706	671	0
Area treated in Pathway C (acres)	496	470	0
Increase late-successional habitat in late-successional and riparian reserves:			Plantations to develop at natural rate
Accelerate development of late-successional habitat in reserves--late-successional and riparian (acres)	2,670	2,591	0
Reopen system roads in reserves (miles)	5.0	0	0
New temporary roads in reserves (miles)	0.9	0	0
Reopen temporary roads in reserves (miles)	6.2	0	0
Total skyline yarding volume (mbf)	35,676	11,484	0
Total helicopter yarding volume (mbf)	3,084	25,968	0
Estimated total timber-sale value (dollars)	3,833,364	2,869,572	0
Essential and mitigated non-essential KV projects funded (%)	100	100	0
Non-essential (enhancement) KV projects funded (%)	64	34	0
Precommercial thinning in reserves (acres)	2,032	2,032	0
Maintain existing early-seral habitat (meadows) in reserves (acres)	40	40	Meadows would revert to conifer or hardwoods
Restore watershed health and associated aquatic ecosystems:			
Decommission roads in watershed (miles)	49	49	0*
Close roads in watershed (miles)	76	61	0*
Abandon roads in watershed (miles)	0	15	0*
Stream channels reconnected (number)	85	85	0
Large wood in streams (miles)--Private	7	7	0
Forest Service	16	16	0
Riparian planting (acres)	200	200	0
Maintain the function and diversity in matrix lands while providing timber and other products and amenities:			
Commercial thin in matrix (mmbf)	7.0	6.0	0
Reopen system roads in matrix (miles)	1.7	0	0
Build new temporary road in matrix (miles)	0.1	0	0
Reopen temporary road in matrix (miles)	3.4	0	0
Maintain existing early-seral habitat (meadows) in matrix (acres)	11	11	0
Create and maintain additional early-seral habitat in matrix (acres)	14	14	0

*Road actions are limited to maintaining and repairing ATM roads.

Table 4. Comparing likely effects of Alternatives 1, 2, and 3, based on the issues, objectives, and outcomes

Issue, objective, and outcome	Alternative 1	Alternative 2	Alternative 3 (no action)
Learn from a variety of strategies for achieving late-successional forest conditions and aquatic conservation	Increases learning through a more effective monitoring strategy	Increases learning through a more effective monitoring strategy	Does not achieve the objectives of the management study
Increase late-successional habitat in late-successional and riparian reserves	Maintains stand health and accelerates growth of trees in plantations Increases stand complexity and diversity in plantations	Maintains stand health and accelerates growth of trees in plantations Increases stand complexity and diversity in plantations	Stand health and growth will decline Stands will develop at a rate different from natural stands of comparable age .
Restore watershed health and associated aquatic ecosystems	Reduces effects of road sediments on streams Reconnects stream channels Reduces effects of roads on low, peak, and storm flows Reduces effects of roads on large-wood recruitment and debris flows Increases stream and riparian reserve complexity	Reduces effects of road sediments on streams Reconnects stream channels Reduces effects of roads on low, peak, and storm flows Reduces effects of roads on large-wood recruitment and debris flows Increases stream and riparian reserve complexity	No change No change No change No change No change
Maintain the function and diversity in matrix lands while providing timber and other products and amenities	No commercial timber harvest in mature stands Increases complexity and diversity in plantations Provides 7 mmbf of timber	No commercial timber harvest in mature stands Increases complexity and diversity in plantations Provides 6 mmbf of timber	No change No change Provides no timber volume
Aquatic conservation objectives	Moves toward historical conditions and meets all objectives	Moves toward historical conditions and meets all objectives	Watershed differs from historical conditions

Table 5. Comparing likely effects of Alternatives 1, 2, and 3 on water quality, based on short-term (ST) and long-term (LT)* changes from existing conditions

Actions and water-quality issues	Alternative 1	Alternative 2	Alternative 3 (no action)
Commercial thinning			
Stream temperature	No change	No change	No change
Peak, storm, and low flows	No change	No change	No change
Sediment production			
Plantation thinning	No change	No change	No change
Log hauling	ST increase LT no change	ST increase LT no change	No change
System (classified) road actions			
Sediment production			
Reopen (6.7 mi., Alt. 1)	ST increase LT no change	No change	No change
Close (76 mi., Alt. 1; 61 mi. Alt. 2)	LT decrease	LT decrease	No change
Decommission (49 mi.)	ST increase LT decrease	ST increase LT decrease	No change
Abandon (15 mi., Alt. 2)	N/A	LT Increase	LT Increase
Temporary (unclassified) road actions			
Sediment production			
New (1.0 mi., ridgetop locations, Alt. 1)	No change	No change	No change
Reopen (9.6 mi., Alt. 1)	ST increase LT no change	No change	No change
Large wood in streams			
Stream temperature	Decrease	Decrease	No change
Sediment production	ST increase LT no change	ST increase LT no change	No change
In-stream sediment retention	LT increase	LT increase	No change
Riparian planting			
Stream temperature	ST no change LT decrease	ST no change LT decrease	No change
Snag and coarse wood creation			
Stream temperature	No change	No change	No change
Precommercial thinning			
Stream temperature	No change	No change	No change
New road to access private land (0.5 miles, primarily on ridgetop)			
Sediment production	No change	No change	No change

*ST = short term or up to 5 years; LT = long term or more than 5 years.

What alternatives were developed?

See Map 6

See Map 6

See Map 7

See Map 7

See Map 8

See Map 8

What are the existing conditions in the Five Rivers area?

CHAPTER 3

In chapter 3, we describe the existing environmental conditions on the lands proposed for management actions; it is equivalent to the traditional section, "Affected Environment".

The Lobster-Five Rivers Watershed Analysis (USDA 1997a) and the Late-Successional Reserve Assessment, Oregon Coast Province Southern Portion (USDA, USDI 1997) describe the attributes of the Five Rivers-Lobster Creek watershed much more fully than do the short summaries that follow.

Land Status

The Plan designated federal lands in this area as late-successional reserve, riparian reserve, or matrix (land not allocated as one of the two kinds of reserves). The size, ownership, and allocations for each of the subwatersheds is shown in table 6. Land allocations are shown on maps 6, 7, and 8. The area also contains lands designated by the U.S. Fish and Wildlife Service as critical habitat for the northern spotted owl (USDI 1992) and the marbled murrelet (USDI 1996). No wilderness or roadless areas are in or adjacent to the planning area.

Table 6. Land ownership and federal land allocations

Subwatershed	Total area (acres)	Federal land (acres)	Private land (acres)	Siuslaw NF (%)	Private land (%)	Late-successional reserve (%)	Riparian reserve (%)	Matrix (%)
Cascade Creek	3,573	3,485	88	98	2	6	74	18
Crab Creek	4,935	4,609	326	93	7	40	45	8
Green River	6,198	5,506	692	89	11	46	36	7
Lower Buck Creek	4,184	3,481	703	83	17	11	57	15
Lower Five Rivers	4,374	3,194	1,180	73	27	45	18	1
Middle Five Rivers	4,374	3,380	994	77	23	73	3	1
Upper Buck Creek	3,642	3,106	536	85	15	65	16	4
Upper Five Rivers	5,730	5,320	410	93	7	93	0	0
Total	37,010	32,081	4,929	87	13			

Climate and Substrate

Climate

Climate interacts with the land to create the fertile temperate rain forest of the Oregon Coast Range. Soft, sedimentary rocks weather to form permeable, fertile soils prone to landslides. High rainfall and frequent landslides have sculpted a complex topography of short, steep slopes with many streams per square mile.

Cool, wet winters and warm, dry summers are the norm in the watershed. Temperatures range from about 34°F in January to about 76°F in August, averaging about 53°F. The annual rainfall is 80 to 100 inches; about 90% of it falls between October and May. Snowfall is occasional but rarely lasts longer than a day or two.

Rock and soils

The watershed is underlain by fine-grained sandstones and siltstones, called the Tyee formation. Light, permeable soils develop quickly on this easily weathered sedimentary rock. Landslides are frequent on slopes of more than 70% at the heads of streams, usually creating debris flows in the channels. These debris flows deliver most of the sediment and large wood that are important to creating stream complexity and fish habitat. Stream sediments are mostly gravel to fine sand; large rock fragments break down in tens to hundreds of years.

Dense volcanic rocks sometimes cap the ridges or appear as narrow ribbons of erosion-resistant rock along streambeds. The weathering products of these rocks are more durable than the ones from sedimentary rocks; the process of decomposing to sands and silts may take thousands of years.

Hydrologic Conditions and Water Quality

The planning area is part of the Five Rivers-Lobster watershed, a tributary of the Alsea River basin. Eight subwatersheds make up the area (table 6). Although Buck Creek and Five Rivers function as hydrologic units, they are subdivided for management. These eight subwatersheds comprise 456 stream miles, slightly more than half the total for the Five Rivers-Lobster watershed.

Stream flow is significantly higher in winter than in summer. Flow rates respond quickly to rainfall, in part because soils are generally thin with little storage capacity. Floods are due to high rainfall storms and rain-on-snow events. The planning area had a large flood in 1972, according to stream-gauge records that go back 30 years. Adjacent watersheds had major floods in 1964, 1974, and 1996.

These streams are typical of Coast Range watersheds underlain by the Tyee formation sandstone:

- ⇨Drainage patterns are branched, with some streams entering obliquely and others at nearly right angles.
- ⇨Drainage densities are high, ranging from 6.3 to 8.8 miles per square mile.
- ⇨Low-gradient channels are common; 7.1% of stream miles have a gradient less than 4%.
- ⇨Riffle streambeds commonly consist of gravel and cobbles embedded with sand, which may impair fish spawning and rearing.
- ⇨Boulders are rare, so large logs and woody material are required to provide channel roughness in most stream reaches.
- ⇨Many stream reaches contain few large logs and little woody material.
- ⇨Beaver dams are important for creating pools and storing water.

Mid-slope and valley-bottom roads disconnect stream channels. Roads crossing streams create a potential barrier that may slow or keep coarse sediments and large wood from moving. They are a potential source of management-related sediment themselves, if they fail.

Forest Service roads in the Five Rivers watershed cross streams at 125 sites. A total of about 32,100 cubic yards of fill material are contained at these sites (table 7). Forty-seven percent of fill volume is in the Upper Five subwatershed, 18% in the Lower Five subwatershed, 13% in the Green River subwatershed, and 10% in the Cascade subwatershed.

Based on recent road condition surveys, some culvert inlets at stream crossings are plugged or partially plugged and thus more likely to deliver road-related sediment to streams than culverts with clear or open inlets. A plugged inlet can lead to failure of the road fill material, or a stream can be diverted out of its channel if the culvert inlet becomes plugged and water is ponded behind the fill. Fill volumes associated with these high-risk stream crossings are shown in table 7. Fifty-nine of the 125 stream crossings have this potential to divert water (table 7).

Table 7. Existing road conditions at stream crossings and fill volumes

Subwatershed	Number of stream-crossing sites	In-stream fill volumes in cubic yards	High-risk in-stream fill volumes in cubic yards	Stream crossing-sites with potential to divert water
Cascade	20	3,300	200	6
Crab	4	600	0	2
Green River	51	4,200	1,400	20
Lower Buck	12	1,500	800	5
Lower Five	7	5,700	200	7
Middle Five	5	800	30	4
Upper Buck	1	900	900	0
Upper Five	25	15,100	1,000	15
Total	125	32,100	4,530	59

Note: Numbers are taken from road-fill assessment tables in the project file.

Water temperature has been monitored by the Oregon Department of Fish and Wildlife, Bureau of Land Management, Oregon State University, and the Forest Service for the last six years. Based on their work, the Oregon Department of Environmental Quality placed Cascade Creek and Five Rivers on the 303(d) list (water-quality limited) for elevated summer water temperatures in 1996. Buck Creek and Green River were added to the list in 1998 (DEQ 1998). These streams have seven-day average maximum water temperatures higher than 64 degrees F., exceeding the water temperature beneficial to native fish.

High water temperatures are due to various factors. The principal source of heat for small forest streams is sunlight on the stream surface (Brown 1985). Over the last 60 years, riparian vegetation in some areas of Five Rivers on the National Forest has been converted from a mix of conifers and deciduous trees to meadows or small deciduous trees, increasing stream surface exposed to sunlight. Vegetation was converted by unstable sediment caused by large woody debris removal**,** valley-bottom roads, homesteads, and timber harvest adjacent to perennial streams. Channel widening from large sediment pulses also increased stream surface exposed to sunlight. Substrate removal from channel scour or stream clean-out exposed subsurface water to sunlight. All these factors are likely to have contributed to increased stream temperatures.

Fire

Fire has been the primary disturbance influencing the vegetation. Although the frequency of natural fires is unknown, they were likely infrequent (150 to 750 years apart) and probably large, high-intensity, stand-replacing fires during extreme weather cycles, particularly periods of prolonged drought or high lightning activity.

Fire was used as a tool by American Indians and by Euroamerican settlers to clear forests for farming, livestock grazing, and homesteading. These planned fires often escaped and grew large before they were extinguished by major changes in weather. Human activities probably caused the Yaquina Fire of 1849, which burned some 148,000 acres including most of the planning area. After the fire, other settlement fires reburned portions of the same area; the fire of 1914, for example, burned most of the area north of the town of Fisher and the southern portion of Upper Buck subwatershed.

Fire became a common tool in the mid 1900s as a site-preparation treatment after timber harvest. The resulting fires, along with earlier human-caused fires, resulted in some areas being burned 3 or 4 times in the last 150 years, a 12-fold increase over natural rates.

Currently, the highest potential for ignition is by people. Fires are most likely to be started by recreational users of the forest, commercial activity, and arson. Most if not all lightning is accompanied by a significant amount of rainfall, sufficient to reduce the probability of wildfire.

Human Uses and Influences

Heritage resources

Documentation of American Indian use of the interior valleys of the Coast Range is limited. The Kalapuya from the Willamette Valley and the Alsea from the coast may have used the stream-side zone occasionally for summer travel routes, trade, and gathering resources (like fish, lamprey, hazel nuts).

Homesteading began in the 1870s, and the last pulse was in the early 1920s. Fewer than 150 people currently live there. Valley bottoms adjacent to Five Rivers and its main tributaries were the preferred settlement sites. Agriculture and livestock were the primary means of subsistence until the onset of logging in the 1940s. Grazing and farming required removing trees from valley-bottom lands, including trees growing adjacent to streams.

Industrial timber harvest began on private lands in 1940 and peaked in the 1950s. Timber harvest on public lands began in the early 1950s and peaked in the early 1980s. By then--and into the early 1990s--private lands were being harvested a second time. From the early 1990s, mature timber has not been harvested on federally managed lands in the watershed because of court injunctions and subsequent changes in management direction provided by the Plan.

Recreation

The watershed has no developed recreation. People engage in a variety of dispersed recreational activities, similar to historical uses--hunting, fishing, sight-seeing, berry picking, and camping--

on a limited and seasonal basis. Elk and deer hunting is considered the predominant recreational activity.

Special forest products

Greenery (salal, sword fern, evergreen huckleberry, and dwarf Oregongrape), moss, firewood, transplants (shrubs, tree seedlings), mushrooms, Christmas trees, and cascara bark are the primary special forest products gathered through leases (greenery contracts) and permits (miscellaneous forest products). Four greenery leases are currently active in the planning area.

Public and Management Access

The area has a high density of roads, reflecting the extensive human activities in the watershed. The initial primary road system, serving homesteads and timber harvest, is reflected in the current county road system and predates the 1950s. This system was used to haul timber to local mills, as well as to mills on the coast or in the mid-Willamette valley.

About one-half of the area's roads are in the valley bottoms, along rivers and streams, and on mid-slope terrain. Beginning in the late 1960s, federal roads were built, connecting all the major ridge tops and side ridges to the valley-bottom road system. The federal roads, in conjunction with county roads, provided year-round access for administrative and general public use. Although the Five Rivers county road provides a direct route to State Highway 34, local residents have relied on the extensive forest road system for more direct and convenient access to valley communities like Eugene and Corvallis and coastal communities like Yachats and Florence.

Federal roads have a design life of about 30 years; major culverts and bridges were designed to withstand 50-year peak-flow events. Approaching 30 years old and older, many of these roads have corroded and failing galvanized steel culverts. Asphalt concrete surfacing continues to age, showing signs of subgrade settlement and failures. Severe winter storms between 1996 and 1999 caused many steep hillsides above and below roads to slide, taking portions of roads with them.

The proposed National Forest Road Management Strategy (USDA 2000b) would revise policy on how a Forest transportation system is developed and managed. By this strategy, roads will be developed and managed in a way that considers the benefits and costs of access and road-associated effects on the ecosystem. The Five Rivers Landscape Management Project has incorporated these concepts in determining the actions for roads in the Five Rivers watershed. No unroaded areas, as defined under the proposed national strategy, are in the Five Rivers watershed nor are any designated roadless areas.

The Siuslaw's Access and Travel Management (ATM) Guide (USDA 1994) defines a permanent, strategic road system maintained for both car and truck traffic throughout the watershed (map 9). A total of 174 miles of Forest-development roads plus 27 miles of county roads now constitute a road-density range of 2.4 to 3.2 miles per square mile of watershed. The combined annual daily traffic counts on Forest Service roads in the watershed average 9 vehicles daily; Road 32 is the most heavily used (13 vehicles daily).

The average annual cost for maintaining and repairing the ATM system (51 miles of primary and secondary roads) in the planning area is about $225,000. The non-ATM system is maintained by individual projects. The expected average annual costs to maintain the non-ATM system is about $181,000. Current maintenance is in the planned access management design for the road system but below what the traveling public has been accustomed to. Non-ATM road (project roads) maintenance continues to be deferred between project entries, resulting in continuous road deterioration.

Current closures on the system of Forest Service roads is about 33 miles gated or otherwise barricaded to vehicle use, 47 miles that have grown closed, and another 62 miles still open to high-clearance vehicles but growing closed, allowing for a passive approach to closure.

Ironically, many of the roads without an identified long-term need are often the newer (1970-1990) ones built on stable ridge-top sites. These newer roads were built to strict engineering specifications, including compacted fills, but their locations offer little opportunity to replace the older, more poorly located or built valley-bottom and mid-slope roads that access private land and nearby communities.

The current Forest Service “classified” system of roads is in three maintenance categories: level 1 roads (project roads) are closed (stored) between use periods; level 2 roads are maintained for high-clearance vehicles; level 3 to 5 roads are maintained for low-clearance vehicles at various degrees of driveability and use. The maintenance categories vary the frequency and intensity of all maintenance activities, thus creating the wide range of cost differences (table 8).

Table 8. Existing road maintenance miles and costs by subwatershed

Subwatershed	Maintenance level 1	Maintenance level 2	Maintenance levels 3 to 5	Annual maintenance costs
Cascade	8.6	8.6	4.5	$38,907.00
Crab	1.4	18.6	8.7	$61,299.00
Green River	10.0	12.2	0	$50,440.00
Lower Buck	3.1	12.5	4.4	$39,150.00
Lower Five	4.8	14.6	0	$40,595.00
Middle Five	2.0	15.0	0	$32,733.00
Upper Buck	2.7	7.1	5.1	$31,265.00
Upper Five	1.7	20.9	7.7	$111,060.00
Totals	34.3	109.5	30.4	$405,449.00

Notes: Mileages are whichever is the greater: GIS (digital) or TMS (road log) miles.
Costs do not include overhead and reflect an annual average cost over 30 years.
Numbers are taken from system road tables in the project file.

Four roads in Green River (3230, 3231, 3232, and 3250), two in Lower Five (3210 and 3412), and two in Upper Five (32 and the Summers Creek portion of 3505) subwatersheds have the highest incidence of storm-related damage.

Terrestrial and Aquatic Conditions and Species

Forest stand conditions

Before the 1800s, most of the Five Rivers land was in old-growth forest of Douglas-fir, western hemlock, and western redcedar, growing in very large stands of more than 100,000 acres. The existing natural stand structure resulted from the Yaquina Fire of 1849 (Juday 1977) and subsequent, smaller fires. These stands are now primarily Douglas-fir, though scattered, old remnant trees and old-growth patches persist on low slopes and in valley bottoms. Other tree species are generally lacking, except along the southern boundary of the project area, where western hemlock and western redcedar are regenerating, and the area north of Fisher that has more hardwood and hardwood-conifer mixed stands than farther south. Existing natural conifer stands are fragmented, and patch size is now less than 2,000 acres (map 9). Few large snags and logs are in these stands, but the amounts are within the range of natural variability. Laminated root rot, brown cubical rot, Swiss needle cast, and Douglas-fir beetles are found throughout these stands but not at epidemic or outbreak rates.

In 1982, insect and disease surveys on the former Alsea Ranger District showed that 73% of the 11 stands surveyed in the planning area were infected with laminated root rot (Goheen et al. 1982). Inoculation rates were found to be as high as any sites in the Pacific Northwest. Additional surveys in 1984 and 1985 (Goheen et al. 1986) and stand exams in 1998 identified additional sites of infestation, further extending its known distribution. These exams also found Swiss needle cast in some of the stands, with trees showing needle loss and abnormal diameter growth.

Forest management

Commercial harvest of mature and old-growth stands on federal lands began in the 1950s, with a focus on intensively managing for timber products. Management usually included these activities:

- ⇨Clearcut harvesting;
- ⇨Yarding of dead and downed logs;
- ⇨Site preparation (chemical, before 1984; manual, after);
- ⇨Broadcast burning (before 1992);
- ⇨Planting 400 to 500 trees per acre (mostly Douglas-fir before 1980; after, planting included western hemlock, Sitka spruce, and western redcedar);
- ⇨Controlling competing and unwanted vegetation (chemical, before 1984; biological or manual, after);
- ⇨Precommercial thinning, at ages 10 to 15, to 250-300 trees per acre; and
- ⇨Commercial thinning planned at ages 30 to 35.

Federal plantations (map 10) now account for 15,627 acres: 4,091 acres are 5 to 15 years old; 3,124 acres are 16 to 24 years old; and 8,412 acres are 25 years old and older.

This intensive regime resulted in very uniform stands dominated by Douglas-fir. By age 30, growth rates and crown ratios in these dense stands are beginning to decline. Mortality of suppressed and intermediate conifers and hardwoods is increasing. Because of past management actions, current amounts of coarse woody debris (snags and logs) are very low. Downed wood biomass in Oregon Coast Range forests should range from 525 to 4,839 ft^3/acre (USDA, USDI 1997), but only a few managed stands in the area have more than 500 ft^3/acre. Dense canopy closure in many stands has resulted in little or no understory, reducing structural and species diversity.

Aquatic species

Populations of wild salmonids in the Alsea basin, except those of fall chinook and resident cutthroat trout, are depressed (ODFW 1997). Overfishing, habitat degradation, hatchery-fish interactions, and poor ocean conditions have all contributed to the decline of wild fish (NRC 1996). Salmonid distribution in summer is similar to the distribution of the best remaining habitat, with most fish in headwater portions of major tributaries (MCWC 1998). Winter distribution of salmonids is not documented, but it is assumed to shift downstream into the lower portions of the major tributaries.

Five Rivers supports populations of fall chinook and Oregon coast coho salmon (listed as threatened in August 1998), winter steelhead, sea-run and resident cutthroat trout, speckled dace, Pacific lamprey, and a few species of sculpins. Five Rivers and its tributaries are major contributors to salmonid production in the Alsea basin. The potential for high-quality habitat is high in Five Rivers and its tributaries because of its abundance of low-gradient stream channels with wide valley floors. Before settlement, these conditions probably produced some of the best habitat for coho salmon in the Alsea basin.

Human activities (settlement, timber harvest, roads, and removal of large wood from streams) have reduced both the amount and quality of fish habitat in the planning area. Reduced shade has raised water temperatures in summer, limiting salmonid rearing capacity in most moderate to large fish-bearing streams. Substantially reduced numbers of large conifers in riparian areas are expected to keep fish habitat in poor condition for decades. Mid-slope and valley-bottom roads have disconnected many stream channels, creating barriers that slow or prevent aquatic species from moving. Fine sediments eroding from roads and culvert failures degrade spawning gravels by filling in substrate spaces, eliminating oxygen needed by developing eggs and fry.

The best remaining habitat is in the headwater portions of major tributaries with less than 2% gradient (upper Five Rivers, Green, Crab, and Buck subwatersheds). In these areas, riparian vegetation is least disturbed, summer stream temperatures are lower, large wood is more abundant, and stream channels are more connected to their floodplains than they are downstream. Beaver ponds are a major source of high-quality fish habitat, particularly in the upper portions of large tributaries.

Terrestrial species

The watershed analysis describes a fragmented landscape for wildlife. In all subwatersheds, mature forest habitat is below 40%, and interior mature forest is less than 15%. All interior forest habitat patches are smaller than 170 acres (table 9). Early-seral habitat ranges between 8 and 17% in the subwatersheds. Current habitats favor species more closely associated with fragmented landscapes and with early- and mid-seral communities. The species currently known to depend on mature and old-growth habitat, as well as those found in young and fragmented habitats, are listed in the watershed and late-successional reserves assessments (USDA 1997a; USDA, USDI 1997).

Table 9. Mature and interior forest habitat

Subwatershed	Total area (acres)	Mature habitat (acres)	Mature habitat (%)	Interior habitat (acres)	Interior habitat (%)	Maximum interior patch size (acres)
Cascade Creek	3,573	985	28	79	2	79
Crab Creek	4,935	1,671	34	345	7	105
Green River	6,198	1,804	29	465	8	104
Lower Buck Creek	4,184	1,323	32	261	6	168
Lower Five Rivers	4,374	1,326	30	242	6	110
Middle Five Rivers	4,374	1,490	34	364	8	86
Upper Buck Creek	3,642	1,403	39	528	14	125
Upper Five Rivers	5,730	2,024	35	645	11	61
Total acres or average percentage	37,010	12,026	32	2,929	8	105

Listed and sensitive species--Proposed actions may affect bald eagles, northern spotted owls, and marbled murrelets, all listed as threatened under the Endangered Species Act of 1973, as amended. A full description of their status in the planning area may be found in the biological assessment prepared for this project. The biological assessment disclosed that:

- ⇨The planning area is outside the range or contains no suitable habitat for the Oregon silverspot butterfly, brown pelican, Aleutian Canada goose, Nelson’s sidalcea, western lily, or western snowy plover.
- ⇨About 2,350 acres are suitable (mature conifers one mile on either side of major rivers, and 0.5 mile on either side of major tributaries) bald eagle habitat, including 150 acres on private land.
- ⇨No bald eagle nesting territories are in the area.
- ⇨One pair and three resident, single northern spotted owls have been documented.
- ⇨The reproductive status of the owl pair has been evaluated annually since 1991; the status of resident singles has been evaluated about every other year. No spotted owl reproduction has been documented between 1991 and 1999.
- ⇨On federal lands, the riparian reserve land allocation is intended to serve as connectivity corridor between late-successional reserves for dispersing owls. In each of the subwatersheds, at least 68% of each riparian reserve functions as dispersal habitat, and at least 69% of each subwatershed currently functions as dispersal habitat.
- ⇨About 360 acres of plantations develop annually into dispersal habitat.
- ⇨About 44 occupied marbled murrelet sites are in or within 1/4 mile of the planning area.
- ⇨Although the area has not been surveyed for marbled murrelets since 1992, the likelihood is about 90% that suitable habitat is occupied by marbled murrelets, based on Siuslaw NF survey experience.

Regionally sensitive and survey-and-manage species--Regionally sensitive, as well as survey-and-manage species, have been documented in the area. Review of the watershed analysis, subsequent evaluations, and surveys show that:

- ⇨Although more than 55% of the area is considered potential habitat for red tree voles, a secondary prey species of the owls, their natural distribution is somewhat clumped and patchy (USDA, USDI 1999a). Although documented in younger forests, such as plantations, these habitat types are most likely population sinks and unlikely to provide population persistence of red tree voles over the long term (USDA, USDI 2000).
- ⇨The papillose taildropper slug has been found in 25 stands being considered for treatment.
- ⇨The planning area contains about 20,500 acres of suitable habitat for six protection-buffer fungal species. Proposed commercial thinning units contain about 3,200 acres of suitable habitat for these species.

Other species of regional or social concern--Other species of regional or social concern have been documented in the area. Review of the watershed analysis and subsequent evaluations show that:

- ⇨Managing and enhancing elk habitat have been emphasized in the area.
- ⇨Five Rivers is considered one of the better hunting areas in the Alsea subunit.
- ⇨The Landbird Strategic Plan (USDA 2000c) focuses on watershed health and restoration, sustainable forest ecosystem management, forest roads, and recreation.
- ⇨Neotropical bird restoration efforts focus on the larger international issues of maintaining populations in both their winter and summer ranges.
- ⇨Six populations of loose-flowered bluegrass are designated as buffered (protected) populations under the Conservation Strategy for *Poa laxiflora* (USDA 1993).
- ⇨Populations of noxious weeds are common in disturbed sites such as log landings, pastures, and along roads.

See Map 9

See Map 9

See Map 10

See Map 10

What environmental effects are predicted for each alternative?

CHAPTER 4

In chapter 4, we predict the likely effects of the actions under each alternative (corresponding to the traditional section, "Environmental Consequences"). Environmental conditions described in chapter 3 set the baseline from which direct, indirect, and cumulative effects are analyzed in chapter 4. The Northwest Forest Plan, FEMAT report, Late-Successional Reserve Assessment, and the Lobster-Five Rivers Watershed Analysis provide evidence for baseline environmental conditions. These broad-based assessments of environmental conditions provide a cumulative view of environmental conditions at different landscape scales and consider past, present, and reasonably foreseeable actions.

One advantage of planning the Five Rivers Project at the landscape scale (37,000 acres in the project area) is an improved analysis of cumulative effects. Knowing the site-specific details of all projects in a large geographic area, allows us to predict cumulative effects with more certainty than if projects were analyzed individually. The analysis of direct and indirect effects in this chapter inherently includes cumulative effects because all foreseeable future federal actions in the watershed are included in the analysis. Cumulative effects are summarized on pages 78, 79, and 80 and include how all actions (including those expected from other landowners) affect each resource.

In this chapter, we predict the likely environmental effects of the proposed alternatives, whose outcomes are based on the assumption that the project design criteria (appendix B) have been followed. These criteria were also used during formal consultation with the National Marine Fisheries Service and will be used by the U.S. Fish and Wildlife Service to evaluate effects on listed species. The use of these criteria is reflected in the amount of take and in the terms and conditions provided in the biological opinions issued by these agencies.

Based on the science literature and our collective experience, we are confident in the accuracy of our analysis of the **current** conditions discussed in chapter 3. In chapter 4, when we describe the environmental effects of each alternative, we are **predicting** those effects based also on the literature and our collective experience; however, we recognize that predictions are inherently uncertain, some just a little and some highly.

Because of the similarities of environmental conditions and ecological processes found in the planning area, we expect site-specific effects and environmental responses to the proposed actions to be fairly uniform throughout. In the following pages, therefore, we expect our generalized discussions on effects can be applied to any given location in the landscape with a high degree of confidence that the effects described will fit the site.

When the Forest Supervisor chose the members of the interdisciplinary team, he considered possible scenarios for this environmental impact statement and determined what disciplines would illuminate decisions about them. Relying on his professional judgment and expertise, he chose the disciplines and formed the team of Forest experts in those disciplines. Team members reviewed areas where actions are proposed, reviewed relevant refereed literature and

Forest assessments for this planning area, and consulted disciplinary colleagues in the Forest Service, other agencies, universities, and elsewhere. Often, literature reviewed by team members was deemed incomplete and, though studies of similar environments and similar scenarios were reviewed, the expert's professional judgment was required to determine what information can be appropriately used here--and how strongly it supports predictions about what the environmental effects of proposed actions will be. Although team members benefit from the array of research information and the insights of colleagues, they are valued most highly for their experience in and knowledge about the Five Rivers area.

Consultation with other experts helps assure that the literature review did not miss a valuable resource, and it provides opportunity to debate and strengthen the team expert's conclusions about how proposed actions are likely to affect the environment. After several team meetings and one-on-one discussions among team members on how each one's predictions might affect or be affected by all of the others, each team member wrote a section of this chapter. Then all of them reviewed the whole chapter to be sure they find the others' predictions clear and supportable.

In this chapter, team members' names accompany their written contributions to indicate that they believe the cited references are relevant, the inferences drawn from them are appropriate, and the predictions are supported by the cited literature and their own professional judgment. In this section, a single author uses "I"; when "we" is used, it means one or more other team members concur.

Predicted Effects of Actions To Compare Strategies in the Management Study *(Bernard Bormann)*

Learning from a management study that compares three different management pathways will inform and improve future land management decisions (Bormann et al. 1999). Both Alternatives 1 and 2 would implement such a study (appendix A), based on adaptive management principles and incorporating scientific design concepts to increase confidence in interpreting the outcomes, to improve actions for meeting the Plan goals of developing late-successional habitat and restoring watershed health.

Alternatives 1 and 2 provide for applying the management study under the most restrictive standards and guides for each land allocation. The management study does not allow applicable standards and guides to be eased on any land allocation. Alternative 3 provides no mechanism for a comparative management study.

Except for land status, and public and management access, effects on the resources are similar--that is, on soils, stream flow, water quality, fire, human use and influences, forest stand conditions, aquatic species, and wildlife habitat.   Alternatives 1 and 2 provide a forum to illuminate the debate on how well the selected management strategies allow the landscape to develop late-successional-forest conditions and healthy watersheds. This approach is expected to accelerate the rate at which management actions are improved. Under Alternative 3, the agency would continue to depend on a fragmented approach of monitoring individual actions. Historically under this approach, improvements in management actions have been slow.

Land status

Applying the study design under Alternatives 1 and 2 would place 461 acres of matrix into the passive management pathway. Although placement would not change the allocation of these lands for the current planning period, these lands would have no stand management and limited aquatic restoration actions.

Public and management access

Alternative 2 would result in the loss of access to study area 4C (map 5), reducing the number of study replications for this pathway from 4 to 3. Although this reduction will make it much more difficult to identify differences between pathways, the management study will remain viable. Access to the remaining study areas could also be lost in the long term, thereby eliminating the benefits of the management study.

Typically, about 5% of Forest funds is used for monitoring Forest projects. The Team regards the management study as an opportunity to more effectively use the funds intended for monitoring on the Forest. Because of its identified monitoring strategies and priorities, the management study is expected to be a high priority for Forest funding relative to other Forest projects.

Predicted Effects of Actions To Address the Shortage of Late-Successional Habitat

Soils, stream flow, and water quality

Soils (Courtney Cloyd)--In a study of sediment production from forest roads in western Washington, Reid and Dunne (1984) found that road-use intensity directly affected the volume of fine sediment eroded from road surfaces. Road use is compared to sediment production in table 10 (modified from Reid and Dunne's table 4). These authors attribute the sediment yield associated with paved roads to cutbank and ditch erosion. Soils in the Five Rivers watershed are generally similar to those of Reid and Dunne's study area, as are road conditions.

An average of 3 to 4 log trucks per day is expected for a typical skyline cable thinning sale. Where helicopter yarding is used, 8 to 10 log trucks per day are expected, but fewer roads would be used for hauling. Many of the roads are on ridgetops with no stream crossings, so no sediment is expected to enter streams from there. In the short term, sediment yield from log-truck traffic will increase where mid-slope and valley-bottom roads cross streams.

Sediment yield from log-truck traffic will be lower than predicted by models such as used in table 10 because constant reduced tire pressure will be required (appendix B, page B-5). A study of central tire inflation (reduced air pressure in tires) on the Siuslaw National Forest (USDA 1988) showed less wheel-track rutting during log haul, and a significantly reduced need for road maintenance (blading) during wet-season haul. We have observed a direct relation between road blading and increased fine sediment loss during wet-season haul. Reduced need for road surface blading will reduce the volume of fine sediment available for delivery to streams. A 3-year study by Foltz (1994) on the Lowell Ranger District of the Willamette National Forest showed 15 to 59% reductions in road sediment yields with a constant reduced tire pressure of 70 pounds per square inch (psi) compared to the yields with a standard highway tire pressure of 90 psi. The greater reductions were during heavier rainfall.

Table 10. Average sediment yields from road use

Road type and amount of use	Sediment yield, tons/mile per year
Heavy use (more than 4 log trucks per day)	887.40
Moderate use (1-4 log trucks per day)	74.60
Light use (no log trucks)	6.80
Paved	3.50
Abandoned (no vehicle use)	0.90

Luce and Black (1999) reported that sediment production from forest roads in the Oregon Coast Range varies with foundation soil characteristics. They also found that vegetated inboard drainage ditches and cut slopes reduced sediment production by about 7 times compared with cut slopes and ditches cleared of vegetation by road maintenance. Their findings indicate that actual sediment yields are likely to vary from yields estimated by predictive models such as used in table 10 (Reid and Dunne 1984).

Duncan et al. (1987) cite studies of road-surface sediment routing in large western Oregon and Washington watersheds that determined 20% of the road runoff points (ditch relief culverts) discharged onto the forest floor, and 80% emptied into stream systems. Of those stream-entry drainage points, 88% entered first- or second-order channels, and 13% emptied into year-round water courses. Duncan et al. also found that at least 55% of all road surface erosion was deposited between 311 and 410 feet from the entry point. They found that the finer sediment fraction tended to move farther from the entry point than did coarse sediment, and that lower stream gradients and large woody material in the channel more effectively trapped and held sediments than did other configurations. I have observed comparable sediment routing and deposition in the Oregon Coast Range, where about 90% of the first- and second-order channels contain water year-round.

Alternative 1 road management actions will have the following effects on soils, hydrologic conditions, and water quality:

Reopening and using existing temporary roads

- ⇨ Because project design criteria (appendix B, pages B-5 through B-7) were based on the evidence presented, I expect a reduction of at least 20 to 60% in the sediment volumes predicted in table 10. After projects are completed, I expect fine sediments from closed roads to be in the range of the light use and abandoned categories (table 10). Decommissioned roads should yield sediments in the range of the abandoned road category.
- ⇨ Based on local experience, and from monitoring past projects, construction sediment that cannot be practicably removed from the stream channel generally

- ⇨ erodes during high winter flows in the first two or three winters after excavation. Disturbed areas are usually revegetated, and stream channels have reached equilibrium after 5 years, so that management-related sediment entering streams is near zero. Therefore, I expect the volume of management-related fine sediment delivered to streams at each crossing's culvert installation or removal site to be less than 5 cubic yards.
- ⇨ Based on local experience, unused roads on the Siuslaw National Forest are usually covered with leaf litter and vegetation within 5 years of closure, which effectively eliminates road surface erosion.
- ⇨ Studies of mechanical compaction in forest soils cited in Froelich and McNabb (1983) show that three decades or more may pass before compacted soils return to their former bulk densities and porosities by natural processes. They evaluated two tillage methods, disk harrows and a prototype winged subsoiler. Both methods were found to increase soil shattering, which facilitates aeration and disaggregation. Froelich and McNabb also reviewed other studies that showed mechanical tillage of several compacted soil types improved conifer growth, apparently as a result of increased aeration and reduced soil strength. Based on these studies and our field observations, we expect improved conifer growth when new and existing temporary roads are subsoiled after use.
- ⇨ Based on local experience, repairing and stabilizing minor road failures and improving road drainages reduces the potential for new failures on reopened roads.

Building and using new temporary roads

- ⇨ I have observed that soil erodes for 2 or 3 years after roads are built, transporting small volumes of sediment beyond the fillslope limits, particularly during rainstorms. This material usually stops moving within 50 to 100 feet of the fill-slope. Beyond that point, the transporting water disappears into the porous forest floor (Bilby et al. 1989). No road-building or haul-related sediment is expected to reach a stream because all proposed new temporary roads would be on ridges and more than 100 feet from streams.
- ⇨ The effects of compaction will be similar to those described under reopening temporary roads.

Closing roads between treatments

- ⇨ Based on Reid and Dunne's (1984) sediment production rates (table 10), we expect closed roads to produce less sediment than those remaining open to vehicular traffic.

Alternative 2 road management actions will have the same effects as Alternative 1's, with these differences:

Reopening existing and building new temporary roads

- ⇨ No temporary roads will be reopened or built to accomplish commercial thinning, so no short-term sediment will be produced from these roads.

By implementing project design criteria--such as requiring constant reduced tire pressure for log trucks, avoiding blading of ditches as much as possible, monitoring roads during heavy rains, using straw bales as sediment traps where needed, and limiting some log hauling to the dry season--we expect significant reductions of sediment yield compared to the yields shown in table 10. Because of these mitigating actions, we do not expect Alternatives 1 and 2 to have significant adverse effects on water quality (appendix B, page B-5).

Stream flow (Courtney Cloyd)--Studies cited in the Alsea watershed study (Brown 1972) document increases in streamflow after clearcut logging and partial thinning, and the more extensive the clearcutting, the greater the increase in streamflow. In another study of the Alsea experimental watersheds, Harr and Krygier (1972) found an increase in low-flow rates for 2 of 5 study years in a 750-acre watershed that was 25% patch cut. After 5 years, no trend toward pre-logging low flow rates was found. Harr (1976), evaluating four paired watershed studies in western Oregon including the Alsea basin, indicates that annual water-yield increases decline over time, but they may take more than 20 years to return to pre-logging yields. Based on results of six paired watershed studies in western Oregon, including the Alsea watershed study, Harr (1983) notes that water yield increases are eliminated after about 27 years because of vegetation regrowth.

The Five Rivers area has the same underlying geology and geomorphology as the Alsea watershed study, and the drainage densities and stream gradients are similar as well. These areas share the rainfall-dominated climate of the Oregon Coast Range, where storm flow is the result of rain events with high intensity, long duration, or both. Under Alternatives 1 and 2, plantations will be thinned on 4.8 to 15% of each subwatershed's acreage, or 8.7% of the project area (table 11). Because the affected area of each treated subwatershed is small and the past effects of clearcut logging may still influence stream flows, we do not expect plantation thinning to measurably increase peak, storm, and low flows.

Table 11. Thinning acres by subwatershed

Subwatershed	Total area (acres)	Commercial thinning (acres)	Commercial thinning (%)
Cascade Creek	3,573	211	5.9
Crab Creek	4,935	747	15.0
Green River	6,198	469	7.6
Lower Buck Creek	4,184	472	11.3
Upper Buck Creek	3,642	367	10.0
Lower Five Rivers	4,374	211	4.8
Middle Five Rivers	4,374	233	5.5
Upper Five Rivers	5,730	520	9.1
Totals	37,010	3,230	8.7

Alternative 3 will not change current stream flows.

Water quality (Jan Robbins)--Studies of streams in small Coast Range watersheds by Brown and Krygier (1970), Brazier and Brown (1973), and Brown (1972) determined that tree shading provided by unlogged buffers between streams and clearcut units prevented water temperature increases. Brown (1972) found that water temperatures declined when streamside vegetation returned after logging. Brazier and Brown (1973) found that 79-foot-wide buffer strips provide maximum shading to streams. Beschta et al. (1987) found, in western Oregon, that buffer strips at least 100 feet wide between small streams and clearcuts provide about as much shading as an old-growth forest does. Beschta et al. (1987) cited one study in the Oregon Coast Range that showed 50% of a stream was shaded 5 years after clearcutting and burning. Harris (1977) noted that stream temperatures in Deer Creek and Needle Branch subwatersheds in the Alsea watershed study were trending back toward prelogging conditions 7 years after harvest. Brown and Krygier (1970) noted that the increase in stream temperature for a given exposure to sunlight (loss of shade) is inversely proportional to stream volume. Small, shallow streams are more affected by shade loss than are larger streams, and temperatures in all streams are most affected by shade loss during low-flow periods in summer.

Based on information in the studies cited, most effective stream shading is within the first 30 feet of stream centers. Under Alternatives 1 and 2, thinning plantations to within 90 feet of streams will have no effect on water temperature. Thinning to within 50 feet of streams is unlikely to have any measurable effect on stream temperature. The effects of thinning are expected to decrease in 5 to 10 years as canopy closure approaches 80%.

Fire (*Carl West*)

Based on Forest fire records since 1975, the Siuslaw National Forest has averaged 11 fires, burning about 35 acres a year. People caused about 95% of those fires; in other words, on this Forest, most fires are in accessible areas. Therefore, though commercial thinning may increase fuel loading, reduced access because of road closures is likely to reduce the risk of fire ignitions. Because the potential for fire ignition cannot be eliminated, however, the team is obligated to disclose the potential for wildfire as a result of an ignition in a commercial thinning unit.

In the Five Rivers watershed, about 40 acres of commercial thinning units lie adjacent to and within 25 feet of ATM roads. Fuel treatments such as burning hand-piled slash will be adjacent to and within 25 feet of these roads, after thinning operations are completed, to mitigate the potential for wildfire. Hand-piled burning is not expected to adversely affect the Corvallis airshed, but it may cause some short-term localized negative effects to air quality.

Andersen (1982) developed aids to assist fuels and fire behavior analysts in determining an appropriate fuel model or models for estimating potential fire behavior. He developed 13 fuel models representing the various components of living and dead vegetation in forests or range-lands across North America. Andrews' (1986) fire-behavior program (BEHAVE) predicts fire behavior characteristics such as fireline intensity, rates of spread, and resistance to control. Using these tools--along with local knowledge and weather variables from Cannibal Mountain--I expect thinning under Alternatives 1 and 2 to have the following effects on fuels and the potential results from fire ignitions:

- ⇨ Commercial thinning in the managed stands will increase fuels on the forest floor, as will adding coarse woody debris gradually.
  - Fuels created from slash will result in the thinning units' falling under the light-slash fuel model (fuel model 11) in the light-to-moderate thinning units and the medium-slash fuel model (fuel model 12) in moderate to heavy thinning units.

  - ↳ The fuels are expected to decay over time, decreasing the risk of wildfires. Observations of past thinning have shown decomposition of the fine fuel component (needles and twigs) in 3 to 4 years. This period would be when the thinning slash could support a surface fire.
  - ↳ Leaving whole trees on the ground as coarse wood increases resistance to control by fire suppression resources beyond that for fine fuels.
- ⇨ Fire behavior in thinning slash in late summer would create fireline intensities and flame lengths difficult for hand and engine crews to suppress safely and successfully by direct attack.
  - ↳ Roads and skid trails would be the primary control lines in indirect suppression, likely increasing the number of acres burned.
  - ↳ The late-successional reserve objective to limit the size of all wildfires in the reserve would be difficult to meet.
- ⇨ Increased fireline intensity could increase the cumulative effects on other resources.
  - ↳ Soils could be damaged by burning off nutrients and organic matter and increase potential for overland flow.
  - ↳ The severity of any damage would be directly linked to the intensity of the fire.
- ⇨ Increasing the number of thinned units in a given area increases the hazard with a larger area of contiguous fuels. Spotting from one thinned unit to another is likely, given the wind speed that would be expected on a high fire-danger day.

Alternative 3 will not change the current potential effects from fire ignitions. As roads continue to deteriorate, access to fires will continue to become more difficult.

Human uses and influences

Heritage resources (Ken McCall)--I searched the literature to determine if known heritage resources (historical and archaeological sites) exist in the planning area and found no sites likely to be affected by this project. Actions--such as reopening system roads, building new temporary roads, reopening temporary roads, and commercial thinning--are on previously disturbed sites and will not require field inventories, based on our 1995 agreement with the State Historic Preservation Office (appendix B, pages B-2 and B-3, provides additional information about our agreement).

Recreation (Ken McCall)--The primary consequence of the proposed actions would be to change from motorized to nonmotorized access, a process already happening under the ATM system and road decommissioning across the Forest. The highest concentration of vehicle travel on the interior forest will continue to be associated with hunting seasons. Access to dispersed recreation sites will be maintained under all alternatives.

Scenery (Jessica Dole)--Proposed actions are consistent with the scenic-quality objectives for the planning area. Proposed thinning actions are expected to increase the scenic value of the planning area in the long term by restoring the landscape to a generally continuous (less fragmented) forest with mostly larger diameter trees. The existing scenery in the Alsea River corridor will not be affected because the proposed actions will be in areas not visible from the Alsea River-Highway 34 scenic corridor.

Special forest products (Paul Thomas)--Opportunities to gather special forest products through permits and leases will continue. Limited vehicle access will make collecting special forest products more difficult. The value of recent sales (summer 1999) of special forest products on the Waldport Ranger District are about 30% lower than for previous sales. These rates reflect an over commitment on past sales and more difficult access (Palmer, pers. comm.).

Public and management access *(Dan Mummey)*

Under Alternative 1, about 133 miles of system roads will remain, including about 15 miles of private-lands access leading from county roads. Changes in ATM routes will amount to about 2.4 additional miles of ATM travel on ridgetops around the segment of road 32 (primarily valley-bottom and mid-slope road) should this road segment be decommissioned. Alternative 2 will abandon (eliminate road maintenance) non-ATM roads as they fail. Initially, Alternative 2 will maintain 15 fewer miles than Alternative 1 because some roads are blocked by slides or other failures. The following summarizes the effects of Alternatives 1 and 2:

Alternatives 1 and 2

- ⇨ During timber harvest, periods of frequent log-truck traffic would affect county and Forest roads. Although these roads were built and maintained to support timber harvest, about 6 years has elapsed since the last harvest of timber from these federal lands; thus, log-truck traffic may be a new experience for some residents not accustomed to meeting these vehicles on narrow roads.
- ⇨ Between resource management activities, closing roads reduces vehicular access for resource managers and forest users.

Alternative 2

- ⇨ By abandoning roads as they fail, Alternative 2 will reduce the number and kinds of actions--such as thinning managed stands and decommissioning roads--for meeting the goals of the late-successional reserve and aquatic conservation strategies.

Forest stand conditions *(Ed Obermeyer)*

To analyze Alternatives 1 and 2 treatment effects, the ORGANON (Oregon growth analysis and projection) model was used to model individual tree growth by using the Stand Management Coop (SMC) version (Hann et al. 1997) developed from permanent plots in western Oregon, Washington, and British Columbia. A summary of a model run on stand 224 indicates that the following effects can be expected from the different thinning treatments (table 12):

- ⇨ Diameter growth rates will increase, accelerating the development of large-diameter trees. At age 80, the average stand diameter will be 30 inches dbh, with 40 trees per acre (TPA); trees in the 100 trees-per-acre treatment will not reach this size until after 117 years.
- ⇨ Height growth rates are comparable for all treatments. Although heavy thinning treatments (40 TPA) are at a higher risk to blowdown for a few years, height-diameter relations are more favorable under this treatment, so trees are less prone to blowdown and breakage over time.

- ⇨ By allowing an understory to develop, heavy-thinned stands will result in multi-aged, two-storied stands. Lightly thinned stands (100 TPA) will continue to be dense and single-storied until further thinning or natural disturbances reduce their density.
- ⇨ Increased growth rates will accelerate developing high-quality snags and coarse woody debris. Mortality will increase in the lightly thinned treatment, creating large amounts of woody debris and snags (28 in 80 years), but most of them will be small and likely to decay rapidly because of the high percentage of inner bark and sapwood. These physiologically active tree tissues are the first components of downed trees to decay (Maser and Trappe 1984). Half of the mortality will be in trees less than 20 inches in diameter. Heavy thinning treatments will allow larger, longer lasting material to develop for snags and coarse woody debris, but natural mortality will account for only 3 trees in 80 years. This material will be relatively large, however--about 20 to 30 inches in diameter.
- ⇨ Live-crown ratios will increase for a while after all treatments before beginning to decline, unless stands are thinned again. Larger ratios will be maintained longer under heavy than under light thinning. Crown ratios will remain above 30% until age 100 in the heavy thinning, compared to about age 65 in the light thinning. Live-crown ratio can be considered an index of individual tree vigor (Oliver and Larson 1996). Trees with large crown ratios will not only grow faster, but will be more resistant to insects, diseases, and other environmental hazards.

Additional analysis indicates that:

- ⇨ In a study on 10 sites in the Oregon Coast Range, Tappeiner et al. (1997) found that trees in old-growth stands had little competition from one another because of the low numbers of trees per acre. Young plantations, such as those on the Five Rivers watershed, were planted--after logging--at 500 to 700 trees per acre, and only a few of the stands were thinned to 60 to 100 trees per acre. We expect that proposed heavy thinning will allow residual trees in those stands to develop on a trajectory consistent with natural old-growth stand development.
- ⇨ Tappeiner et al. (1997) also found that self-thinning was uncommon during the development of the older stands studied, indicating that canopy gaps in these forests were the result of conifer establishment as well as mortality of individual, large trees. Therefore, selecting trees for thinning based on a variable distribution should create numerous small openings in these stands that more closely mimic natural stand development. My observations of commercial thinnings, such as Big Elk Timber Sale on the Waldport Ranger District, indicated that diameter-limit thinning was effective in creating these openings.
- ⇨ A density-management study conducted on the Waldport and Mapleton Ranger Districts (Emmingham 1996) indicated that canopy cover varied from 30 to 70% immediately after commercial thinning when stands were thinned to 30 to 100 trees per acre. Unpublished data 5 years after thinning showed that crown cover had increased to 47 to 82% at the same sites (Chan, pers. comm.). Chan also indicated that most native tree species require a minimum of 30 to 60% open light (canopy openings) to allow for successful establishment and growth. Heavy thinning treatments (40 trees per acre) will increase the amount of light reaching the forest floor and provide a more suitable environment for understory development. This thinning,

combined with the future recruitment of snags and coarse woody debris, will continue to provide additional light and allow multistoried stands to develop.

- ⇨ Thies and Sturrock (1995) compiled information from research findings and observations by forest pathologists and resource managers in the Pacific Northwest on the susceptibility of tree species to laminated root rot. Susceptibility ratings representing a near consensus of pathologists working in western North America were presented. They found Douglas-fir highly susceptible, western hemlock intermediately susceptible, western redcedar resistant, and hardwoods immune. They recommended planting tree species immune or with low susceptibility to the disease (tolerant or resistant). Therefore, underplanting with immune hardwoods (bigleaf maple and red alder) and resistant species (western redcedar) are expected to reduce inoculum and spread of the disease.
- ⇨ Understory planting of native conifers and hardwoods in openings will increase both the stand diversity and structure that provide the framework for developing multistoried stands.

After all actions are completed in existing plantations, we expect the following treatment effects on stocking:

- ⇨ In the study areas
  - ↳ In pathway A, 1,057 acres will contain an overstory of 130 to 300 trees per acre of Douglas-fir with little or no understory.
  - ↳ In pathway B, 706 acres under Alternative 1 and 671 acres under Alternative 2 will contain an overstory of 40 to 90 trees per acre of predominantly Douglas-fir with an understory of 70 trees per acre of western hemlock, western redcedar, and native hardwoods. About 263 acres will contain an overstory of 140 to 270 trees per acre, dominated by Douglas-fir with little or no understory.
  - ↳ In pathway C, 496 acres under Alternative 1 and 470 acres under Alternative 2 will contain a Douglas-fir overstory of 60 to 110 trees per acre.

  Outside the study areas
  - ↳ About 2,028 acres under Alternative 1 and 1,980 acres under Alternative 2 will contain a Douglas-fir overstory of 40 to 100 trees per acre. About 406 of these acres under Alternative 1 and 399 acres under Alternative 2 will contain an understory of 50 trees per acre of western hemlock, western redcedar, and native hardwoods.

    About 2,843 untreated acres in Alternative 1 and 2,952 acres in Alternative 2 will continue to develop as dense, single-storied, Douglas-fir stands.

    As roads fail in the future, the number of untreated acres will increase under Alternative 2.

    About 2,346 acres of plantations, 25 years and older, will continue to develop but will not be ready for thinning for 10 to 15 years from now.

In summary, we believe that, when considered together, ORGANON predictions, specific studies, and long-term observations suggest that thinning activities will provide the greatest opportunity for developing late-successional forest characteristics in the shortest time. Thinning will reduce stocking enough to allow for optimal or near optimal growing conditions for several to many years, as well as providing conditions suitable for establishing understory, recruiting snags and woody debris, and developing stand structure and species diversity. Thinning will provide adequate growing room for residual trees, which will maintain stand health and reduce the probability of large-scale outbreaks of insects or disease. As high-quality snags and coarse woody debris develop over time, late-successional characteristics can be expected to improve gradually. These effects will differ depending on treatment intensity. We believe the only way that thinning could not help these stands develop late-successional characteristics would be if blowdown, or insects and disease outbreaks, affected thinned stands and not unthinned stands. These results appear unlikely, but they cannot be ruled out.

Table 12. ORGANON growth and yield projections for stand 224

Age	TPA	DBH	Height (HT40)	Mortality	Crown ratio %
40 TPA					
37	210	13.1	97	0	32
*37	40	17.0	97	0	36
47	40	20.5	116	0	46
57	39	24.0	136	1	47
67	39	27.0	153	0	41
77	39	29.4	167	0	37
87	38	31.5	180	1	34
97	38	33.3	191	0	31
107	38	34.9	201	0	29
117	37	36.2	210	1	27
45 TPA					
37	210	13.1	97	0	32
*37	45	16.8	97	0	36
47	45	20.2	116	0	46
57	44	23.6	136	1	45
67	43	26.4	152	1	39
77	43	28.8	167	0	35
87	43	30.7	179	0	32
97	42	32.4	191	1	29
107	42	33.9	201	0	27
117	41	35.2	209	1	25
60 TPA					
37	210	13.1	97	0	32
*37	60	16.3	97	0	35
47	59	19.5	116	1	45
57	58	22.5	136	1	40
67	57	25.0	153	1	35
77	56	27.0	167	1	31
87	55	28.8	179	1	28
97	54	30.3	190	1	26
107	53	31.6	200	1	24
117	52	32.8	208	1	23
80 TPA					
37	210	13.1	97	0	32
*37	80	15.8	97	0	34
47	78	18.7	117	2	42
57	76	21.3	136	2	36
67	74	23.5	153	2	31
77	72	25.2	167	2	28
87	70	26.8	179	2	25
97	68	28.2	191	2	23
107	66	29.4	199	2	22
117	63	30.6	208	3	20
100 TPA					
37	210	13.1	97	0	32
*37	100	15.3	97	0	35
47	97	18.1	117	3	39
57	94	20.4	136	3	33
67	90	22.3	153	4	29
77	87	23.9	167	3	26
87	83	25.4	179	4	23
97	80	26.7	190	3	22
107	76	27.9	200	4	20
117	72	29.1	208	4	20
No Action					
37	210	13.1	97	0	32
47	188	15.2	119	22	30
57	168	17.0	138	20	26
67	149	18.8	154	19	23
77	132	20.4	169	17	22
87	118	21.9	181	14	20
97	107	23.4	192	11	19
107	97	24.8	200	10	19
117	89	26.2	208	8	18

* = after thinning; TPA = trees per acre; DBH = diameter at breast height; Height (HT40) = height of 40 tallest trees.

Timber-sale economics (Bruce Buckley)--Commercial thinning under Alternative 1 in late-successional and riparian reserves will produce about 32 million board feet. Thinning in matrix lands will produce an additional 7 million board feet. Commercial thinning under Alternative 2 in reserves will produce about 31 million board feet, and an additional 6 million board feet will be produced in matrix.

The economic analysis used the transaction-evidence appraisal (TEAECON) program developed by the Mount Hood National Forest. This program--developed for planners in Oregon and Washington--is used to analyze basic gross timber values and develop estimated advertisement rates for sales greater than 250 thousand board feet. The program accounts for Forest Service expenses associated with planning, sale preparation, and sale administration.

The primary factor affecting the difference in expected advertised rates between alternatives is the higher costs associated with helicopter logging, which has a lowering effect on advertised rates . Under Alternative 1, helicopter logging comprises about 9% of the total volume; under Alternative 2, helicopter logging comprises more than half the volume (appendix C, C-3 and C-4). Based on recent (spring 2000) market rates in Oregon and Washington, advertised rates for potential bidders would be $98.90 for Alternative 1 and $76.62 for Alternative 2 per thousand board feet. At these rates, Alternatives 1 and 2 would generate sufficient revenue to cover Forest Service expenses, provide revenue to counties pursuant to the “Secure Rural Schools and Community Self-Determination Act of 2000”, provide 10% of gross value to roads and trails, fund all essential Knutson-Vandenberg (KV) projects, such as underplanting in heavy thinning areas, and fund all mitigated non-essential KV projects such as snag and down wood creation. Essential KV and mitigated non-essential KV projects have the highest funding priorities (appendix B, pages B-12 through B-14).

As table 13 illustrates, the primary difference between the alternatives is reflected in how well non-essential KV projects are funded. Depending on future market values for small wood, additional funds (or fewer) could be available for non-essential KV projects.

Some of the non-essential restoration projects, such as large wood additions for streams and road decommissioning, are likely to be funded from other sources and therefore received low priority rankings for KV funds. Likely funding sources for large wood addition projects include Forest Service appropriated dollars, KV dollars from previous sales, and cooperative grants with other entities. Likely funding sources for road decommissioning include funds from flood supplemental, road maintenance, and soil and water dollars. Costs of large wood ($300,000) and road decommissioning ($107,200) projects comprise about 17% of the total costs for non-essential KV projects under both Alternatives 1 and 2. Because these projects will most likely not be funded by KV, these costs were not included in table 13.

Table 13. Estimated sale value, collections, KV project costs, and percentage of non-essential KV projects funded

Altern-atives	Total sale value	NFF collections	Essential KV and mitigated non-essential KV projects	SSF collections	Total non-essential KV projects	Percentage of non-essential KV projects funded
1	$3,833,364.00	$1,341,677.00	$722,105.00	$530,178.00	$1,945,265.00	64
2	$2,869,572.00	$1,004,350.00	$691,729.00	$512,287.00	$1,948,070.00	34

Young-stand management (Ed Obermeyer)--About 2,366 acres of young plantations (ages 5 to 15) will be available for treatment. Although many research projects have been initiated to study how stand management activities affect the development of late-successional conditions in older stands, younger plantations have received little or no study. My own knowledge and observations indicate that younger plantations have better species composition and diversity than are typically found in older plantations because past precommercial thinning usually removed native hardwoods and hemlock. Anecdotal evidence suggests that initiating management activities that maintain species diversity and growth rates at a younger age would allow plantations to develop late-successional characteristics similar to older stands, but more effectively and sooner. Consequently, early silvicultural intervention in young plantations should allow them to grow faster and develop late-successional characteristics sooner than the older stands managed primarily for timber. Effects of Alternatives 1 and 2 are expected to:

- ⇨ Reduce stand densities to more closely mimic natural stand development in the project area.
- ⇨ Maintain or enhance growth rates for several decades, with effects lasting longer in the stands proposed for heavy thinning.
- ⇨ Increase species diversity because existing native hardwoods will be retained and shade-tolerant conifers will be emphasized over shade-intolerant species. Retaining a wide variety of species will also help accelerate the development of multistoried stands.
- ⇨ Enhance stand diversity by retaining untreated clumps and stand openings. Variable distribution patterns will allow understory vegetation and structure to develop.
- ⇨ Develop high-quality snags and large woody debris sooner because high growth rates can be maintained for long periods, providing early recruitment of large-diameter material.
- ⇨ Increase stand resistance to major disturbances from insects, diseases, or other environmental factors by enhancing stand diversity.

When all actions are completed, the following effects of treatments on stocking can be expected.

- ⇨ The 2,366 acres of young stands, currently 5 to 15 years old, will contain about 80 to 140 trees per acre. These stands are primarily of Douglas-fir, but they will also contain a component of western hemlock, western redcedar, and native hardwoods.
- ⇨ In pathway A, 425 acres will not be treated and will continue to develop as dense, Douglas-fir stands with about 300 to 400 trees per acre. An additional 1,300 acres have already been precommercially thinned to 120 to 200 trees per acre. Although dominated by Douglas-fir, they contain a minor component of western hemlock, western redcedar, and native hardwoods.
- ⇨ Under Alternative 2, fewer acres will become available for commercial thinning in the future as roads fail. Currently, 299 acres or 13% of the young stand acres would not be available for harvest.

No adverse indirect effects are anticipated in thinned areas. These actions will provide a long-term benefit by maintaining stand health and accelerating development of late-successional habitat that includes large trees, snags, logs on the forest floor, canopy gaps, multistoried stands, and diverse species composition. Within about 45 to 80 years, most stands will average 30 inches in dbh and contain high-quality snags and coarse woody debris. Understories, about 40 years old, will add species and structural diversity. Relatively large blocks of multistoried stands will exist across the planning area, as natural and managed stands blend together.

Adverse cumulative effects for acres in pathway A, under passive management, and untreated acres would be the same as identified under the no-action alternative.

Alternative 3 (no action)--Without harvest activities, 6 to 7 million board feet will not be harvested from lands designated as matrix. About 5,525 acres will continue to develop as dense, single-storied Douglas-fir stands. Plantations will continue to grow over time, but they will develop differently from existing stands that have achieved old-growth dimensions (Tappeiner et al. 1997). Trees will have less opportunity to express dominance because they all have equal growing space as a result of past vegetation management and precommercial thinning. Competition will continue to increase between individuals as trees compete for limited resources, especially light. Trees will grow taller as they strive to obtain sufficient sunlight, but diameter growth will slow in response to loss of crown. As these trees become more dependent on neighboring trees for support they will become less stable. Trees will become more susceptible to insects, disease, and windthrow, and stand health will decline. When trees occupy the available growing space, they will begin the stem-exclusion phase, which effectively prevents other trees from becoming established and starts killing the weaker trees in the stand (Oliver and Larson 1996). Mortality will increase dramatically as the intermediate and suppressed trees lose their ability to compete and die. These dead trees will increase snags and coarse woody debris, but they will be too small to be of high quality and are expected to decay rapidly. As understory vegetation continues to decline, bare mineral soil will become more prominent and additional soil movement can be expected in stands where slopes exceed 30%, based on observations in similar stands on the Waldport Ranger District.

Because stands are fairly uniform, opportunities for establishing species or structural diversity through natural processes will remain low for many years, without major disturbance events. Eventually, over long periods, natural disturbance events will create openings in stands, allowing shade-tolerant species to become established in the understory, gradually creating additional structure and diversity. This alternative provides the least opportunity to accelerate development of late-successional conditions, although stand diversity on a larger landscape scale may be enhanced by retaining untreated areas. Late-successional reserve objectives will likely be delayed for many decades in these stands.

Effects of applying this alternative are shown in the control plots on the Black Rock study site near Fall City, Oregon (Marshall, pers. comm.). The plots represent an 85-year-old stand that had 486 trees per acre at age 48. Although this stand contains more trees than most of the Five Rivers stands, it does provide a basis for comparing the development of overstocked stands over a long time. Considerable mortality reduced stocking in this stand to 232 trees per acre by 1995, but little or no understory structure or diversity has developed. Although diameter growth has remained small, height growth has continued, producing tall, spindly trees prone to windthrow. Crowns have receded so the trees are less vigorous and more prone to effects of insects, diseases, and other environmental factors. Large numbers of trees continue to die and fall over, but the growing space is quickly used by other trees, preventing any appreciable light from entering the understory. Little vegetation is found on the forest floor; what is there is related to minor disturbances and unlikely to persist. This process will likely continue until affected by a major disturbance or until trees have had enough time to begin differentiating from their neighbors.

Similar results are predicted when the average stand (age 25+) in the Five Rivers project area is modeled by using ORGANON (table 12). Results of this model indicate that:

- ⇨ Stands will continue to lose crown ratios from now through age 117, ranging from 32 to 18%.
- ⇨ By age 117, 58% of the stand (121 TPA) will die and become large woody debris or snags. This wood will be relatively small; 92% of it will be less than 20 inches in diameter and 61% less than 15 inches.
- ⇨ Average stand diameter will be near 26 inches dbh at age 117.
- ⇨ Height of the 40 tallest trees per acre will be 208 feet. Trees will be very tall in relation to their diameters and remain susceptible to windthrow and breakage.
- ⇨ Crown ratios will continue to decline from now through age 117, indicating that stand vigor will degrade, becoming more susceptible to insects, diseases, and other environmental factors.

Younger stands, 5 to 24 years of age, will continue to develop into dense, single-storied stands dominated by Douglas-fir. Many of these stands will enter the stem-exclusion phase at a much earlier age than do precommercially thinned stands.

Cumulative effects--Within 25 years, virtually all of the managed stands proposed for thinning would be in the stem-exclusion phase, ranging in age from 30 to 75 years old. This condition would persist for many decades until stands differentiate enough to allow for understory vegetation to begin to reappear or natural disturbances create sufficient openings. Stand health will decline, and insect and disease outbreaks will be more severe and cover larger areas. Laminated root rot will continue to play a significant role in maintaining bark beetle populations over time. This root disease will provide a continuous source of favorable host material for beetles between those times when conditions are favorable for outbreaks (Thies and Sturrock 1995). Douglas-fir is likely to continue to dominate these stands until a major disturbance or sufficient smaller disturbances allow shade-tolerant species to become established. Eventually, as seedlings become established and grow, they will provide additional structure and diversity, slowly evolving into multilayered stands. Then, the natural and managed stands would eventually have similar structure.

Aquatic species *(Jack Sleeper)*

Thinning and associated actions (reopening roads, haul, and so on) used to develop late-successional habitat are not expected to affect fish directly. In the short term, turbidity and sediment inputs may increase locally during timber haul, road building, and decommissioning. These increases are expected to be insignificant because they will be small, of short duration, and very limited in geographic extent. A review of the biological opinion prepared for this project has concluded, however, that some watershed restoration actions (road decommissioning and placement of large wood in streams) under Alternatives 1 or 2 are likely, in the short term, to adversely affect Oregon coast coho salmon--listed as threatened in August 1998--and their habitat, but they are expected to have a beneficial effect in the long term. By not thinning managed stands, Alternative 3 will not accelerate the development of large wood for fish habitat.

Terrestrial species *(Paul Thomas)*

The Forest Ecosystem Management Assessment Team report (USDA, USDI et al. 1993) summarizes the numerous publications that describe the structure and composition of late-successional and old-growth forest systems. Attributes included the presence of live old-growth trees, snags, fallen trees on land, and multiple canopy layers. These authors also summarize the current understanding of ecological processes that affect the development of these systems, including tree growth and maturation, death and decay of larger trees, low-to-moderate-intensity disturbances, establishment of trees in gaps or under the canopy, and closing of canopy gaps by lateral canopy or understory growth. They suggested that some processes (such as growth, mortality, and understory development) can be accelerated through silvicultural practices, but others (such as maturation of trees and decay of tree boles) require time. In summarizing ecosystem functions, they identified several attributes, such as buffering of microclimate during seasonal climatic extremes, that appear to be lacking or less well developed in managed stands. They conclude that though silvicultural treatments in plantations can, at best, partially restore or accelerate development of some structural and compositional features found in late-successional ecosystems, no certainty exists that old-growth conditions can be created. Because plantations regenerated by different processes than those existing in late-successional forests, however, they conclude that plantations are highly likely to look and function differently from current older stands. In addition, they conclude that maintaining the network of existing natural old-growth stands is important to preserving biodiversity into the future.

The Siuslaw’s late-successional reserve assessment (USDA, USDI 1997) summarized the structure and composition of its mature stands. Conifers ranged between 40 and 88 trees per acre, with conifers greater than 21 inches ranging between 23 and 37 trees per acre. Spies et al. (1988) found, in the Oregon Coast Range, that natural young stands contained 70 logs per acre less than 12 inches in diameter, 39 logs in the 12- to 24-inch size-class, and 4 logs greater than 24 inches. They estimated that coarse wood from the previous stand constituted 58% of the total coarse wood found in the stand.

Because the amount of existing mature forest will remain the same under the action alternatives, we concluded that natural processes and functions will be the dominant forces in creating the structure and composition of late-successional habitat for wildlife in existing natural stands under all alternatives. Based on the conclusions reached in the section discussing forest stand conditions, Alternatives 1 and 2 will provide more acres with the tree sizes, densities, and stand characteristics associated with mature forests sooner than will Alternative 3. Although tree densities and stand characteristics of plantations that will develop under Alternative 3 are found in natural stands, their quantity and distribution are greater than would be found under natural processes. Increasing the size and amount of coarse wood, snags, or tree species diversity in plantations and hardwood-dominated riparian areas under the action alternatives will result in attributes more like the structure and composition found in natural stands. How well these attributes will function remains uncertain. The amount of coarse wood and snags in plantations will also increase under Alternative 3; however, when compared to natural stands, the difference in size and composition of these components will be greater under this alternative than under the action alternatives.

Listed and sensitive species--As required by the Endangered Species Act of 1973, as amended, a biological assessment (a project-file document) has been prepared for this project. This assessment evaluates and describes the potential effects of proposed actions on species listed--under the Endangered Species Act--that may be found on the Siuslaw National Forest. Because the planning area is outside the range or contains no suitable habitat for the Oregon silverspot butterfly, brown pelican, Aleutian Canada goose, Nelson's sidalcea, western lily, or western snowy plover, none of the alternatives affect these species.

Bald eagle--Because no nest sites are known and Alternatives 1 and 2 will not remove suitable habitat, thinning (commercial and noncommercial) of plantations and improving terrestrial habitat will not affect bald eagle habitat. Because the location of the activities is frequented by the public (for example private property, public access) and interest in bald eagles is high, an active nest is likely to be discovered. Because a bald eagle pair might nest in the project area and not be discovered, noise associated with management activities could conceivably disturb a nesting pair. Thus, the noise associated with management activities conducted under Alternatives 1 and 2, may affect but are not likely to adversely affect undetected nesting bald eagles.

Northern spotted owl--Changing canopy cover, or altering snag, or coarse wood composition modifies forest habitats that support spotted owls. The plantations evaluated for thinning are not considered suitable nesting, roosting, or foraging habitat for the northern spotted owl but they are considered suitable dispersal habitat. Although heavy thinning (less than 40% crown closure) is expected to promote the structural development and diversity of the stand over the long term, the dispersal function of those plantations would be lost for 3 to 5 years. Light and moderate thinning is considered to degrade but not remove dispersal habitat. Because large snags are a component found in nesting and roosting habitat, creating snags in natural stands increases the structural complexity of those stands, but removing hazard trees (snags or deformed trees) adjacent to travel routes and work areas reduces stand complexity.

The amount of federal land that will function as dispersal habitat in the riparian reserves and across the landscape after the activities of commercial harvest, coarse wood creation, and inoculation of plantation trees is shown in tables 14 and 15. The primary influence on projected dispersal habitat is the increase in acres of plantations that will meet dispersal-habitat criteria over those currently available. Because heavy thinning of about 400 acres of plantations will not result in dispersal habitat less than is currently available and light-to-moderate thinning of 2,850 acres of plantations will not eliminate dispersal habitat, enough of it will remain to support dispersing owls after all actions are completed.

Table 14. Percentage of riparian reserve that functions as dispersal habitat

Subwatershed	Current (2000) dispersal habitat percentage	Alternatives 1&2 dispersal habitat (2005) percentage	Alternative 3 dispersal habitat (2005) percentage
Cascade Creek	71	76	79
Crab Creek	68	72	72
Green River	77	82	84
Lower Buck Creek	71	80	82
Lower Five Rivers	83	88	88
Middle Five Rivers	72	74	76
Upper Buck Creek	78	78	80
Upper Five Rivers	70	74	74

Table 15. Percentage of federal land that functions as dispersal habitat

Subwatershed	Current (2000) dispersal habitat percentage	Alternatives 1&2 dispersal habitat (2005) percentage	Alternative 3 dispersal habitat (2005) percentage
Cascade Creek	71	75	79
Crab Creek	69	74	74
Green River	76	81	82
Lower Buck Creek	70	79	80
Lower Five Rivers	77	82	82
Middle Five Rivers	76	77	78
Upper Buck Creek	78	78	80
Upper Five Rivers	69	74	74

Short-term effects on northern spotted owls and their habitat of selecting Alternatives 1 or 2 are summarized in table 16. The effects on owls from noise-associated disturbance during Alternatives 1 and 2 actions are shown in table 17. Except for maintaining or repairing the ATM-system roads, Alternative 3 would cause no noise-associated disturbance to owls.

Marbled murrelet--Plantations proposed to be commercially thinned under Alternatives 1 and 2 contain trees less than 130 feet tall and no remnant trees (trees with structure) from the previous stand. Therefore, they are not considered to be suitable or potential marbled murrelet habitat. Noise associated with thinning, including activities like creating coarse wood, could disturb nesting activities on adjacent occupied habitat. Hazardous trees will be removed as part of maintaining roads. Removing trees that have no potential nesting structures would not affect marbled murrelets. Effects on marbled murrelet habitat are shown in table 16. The effects on marbled murrelets from noise-associated disturbance from Alternatives 1 and 2 are shown in table 17. Except for road maintenance or repair of the ATM system, Alternative 3 would have no noise associated with disturbance.

Actions proposed under Alternatives 1 and 2 are expected to speed the development of characteristics associated with late-successional forests. Concern remains over the amount, quality, and use of existing habitat as well as the breeding success of northern spotted owls and marbled murrelets, however. All management activities change existing forest structure and its development, create noise, and--depending on the season-- create smoke or dust, all of which affect the forest environment. Because potential for northern spotted owls or marbled murrelets to use an area being treated or a nearby stand always exists, some risk remains that changing existing conditions may change use patterns, increase susceptibility to predation, or disturb breeding activity. Thus, some risk of effects on these birds exists in the short term under Alternatives 1 and 2. Actions that "may affect and are likely to adversely affect" northern spotted owls or marbled murrelets are associated with actions during the breeding period within ¼-mile of unsurveyed suitable habitat, and reflect the risk associated with affecting an unknown breeding pair.

Table 16. Effects on northern spotted owls and marbled murrelets from habitat modification actions under Alternatives 1 and 2

Activity	Effects to species	Effects on critical habitat
Heavy, light-moderate thinning		
Northern spotted owl	MA-NLAA	MA
Marbled murrelet	NE	MA
Coarse wood, snag creation		
Northern spotted owl	MA-NLAA	MA
Marbled murrelet	MA-NLAA	MA

MA-NLAA: May affect, but not likely to adversely affect. NE: No effect.
MA-LAA: May affect and likely to adversely affect. MA: May affect.

Table 17. Effects on northern spotted owls and marbled murrelets from disturbance associated with Alternatives 1 and 2

Breeding period	Oct 1-Feb 28	March 1 - July 7	July 8 - August 5	August 6 - Sept. 30
Combined thinning actions	945 ac/ 29%	145 ac/ 4%	1120 ac/ 34%	1040 ac/ 32%
Heavy thinning	320 ac/80%	0 ac/0%	30 ac /8%	50 ac/12%
Northern spotted owl	NE	MA-LAA	MA-NLAA	MA-NLAA
Marbled murrelet	NE	MA-LAA	MA-LAA	MA-NLAA
Light-moderate thinning	625 ac/ 22%	145 ac / 5%	1090 ac/ 38%	990 ac/ 35%
Northern spotted owl	NE	MA-LAA	MA-NLAA	MA-NLAA
Marbled murrelet	NE	MA-LAA	MA-LAA	MA-NLAA
Coarse wood, snag creation	37,080 trees	0	0	0
Northern spotted owl	NE	NE	NE	NE
Marbled murrelet	NE	NE	NE	NE

MA-NLAA: May affect, but not likely to adversely affect. NE: No effect.
MA-LAA: May affect and likely to adversely affect.

Regionally sensitive and survey-and-manage species--Through time, all alternatives are expected to maintain or increase the amount of suitable habitat for red tree voles. Considering that no late-successional forest will be removed and known red tree vole sites will be buffered from activities, we concluded populations of red tree voles will remain well distributed throughout the planning area.

The Forest botanist has evaluated the potential effects of proposed activities on sensitive plants. He concluded that no sensitive plant species or potential habitat is known or suspected in or adjacent to proposed project sites and project activities will have no direct or indirect effects on these species.

The botanist also evaluated the effects of proposed activities to survey-and-manage species for which protocols exist. No populations of rare lichens were found; therefore, he concluded these species would not be affected. Management recommendations for giant-spored tree moss (USDA, USDI 1996) suggest that managing for this species would be necessary "if known occupied sites are disjunct or highly localized". The 65 sites in the project area are well distributed in the Five Rivers watershed and surveys throughout the Forest indicate the species is well represented and distributed in the Oregon Coast Range. In addition, giant-spored tree moss was ranked as common to abundant in all but four sites where it was recorded in the project area. For these reasons, the Forest botanist concluded that no specific management prescriptions are needed to ensure the continued viability of giant-spored tree moss in the project area.

Areas proposed for commercial thinning support suitable habitat for six protection-buffer fungal species. Surveys are currently required before implementing ground-disturbing actions for five of the six species (USDA 2000a) after a single-season survey (USDA, USDI 1999b). All new sites found during pre-implementation surveys will be protected following the management recommendations for survey and manage fungi (USDA 1997b).

Survey-and-manage mollusk species were identified based on existing information indicating their close association with late-successional forests, poor dispersal ability, and vulnerability to disturbance (USDA, USDI 1993). They considered all management activities to be a potential threat to mollusks. The papillose taildropper slug has been found in 25 plantations throughout the planning area. Considering that no late-successional forest will be removed and all known sites in managed stands will be buffered or fully protected, we concluded populations of the papillose taildropper slug will remain well distributed throughout the planning area.

Other species of regional or social concern--All alternatives maintain the current existing mature habitat and provide a variety of seral age classes. However, Alternatives 1 and 2 will provide stand characteristics associated with mature forests sooner than Alternative 3. All alternatives will maintain a variety of suitable habitat for land birds. The breeding period for land birds occurs during the same periods as spotted owls and marbled murrelets. Design criteria--such as applying a variety of silvicultral presecriptions, implementing hourly and seasonal operating periods, and limiting the amount of work allowed during breeding periods--reduce the direct effect of management activities on the breeding behavior of land birds. Thus, all alternatives are consistent with the Landbird Conservation Strategy (USDA 2000c).

The Forest botanist also evaluated the response of noxious weeds and loose-flowered bluegrass to proposed actions under Alternatives 1 and 2. He concluded that:

- ⇨ Thinning prescriptions that leave residual stand densities of 60 to 100 trees per acre generally provide adequate canopy coverage to prevent most noxious and undesirable weeds from colonizing.
- ⇨ Units with long segments of temporary road building, landings with fan-shaped setting, creation of meadows, and silvicultural prescriptions calling for open overstory pockets or gaps will increase the potential for weed colonization and establishment.
- ⇨ Thinning actions may directly affect some individual loose-flowered bluegrass plants or nonconservation-strategy populations, however; protecting and maintaining the conservation-strategy sites ensures a high probability of the species' continued viability on the forest.

Predicted Effects of Actions To Improve Watershed Function

Soils, stream flow, and water quality

Soils (Courtney Cloyd)--Reiter et al. (1995) found that 1 to 4 cubic yards of management-related sediment was eroded after culvert and fill removal at several sites on the Umpqua National Forest in western Oregon. They also found that most of the erosion and sediment movement was after the first high flows in the stream, usually in the first fall and winter after treatment.

Decommissioning roads under Alternatives 1 and 2 will have the following common effects on soils, hydrologic conditions, and water quality:

- ⇨ Based on an unpublished 1997 inventory of stream crossing culverts, fill volumes at these sites range from about 50 to 500 cubic yards. Culvert and fill removal would prevent management-related sediment in this volume range from being delivered to streams by erosion or mass movement.
- ⇨ Because the removal methods and objectives on the Umpqua National Forest are the same as those proposed under these alternatives--a tracked excavator removing culverts and all fill material, restoring the original channel gradient--1 to 4 cubic yards of management-related sediment would be eroded after fill and culvert removal.
- ⇨ Removing stream-crossing culverts and fill will allow streams to flow in unrestricted channels.
- ⇨ Based on earlier discussions of erosion after road closure and decommissioning treatments, minor erosion is expected in the first year or two after building of water-bars or water-dips, though it would last longer if vehicle traffic continued.

Road decommissioning under Alternatives 1 and 2 will remove 85 stream crossings from 11 roads in the Five Rivers watershed (table 18). About 21,900 cubic yards or 68% of the in-stream fill volumes will be removed under both alternatives. Of the remaining in-stream fill volumes, 6,700 cubic yards will be on ATM roads, 2,100 cubic yards will be on closed roads, and 1,500 will be on the lower portion of road 3215 identified as “other roads” on maps 4 and 6 (Cascade subwatershed). By removing the fill associated with the 85 stream crossings, the potential for up to 21,900 cubic yards of sediment entering streams will be eliminated.

Stream crossings where culvert inlets are partially or fully plugged are likely to trap stream flow behind the road fill, particularly during storms. These sites are more susceptible than others to erosion or rapid failure of the fill material, which would deliver sediment to streams. Water may also be diverted down drainage ditches or roads, causing off-site problems such as delivering sediment to streams or eroding road surfaces. Recent road-condition surveys indicated that 33 stream crossings in the Five Rivers watershed have a high risk of causing sedimentation of streams (table 19). These sites contain about 4,530 cubic yards of fill material. Through road decommissioning, Alternatives 1 and 2 would remove 24 of these sites most susceptible to failure, leaving in place 9 sites that contain about 1,030 cubic yards of fill material. Five of these remaining sites--three in Lower Buck, one in Lower Five, and one in Upper Five--are on ATM roads where culvert inlets will be maintained open; four of these sites will be on closed roads (table 20). The road-fill assessment tables in the project file provided the numerical information contained in tables 18 through 20.

Table 18. Alternatives 1 and 2 stream crossing and fill volume reductions

Subwatershed	Existing number of stream crossings	Existing in-stream fill volumes in cubic yards	Number of stream crossings to be removed	In-stream fill volumes to be removed in cubic yards	Remaining in-stream fill volumes in cubic yards
Cascade	20	3,300	11	1,800	1,500
Crab	4	600	1	100	500
Green River	51	4,200	51	4,200	0
Lower Buck	12	1,500	0	0	1,500
Lower Five	7	5,700	3	500	5,200
Middle Five	5	800	0	0	800
Upper Buck	1	900	1	900	0
Upper Five	25	15,100	18	14,400	800
Total	125	32,100	85	21,900	10,300

Under Alternatives 1 and 2, road decommissioning will remove 39 of the 57 culverts that could divert streams from their channels if inlets became plugged (table 19). Of the remaining 20 sites, 11 will be on ATM roads with routine maintenance, and 9 will be on closed roads.

Table 19. Alternatives 1 and 2 high-risk stream crossing and fill volume reductions

Subwatershed	Existing number of high-risk stream crossing sites	Existing high-risk in-stream fill volumes in cubic yards	Number of high-risk sites to be removed	Remaining high-risk in-stream fill volumes in cubic yards	Existing - to be removed sites with potential to divert streams
Cascade	1	200	1	0	6 - 6
Crab	0	0	0	0	2 - 0
Green River	14	1,400	14	0	20 - 20
Lower Buck	5	800	0	800	5 - 0
Lower Five	2	200	1	100	5 - 1
Middle Five	1	30	0	30	4 - 0
Upper Buck	1	900	1	0	0 - 0
Upper Five	9	1,000	7	100	15 - 12
Total	33	4,530	24	1,030	57 - 39

Road closure under Alternatives 1 and 2 will maintain 14 stream crossings containing about 2,100 cubic yards of fill material (table 20). Currently, four stream crossings containing about 630 cubic yards of fill are highly susceptible to failure and likely to add sediment to streams because of plugged or partially plugged culvert inlets. Nine sites have potential to divert streams from their channels. Before roads are closed, culvert inlets will be reopened, drain dips will be built above culverts to keep streams in their channels if culvert inlets are obstructed again, and water bars will be built (appendix B, page B-13). We have observed that drain dips or water bars effectively route surface runoff away from the road when the drainage ditch-and-culvert system is blocked, significantly reducing or eliminating erosion. Minor erosion may continue after water dips or water-bars are built, but we expect it to be minimal except where some vehicle use continues and at rates comparable to those determined in table 9 for abandoned roads.

We have observed that continued vehicle traffic after water-bar installation eventually breaks down the shape of water dips and bars, reducing their ability to route water off the road. If vehicle traffic continues on closed roads, water-bar effectiveness would diminish.

During recent winter storms, Forest managers have placed a low priority on post-storm surveys of closed roads because of limited funding and staff time. Walking is the only way to access many closed roads because of thick vegetation or trees. These future road closures may further limit or prevent treating the effects of landslides or erosion.

Table 20. Alternatives 1 and 2 stream crossing conditions for proposed road closures

Subwatershed	Number of stream crossings	Existing in-stream fill volumes in cubic yards	Number of high-risk sites	High-risk in-stream fill volumes	Number of sites with potential to divert streams
Lower Buck	7	1,000	2	500	5
Middle Five	4	600	1	30	3
Upper Five	3	500	1	100	1
Total	14	2,100	4	630	9

Under Alternative 2, about 15 roads currently closed by natural events or management action will be abandoned or not reopened, which means they will not be maintained or decommissioned beyond the point of closure. No stream crossings are behind those blockages. Future naturally occurring road blockages, however, such as landslides or fill failures, may prevent access to stream crossings for maintenance. Based on the effects of recent (1996-99) major storm and flood events in the Siuslaw National Forest, we expect that not maintaining culvert inlets or not removing culverts and fill material from stream crossings will increase the probability of diverting streams from their channels or catastrophic fill failure. By not removing culverts and fills, the potential of large-wood delivery to streams via debris flows will be reduced. Under this alternative, if roads are blocked naturally before road decommissioning and closure actions, the number and kinds of possible actions to meet the goals of the late-successional reserve and aquatic-conservation strategies may be significantly reduced.

Stream flow (Courtney Cloyd)--Wemple (1994) found that road ditches draining into first- and second-order streams function as extensions of the stream network, increasing local peak flows and storm flows by up to 40% in subwatersheds in the western Cascades. Because the relation between road drainage and streams does not depend on the terrain, we expect that actions under Alternatives 1 and 2 will reduce forest-development road density by almost 1 mile per square mile, and thus they are expected to reduce peak and storm flows in the Five Rivers watershed. We expect stream flows to remain at current rates under Alternative 3.

Water quality (Jan Robbins)--The Five Rivers Project Water Quality Restoration Plan--a project-file document that is undergoing review for the listed sections of streams--identifies road decommissioning, large wood placement in streams, and riparian planting as actions that help improve watershed function and lower stream temperature. These actions are part of Alternatives 1 and 2. Conifer planting and release requires removing competing hardwoods, resulting in minor shade loss more than 30 feet from stream centers. Shade loss may locally increase water temperatures until conifer and hardwood growth is sufficient to fill in the open spaces. Considering that riparian planting will be along larger, deeper streams with inadequate shade, we expect any local increase in water temperatures to be within the current temperature ranges for a given stream. Adding large wood to streams is expected to slow movement of sediment through stream channels and provide stable substrate where vegetation can grow and improve shading. In the long term, cumulative actions under Alternatives 1 and 2 will protect or restore water quality on temperature-impaired streams.

Under Alternative 3, riparian shading will increase as trees grow or are naturally established in meadows or other open areas. Water temperature is expected to decrease as tree shading increases, but tree diseases, windthrow, landslide-related debris flows, or other natural disturbances may create openings in riparian areas, allowing localized sun exposure and increased water temperature. Without riparian planting, conversion to conifer trees is not accelerated. Conifers provide more shade than hardwoods do because they grow taller and provide higher quality (longer lasting) large woody debris. Where large wood is lacking in streams, sediment moves rapidly through stream systems. Rapid sediment movement reduces the number of stable stream-adjacent sites that can support the growth and development of vegetation, including large trees that provide shade and large wood.

Fire *(Carl West)*

Under Alternatives 1 and 2, decommissioning roads, placing logs in streams, and riparian planting will not change existing fuel conditions in the watershed. Decommissioning roads will reduce public access, reducing the risk of human-caused fires. Decommissioning roads will decrease access and increase the response time of initial fire-suppression efforts, however. Closed roads and reduced maintenance on ATM roads will also increase the response time under all alternatives. Slow response times may allow the size of wild fires to increase. As roads degrade under Alternative 3, response times are also expected to increase.

Human uses and influences

Heritage resources (Ken McCall)--Under Alternatives 1 and 2, two actions on previously undisturbed ground will require field inventories and concurrence from the State Historic Preservation Office before the actions are implemented. The actions include building a new road to access private land in the Green River subwatershed (maps 3, 5, 7, 8) and placing large wood in streams (maps 2, 4). Riparian planting will not be allowed in areas identified as homestead building sites. No effects are anticipated to known sites because of protection and avoidance measures to be taken when woody debris is placed in streams and trees are planted in riparian areas. Road decommissioning under Alternatives 1 and 2 will have minimal risk of consequences to heritage resources because most are on previously disturbed sites, surveyed sites, or both.

Recreation (Ken McCall)--The primary consequence of closed and decommissioned roads under Alternatives 1 and 2 will be the change from motorized to nonmotorized access. The highest concentration of vehicle travel on the interior forest will continue to be associated with hunting seasons. Access to dispersed recreation sites will be maintained under all alternatives. Through time, the same decrease in recreation opportunities associated with roads will be experienced under Alternative 3, as road conditions deteriorate from lack of maintenance.

Scenery (Jessica Dole)--Actions proposed for improving watershed function are consistent with the scenic quality objectives for the planning area.

Public and management access *(Dan Mummey)*

Under Alternative 1, about 133 miles of system roads will remain, including about 15 miles of private-lands access leading from county roads. Changes in ATM routes will amount to about 2.4 additional miles of ATM travel on ridgetop locations around the segment of road 32 (primarily valley-bottom and mid-slope road) proposed for decommissioning. Alternative 2 will maintain fewer miles as roads are blocked by slides or other failures.

About 33 miles of valley-bottom and mid-slope roads plus 16 miles of ridgetop roads will be eliminated in favor of more stable routes, changing road density from 2.6 miles per square mile of Forest-development road to 2.0 miles per square mile. This change would create a permanent road reduction of about 30%.

Alternative 2, in addition to planned decommissioning, permanently closes about 15 miles of non-ATM roads, without subsequent stabilization treatments beyond points of roadbed failures. Road failures, mass wasting, and sedimentation will continue on roads beyond these failed points of access. About 28% of non-ATM roads--35 miles on midslopes and in the drainages outside the proposed passive-management areas--would waste away in the form of additional sedimentation.

The effects of Alternatives 1 and 2 are summarized, as follows:

Alternative 1

- ⇨ Closes 76 miles of Forest-system roads (maintenance level 1) between planned access periods.
- ⇨ Decommissions 49 miles of Forest-development roads.
- ⇨ Decommissions a 3.3-mile segment of road 32 (Upper Five subwatershed), an ATM secondary low-clearance road, when it fails or unless Lane County accepts a public road easement to maintain the road.
- ⇨ Adds 5.2 miles of ATM high-clearance road to replace the 3.3-mile segment of road 32 after it has failed. This addition will increase average travel distance by about 2.4 miles for vehicles southbound from the Five Rivers county road.
- ⇨ Reduces ATM road maintenance costs by about $32,000 and non-ATM road maintenance costs by about $120,000 annually over the next 15 years.
- ⇨ Keeps county roads and primary and secondary (ATM) Forest roads accessible to all vehicles, but some routes to adjacent communities will be less direct and less convenient for residents.
- ⇨ Eliminates one alternative route for emergency vehicles or evacuating residents if county roads or primary and secondary Forest roads become blocked during emergencies. The more stable and dependable roads--such as the roads that replace the 3.3-mile segment of road 32--are maintained on the ATM system, however.
- ⇨ Builds, under a special-use permit, about 1/2 mile of new road to maintain private access lost from decommissioning Green River Road 3231.
- ⇨ Reduces road density to nearly 1 mile per square mile.

Alternative 2

- ⇨ Closes 61 miles of Forest-system roads (maintenance level 1) between planned access periods.
- ⇨ Decommissions 49 miles of Forest-development roads.
- ⇨ Decommissions a 3.3-mile segment of road 32 (Upper Five subwatershed), an ATM secondary low-clearance road, when it fails or unless Lane County accepts a public road easement to maintain the road.
- ⇨ Adds 5.2 miles of ATM high-clearance road to replace the 3.3-mile segment of road 32 after it has failed, increasing average travel distance by about 2.4 miles for vehicles southbound from the Five Rivers county road.
- ⇨ Eliminates road maintenance on 15 miles of non-ATM roads, with potential of another 20 miles over the next 15 years by abandoning road access.
- ⇨ Reduces ATM road maintenance costs by about $32,000 and non-ATM road maintenance costs by about $127,000 annually over the next 15 years.
- ⇨ Keeps county roads and primary and secondary (ATM) Forest roads accessible to all vehicles, but some routes to adjacent communities will be less direct and less convenient for residents.
- ⇨ Eliminates one alternative route for emergency vehicles or evacuating residents if county roads or primary and secondary Forest roads become blocked during emergencies. The more stable and dependable roads--such as the roads that replace the 3.3-mile segment of road 32--are maintained on the ATM system, however.
- ⇨ Builds, under a special-use permit, about 1/2 mile of new road to maintain private access lost from decommissioning Green River Road 3231.
- ⇨ Reduces road density to nearly 1 mile per square mile.

In contrast to the existing road system (table 8), table 21 illustrates proposed maintenance level mileages and costs by subwatershed for Alternative 1. Tables 21 through 23 contain numerical information from the system road tables in the project file.

Table 21. Alternative 1 road maintenance miles and costs by subwatershed

Subwatershed	Maintenance level 1	Maintenance level 2	Maintenance level 3	Annual maintenance costs*
Cascade	0.5	4	4.5	$28,486.00
Crab	16.7	0	8.7	$40,893.00
Green River	7.9	2.3	0	$24,112.00
Lower Buck	11.3	2.7	4.4	$23,708.00
Lower Five	11.2	5.5	0	$27,745.00
Middle Five	8.9	6.6	0	$24,489.00
Upper Buck	7.7	0	5.1	$21,665.00
Upper Five	11.8	11.1	2.2	$62,501.00
Totals	76.0	32.2	24.9	$253,599.00

*Costs include routine annual maintenance and repairs and road surfacing and stream crossing replacements over the life of the road. Also includes stabilization work for road closure and opening actions needed for managing.

The changes to the existing road system as presented under Alternative 2 are shown in table 22. Proposed maintenance levels and road abandonment mileages and costs are shown by subwatershed.

Table 22. Alternative 2 road maintenance miles and costs by subwatershed

Subwatershed	Maintenance level 1	Maintenance level 2	Maintenance level 3	Road abandonment	Annual maintenance costs*
Cascade	0.5	4.0	4.5	0	$28,486.00
Crab	14.9	0	8.7	1.8	$40,400.00
Green River	6.4	2.3	0	1.5	$23,195.00
Lower Buck	9.2	2.7	4.4	2.2	$22,527.00
Lower Five	4.0	5.5	0	7.3	$23,969.00
Middle Five	8.9	6.6	0	0	$24,489.00
Upper Buck	5.2	0	5.1	2.5	$20,392.00
Upper Five	11.8	11.1	2.2	0	$62,501.00
Totals	60.9	32.2	24.9	15.3	$245,959.00

*Costs include routine annual maintenance and repairs and road surfacing and stream crossing replacements over the life of the road. Also includes stabilization work for road closure and opening actions needed for managing.

Road decommissioning miles and costs for Alternatives 1 and 2 are shown in table 23.

Table 23. Alternatives 1 and 2 road decommissioning miles and costs by subwatershed

Subwatershed	Decommission miles	Decommission costs	Average cost per mile
Cascade	13.5	$20,715.00	$1,540.00
Crab	5.7	$4,274.00	$754.00
Green River	15.8	$34,507.00	$2,191.00
Lower Buck	1.3	$1,277.00	$953.00
Lower Five	2.8	$4,549.00	$1,636.00
Middle Five	1.4	$841.00	$609.00
Upper Buck	3.3	$7,694.00	$2,346.00
Upper Five	5.3	$33,307.00	$6,332.00
Totals	49.1	$107,164.00	$2,191.00

Four roads in Green River (roads 3230, 3231, 3232, and 3250), two roads in Lower Five (3210 and 3412), and two in Upper Five (32 and the Summers Creek portion of 3505) subwatersheds have the highest incidence of storm-related damage. Alternatives 1 and 2 will decommission roads 3230, 3231, and 32 (when a natural event blocks the road or unless Lane County accepts a public road easement to maintain the road), close road 3232, and maintain roads 3250, 3210, 3412, and 3505 as ATM roads.

Forest stand conditions *(Ed Obermeyer)*

Thinning, planting, and release of conifers in Alternatives 1 and 2 will increase the rate at which large-diameter conifers are established in riparian and adjacent upslope areas. Responses would be similar to those modeled for commercial thinning described for meeting the need for late-successional habitat.

Aquatic species *(Jack Sleeper)*

Fish habitat--Robison et al. (1999) documented that upstream migration of juvenile salmonids is prevented or restricted at culverts when outlet drops exceed 6 inches, gradients exceed 0.5%, velocities exceed 2 feet per second, or the depth is less than 12 inches. Several culverts on roads planned for decommissioning prevent or restrict upstream fish passage of juvenile salmonids. Decommissioning roads under Alternatives 1 and 2 will remove about 23 fish-passage barriers and will make about 14 miles of fish habitat more easily accessible for upstream juvenile migrants.

Sedell and Luchessa (1981) documented that large wood was abundant in Oregon coast streams during the early years of European settlement. They documented that organized stream cleaning projects since the late 1800s have removed most wood from Pacific Northwest streams. Oakley (1963) documented removal, and recommended additional removal, of log jams in the Alsea basin in the mid 1900s. The Waldport and Alsea Ranger Districts removed several log jams in the Alsea basin in the 1980s to provide upstream passage for adult salmon. Research in the late 1900s began to identify the ecological functions of wood in streams. Maser et al. (1988) summarize conclusions that wood provides stream complexity, retains sediment and organic material, and creates off-channel and flood-plain habitats. In reaches with gravel or cobble substrates, they found that large wood increases pool area and maximum pool depth. Large-wood additions to stream channels in Alternatives 1 and 2 are expected to have similar effects to those observed by Maser et al. (1988) and will increase the amount and quality of fish habitat compared to Alternative 3.

Fish populations--Solazzi et al. (1998) documented that wood additions to streams increase freshwater survival and smolt production of juvenile salmonids in Oregon coast streams, including tributaries to Five Rivers. Wood additions and upstream migration barrier removals (road decommissioning) under Alternatives 1 and 2 are expected to improve freshwater survival and production of juvenile salmonids.

Listed species--In the short term, actions under Alternatives 1 and 2 to restore watershed health may affect Oregon coast coho salmon or their habitat. I believe that Alternatives 1 and 2 are not likely to adversely affect coho salmon or their habitat. Fish biologists on the aquatic Coast Range Level 1 team and the National Marine Fisheries Service Biological Opinion (a project-file document) conclude that a more than negligible potential for take of Oregon coast coho salmon may be possible because of short-term increases in turbidity and sediment from road decommissioning, increased bank instability from adding wood to streams, and the risk of hitting coho when large wood is placed in streams. Thus, the biological opinion states that these actions are likely, in the short term, to adversely affect Oregon coast coho salmon. The Level 1 team, the Biological Opinion, and I agree that project actions are expected to benefit coho salmon and their habitat in the long term, however. Formal consultation with the National Marine Fisheries Service has been concluded.

Terrestrial species *(Paul Thomas)*

Because the planning area is outside the range or contains no suitable habitat for the Oregon silverspot butterfly, brown pelican, Aleutian Canada goose, Nelson’s sidalcea, western lily or western snowy plover, Alternatives 1, Alternative 2 and Alternative 3 will have no effect on these species.

Bald eagle--Because no bald eagles are nesting in the planning area, and nesting bald eagles are highly visible, felling mature conifers to place in streams is unlikely in areas currently used by nesting bald eagles. Stream restoration actions under Alternatives 1 and 2 that require 1,050 medium to large conifers, including about 30 from the bald eagle buffer, will not effect bald eagles. Additionally, because the proposed private-road, special-use permit is outside the bald eagle buffer, authorizing the building of 0.5 miles of new road under Alternatives 1 and 2 will not effect bald eagles. Alternative 3 will have no effect on bald eagles.

Northern spotted owl and marbled murrelet--Removing 1,050 medium to large conifers may affect the suitability of the area for spotted owls and marbled murrelets, as will the loss of 1.5 acres of mature habitat through road building authorized by a private-road, special-use permit. Removing 1,050 medium to large conifers is not considered adverse because the design criteria (such as the requirement to select trees along the edge of permanent openings) will protect owl and murrelet habitat. Even though the private-road, special-use permit will allow about 960 acres of suitable habitat to develop and function with fewer disturbances as a result of decommissioning 4.8 miles of road, it will affect 1.5 acres of mature habitat, causing risk of losing some suitable nest trees. Thus, based on the potential for accidental removal of or affects on undetected nest trees or birds under Alternatives 1 and 2, the loss of 1.5 acres of mature habitat may adversely affect spotted owls and marbled murrelets. Under Alternative 3, system road 3231, a 4.8-mile valley-bottom road would continue to provide access to the private property.

Depending on the season, noise associated with equipment use and Forest travel can disturb the breeding behavior of nesting spotted owls and marbled murrelets. Watershed restoration activities between July 8 and September 30 would not adversely affect spotted owls. Disturbances associated with using a large helicopter (like a Chinook) late in the breeding season (after September 15) are considered likely to adversely affect spotted owls from the intensity of the noise and the wind disturbance associated with rotor wash. Noise from equipment use for restoration activities may also adversely affect marbled murrelets between July 8 and August 5. Between August 6 and September 15, the effect from such noise on marbled murrelets is not considered adverse. After September 15, disturbance associated with watershed restoration is not considered to affect marbled murrelets.

Predicted Effects of Actions To Provide Timber from Matrix Lands

Commodity production is associated with the matrix land allocation. Timber produced from thinning would be 7 million board feet for Alternative 1 and 6 million board feet for Alternative 2. Under Alternative 2, these numbers are expected to decrease as additional roads fail. In the project area, all units proposed for commercial thinning that contain designated matrix, also include the late-successional or riparian reserve designation within their boundaries. Therefore, the environmental consequences associated with commercial thinning to meet the need for commodities are the same as those actions required to meet the need for increased late-successional habitat in late-successional and riparian reserves. Under Alternative 3, matrix lands would continue to develop as dense, single-story Douglas-fir plantations. Because the stands would not develop the structure and size that thinned stands of a similar age will (table 12), the value and return on previous investments made to manage these lands for timber production would be reduced.

Cumulative Effects (*The Team*)

Alternatives 1 and 2

The Council on Environmental Quality defines cumulative effects on the environment as those that result from the incremental actions of a proposal added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes them (40 CFR 1508.7).

For purposes of analyzing cumulative effects, the geographic area potentially affected by the alternatives is the 37,000-acre Five Rivers watershed. The Five Rivers watershed includes eight subwatersheds and forms the western half of the Lobster-Five Rivers fifth-field watershed. The Team considered the need to extend the geographic area for each of the affected resources, but we believed that effects were not meaningful or measurable beyond the Five Rivers watershed.

The analysis provided for each alternative and resource area reflects the sum of most planned actions on federal lands in the near future, including the effects from changes in the transportation system for Forest users and adjacent landowners. Other likely future actions on federal lands in the Five Rivers Landscape Management Project area include ongoing road maintenance and repair of ATM roads, and harvesting of special forest products such as firewood, salal, swordfern, and moss.

On nonfederal land, which comprises 13% of the project area, the Team expects private landowners to continue current practices and uses of their land and no changes to current county and state land-use regulations. Current uses include farming, livestock grazing, limited non-industrial timber harvesting, and industrial timber harvesting. Based on local industrial timber management objectives and practices, we expect harvest activities on industrial lands (about 3% of the project area) before those stands reach 80 years of age. Currently**,** these stands range from about 5 to 50 years of age, with most younger than 25 years.

Under this project, cooperative actions with private landowners are proposed for the near future that include placing large wood in Crab Creek and Buck Creek and riparian planting near these two creeks (maps 2, 4).

Cumulative effects are measured relative to the baseline conditions described in chapter 3. Where specific effects are not described for a particular resource, cumulative effects are not expected to be measurably different from those under baseline conditions. Proposed actions under Alternatives 1 and 2 are expected to have the following effects:

> Knowledge--The study areas represent small landscapes in which the cumulative effects of multiple projects can be studied over time. Four replications of the three pathways across the landscape strengthen the study design and assure an accelerated cumulative increase in knowledge over time.

Soils--Reopening existing roads, using roads, and decommissioning roads will increase sedimentation in the short term. Abandoning roads under alternative 2 would continue to add sediment at a rate about equal to existing conditions except where future failures increase local sedimentation. Stabilizing and closing reopened roads and closing and decommissioning other roads will reduce sedimentation in the long term. Alternative 1--and to a lesser extent Alternative 2--would cumulatively reduce sedimentation.
Stream flow--Thinning managed stands will not measurably increase peak, storm, or low flows under either alternative. Closing and decommissioning roads will reduce peak and storm flows resulting in a net cumulative decrease over the long term.

Water quality--Thinning managed stands is unlikely to have any measurable effect on stream temperature; road decommissioning, adding large wood in streams, and riparian planting are likely to improve watershed function and lower stream temperatures resulting in a cumulative decrease in temperature.

Fire--Thinning managed stands is expected to increase fuel loading and associated wildfire risk in the short term (3-5 years). By reducing public access, however, road decommissioning and closure will cumulatively reduce the risk of human-caused fire ignition in the long term. Although fire suppression response time will increase where roads are closed, the cumulative effect on wildfire risk over time will be reduced.

Heritage resources--Thinning managed stands and road actions will have minimal risk because actions are on previously disturbed ground. Building a new road to access private land and adding large wood in streams will increase the potential for affecting undiscovered sites. Adverse cumulative effects are not expected.

Recreation--Closing and decommissioning roads will cumulatively shift the recreation experience from motorized to nonmotorized.

Scenery--All actions will be consistent with the scenic quality objectives for the planning area. By speeding the growth and development of trees in plantations, thinning actions are expected to move landscape scenic conditions to a less fragmented, more natural forest setting sooner.

Public and management access--Closing and decommissioning roads across the watershed will reduce public and management vehicle access to public lands for several activities including recreation, hunting, and special forest products gathering. Road maintenance costs will be reduced and limited maintenance funds will be shifted to maintaining the ATM road system.

Forest stand conditions--Thinning managed stands will speed the development of late-successional forest characteristics across about 3,200 acres (commercial thinning stands) and 2,366 acres (precommercial thinning stands). These changes will reduce fragmentation and accelerate development of late-successional forest characteristics.

Aquatic species--When viewed as a whole, all proposed actions are likely to have minor adverse effects on aquatic species during project implementation and up to 2 years later. In the long term, net improvements to aquatic habitat are expected to accrue with reduced sedimentation and risk of failure from roads, accelerated growth of trees in managed stands, input of large wood, and reductions in stream temperature. These actions are expected to significantly benefit aquatic species.

Terrestrial species (listed, sensitive, survey-and-manage)--In the short term, disturbances from noise, road work, adding large wood to streams, and thinning managed stands are likely to have minor adverse effects on all terrestrial species to some degree. The dispersal in timing and distribution of these actions across the watershed, however, are such that impacts are expected to be localized and not lead to adverse cumulative effects. In the long term, accelerated development of late-successional forest conditions is expected to cumulatively benefit species dependent on these conditions. Habitat for species dependent on early-seral conditions will be reduced as decommissioned roads and other forest openings become forested over time, except for openings that are created and/or maintained as early-seral habitat.

Alternative 3

Taking no action, Alternative 3 will follow resource trends described in chapter 3. Short term cumulative effects will be limited to noise disturbance from maintaining and repairing ATM roads. In the long term, knowledge gained will be limited and slow to accrue. Sedimentation from non-ATM roads will increase as roads deteriorate from lack of maintenance; peak and storm flows will remain about the same as the current condition; shading and large wood for streams will take longer to develop before temperatures will be reduced; watershed function will not be improved because of continued use of nearly the entire road network; fire response time will increase as roads fail or roadside vegetation grows and closes roads naturally; recreation experiences will become more nonmotorized as roads close naturally; landscape scenic conditions will take longer to achieve a more natural setting; public and management access and road maintenance costs will remain unchanged, except where roads fail; late-successional forest conditions in managed stands will take longer to develop; aquatic species habitat recovery will depend on natural processes and take much longer; habitat preferred by species dependent on late-successional forest will take longer to develop; mid-seral species habitat will remain on the landscape longer; and habitat preferred by early-seral species will gradually decline as trees encroach on existing meadows and other forest openings.

In summary, considering other ongoing and likely actions on federal and private lands in the Five Rivers watershed, Alternatives 1 and 2 are expected to reduce the adverse cumulative effects of past actions on the landscape, thereby accruing net beneficial cumulative effects for most resources. The cumulative effects are generally beneficial over time and an improvement over existing conditions.

Consistency with Aquatic Conservation Objectives *(Jack Sleeper and Paul Thomas)*

Alternatives 1 and 2

We have evaluated the consistency of all actions under Alternatives 1 and 2 with the nine aquatic conservation strategy objectives of the Northwest Forest Plan. Project activities will not retard or prevent attainment of any of the strategy’s objectives. We have concluded the following for each objective:

Objective 1--Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.

Plantation thinning, road decommissioning, and wood additions to streams will accelerate developing late-successional forest and improving watershed conditions. Thinning will increase the rate of development of large conifers in riparian and upslope areas, understory complexity, and species diversity, which will help restore watershed and landscape features.

Objective 2--Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.

Spatial and temporal connectivity in and between watersheds will be improved through thinning plantations, decommissioning roads, and adding wood to streams. Thinning will accelerate the rate at which plantations become mature stands and increase the connectivity among existing mature stands. Road decommissioning will reconnect about 85 stream channels, allowing unobstructed passage of sediment, wood, and terrestrial and aquatic species. Wood additions will increase the degree of connectedness among stream channels and their floodplains. Improved connectivity will allow aquatic and riparian-dependent species better access to and between refugia to allow diverse life-history types to develop.

Objective 3 --Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

Design criteria for all activities will prevent adverse effects to the physical integrity of the aquatic system. Road decommissioning will reduce management-related sediment inputs in the long term and restore the function of natural process that deliver sediment and wood. Large-wood additions will restore sediment routing and riparian vegetation process that develop the physical integrity of the aquatic system.

Objective 4--Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Water quality will be maintained by variable-width, no-harvest buffers adjacent to all stream channels and wetlands in thinning units. In the long term, thinning, decommissioning roads, and adding wood to streams are expected to improve water quality faster than would the no-action alternative.

Objective 5--Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Plantation thinning is designed to prevent increases in management-related landslides and surface erosion. Thinning is designed to avoid naturally unstable areas. Short-term increases in fine-sediment production associated with road building, rebuilding, haul, and decommissioning, and with wood additions will be minor. Decommissioning roads, closing roads, and adding wood will help restore the natural sediment regime.

Objective 6--Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

Plantation thinning is not expected to result in measurable changes in streamflow. In the long term, thinning, decommissioning and closing roads, and adding wood will restore stream flows to a more natural regime.

Objective 7--Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

In the short term, large wood additions and road decommissioning and closure will restore the timing, variability, and duration of floodplain inundation and water-table elevation. In the long term, plantation thinning will increase the rate that large conifers are developed in riparian areas, which will increase the future supply of large wood to stream channels. Increasing the future supply of large wood to stream channels is needed to restore attributes of this objective.

Objective 8--Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.

Thinning plantations, planting an understory, creating snags and coarse woody debris, and planting and release in the riparian zone will restore species composition and structural diversity of plant communities in riparian areas. Large, standing conifers, large downed wood, multilayered canopies, and species diversity will be improved by these activities.

Objective 9--Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

All activities are designed to restore natural processes that develop habitat for native riparian-dependent species.

Alternative 3

The Lobster-Five Rivers Watershed Analysis identified existing adverse watershed conditions, listed on page 4 of this EIS. Taking no action, Alternative 3 would rely on natural processes, which are expected to take much longer than Alternatives 1 and 2 to correct these conditions.

Where roads are affected by natural hydrological processes, they may fail. Watershed health will remain degraded or subject to periods of degradation from road failure until natural processes have removed sediments associated with road fills. Because current watershed conditions will not be maintained or improved and road fill is expected to remain in the watershed for tens to hundreds of years, Alternative 3 is not expected to meet the objectives of the Northwest Forest Plan's aquatic conservation strategy.

Short-Term Uses and Long-Term Productivity (*The Team*)

The use or protection of natural resources for long-term sustained yield is the legislated basis of management and direction for the Forest Service (USDA, USDI 1994a, p. 321). Short-term uses include actions such as commercial thinning, road decommissioning, and stream enhancement. The design criteria were developed to incorporate the standards and guides of the Siuslaw Forest Plan as amended by the Northwest Forest Plan. We expect that applying them to the proposed management actions will reduce the potential for long-term loss in productivity of forest soils that may result from short-term uses. They will also allow for the long-term development of late-successional habitat and restoring aquatic ecosystems.

Unavoidable Adverse Effects (*The Team*)

Implementing any alternative would result in some adverse environmental effects that cannot be avoided. The design criteria, along with Forest standards and guides, are intended to keep the extent and duration of these effects within acceptable rates, but adverse effects cannot be completely eliminated. The following adverse environmental consequences would be associated to some extent with all alternatives:

- Short-term reduction in air quality from dust, smoke, and vehicle emissions resulting from management actions and forest users.
- Temporary increase in fire hazard from waste material left on the ground from commercial thinning, precommercial thinning, and brush release actions.
- Disturbance to wildlife when their habitat is disturbed by management actions or recreation activities.
- Decrease in habitat for wildlife species dependent on early seral forest conditions.
- Temporary increase in large vehicle traffic during commercial thinning operations.
- Loss of vehicular access through the Forest as roads fail, grow closed, are physically closed, or decommissioned.

Irreversible Resource Commitments (*The Team*)

Irreversible commitments of resources are actions that disturb either a nonrenewable resource (for example heritage resources) or other resources to the point that they can only be renewed over 100 years or not at all. The design criteria--along with Forest standards and guides--are intended to reduce these commitments, but adverse effects cannot be completely eliminated. For example, the continued use of existing roads that access the Forest is an irreversible commitment of the soil resource because of the long time needed for a road to revert to natural conditions.

Irretrievable Commitment of Resources (*The Team*)

An irretrievable commitment is the loss of opportunities for producing or using a renewable resource for a period of time. Almost all activities produce varying degrees of irretrievable resource commitments. They parallel the effects for each resource discussed earlier in this chapter. They are not irreversible because they could be reversed by changing management direction. The following irretrievable commitments of resources would be associated to some extent with all alternatives:

- ⇨ Loss of timber volume production in matrix lands in study Pathway A, where timber management is prohibited or restricted and early seral forest is created and maintained.
- ⇨ Loss of soil productivity as a result of new and reopened temporary roads and landings.
- ⇨ Loss of vehicular access through the Forest as roads are closed or decommissioned.

Environmental Justice (*Denise Lach, Bruce Buckley*)

McGinnis et al. (1996) found that the average per capita income in Lane and Lincoln counties are slightly below the average for the state of Oregon. Weber and Bowman (1999) found that the Lincoln County portion of the project area has a poverty rate of 9 to 13.6%; the Lane County portion has a poverty rate of 11 to 14.8%. These rates are in the average range for Oregon. Based on local knowledge, small pockets of low-income populations live in the planning area. Farming, hunting, firewood gathering, and brush picking are primary subsistence activities. Domestic-use water systems include individual wells and spring-fed systems.

Decommissioning road 32 will be postponed until another major slide again closes the road to vehicle traffic or unless Lane County accepts a public road easement to maintain the road. Decommissioning will adversely affect some of the residents in the southern portion of the planning area who travel to Eugene, Florence, or Mapleton for medical services or supplies. To mitigate this action, an alternate access route using Forest Service roads 3505 (Summers Creek road), 3509, 3510, and 3259 will be improved and maintained primarily as a secondary high-clearance route (maps 3 and 5). Although the alternate route will increase commuting distance by about 2 to 3 miles, depending on residence location, we expect it to be more reliable during periods of heavy rains, given the maintenance histories of the alternate route and road 32.

None of the proposed actions are expected to physically affect farms or water quality of domestic-use water systems. Although road decommissioning and closure actions will reduce access to areas that provide shrubs harvested by brush pickers, thinning of plantations will mitigate this loss somewhat by improving conditions for growth and development of these shrubs. Some proposed actions will provide opportunities for jobs and firewood gathering. Maintaining early-seral habitat and thinning plantations will help provide forage for big game.

In summary, effects of alternatives on the human environment (including minority and low-income populations) are expected to be similar for all human populations regardless of nationality, gender, race, or income. No disproportionately high and adverse human health or environmental effects on minority populations and low-income populations are expected as a result of implementing actions described for Alternatives 1 and 2.

Other Disclosures

Based on the Team's evaluation of the effects, we concluded:

- ⇨ The energy consumption associated with the action alternatives is not significant to national and global petroleum reserves.
- ⇨ Minority groups, women, and consumers may benefit from employment opportunities that action alternatives will provide; the no-action alternative would have neither adverse or beneficial effects. None of the alternatives adversely affects civil rights. All contracts that may be awarded as a result of implementation would meet equal employment opportunity requirements.
- ⇨ None of the proposed actions will affect known prehistoric or historic sites. As outlined in the American Indian Religious Freedom Act, no effects are anticipated on American Indian social, economic, or subsistence rights.
- ⇨ No adverse effects on wetlands and flood plains are anticipated. No farm land, park land, or range land will be affected.
- ⇨ No urban or built environment would be affected by the action alternatives.
- ⇨ All alternatives were designed to conform to applicable laws and regulations pertaining to natural or depletable resources, including mineral resources. The proposed source of aggregate for use on roads is the Klickitat quarry in the Upper Buck Creek subwatershed. Removing aggregate for road use proposed under the action alternatives will contribute to the depletion of aggregate at the quarry. The long-term demand for aggregate is expected to decrease as roads are closed or decommissioned.
- ⇨ This environmental impact statement is tiered to the Siuslaw Forest Plan, as amended by the Northwest Forest Plan, and is consistent with those plans and their requirements.

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Glossary

Most definitions of the terms in this glossary were taken from, or adapted from, the glossaries of the following documents:

- Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl, (USDA, USDI 1994a).
- Forest Ecosystem Management: An Ecological, Economic, and Social Assessment (USDA, USDI et al. 1993); and
- Forest Stand Dynamics: Update Edition, (Oliver and Larson 1996).

Abandoned road--To cease all maintenance, repair, and capitol improvement expenditures of a Forest-development road upon an event that lends the travelway inaccessible to vehicles beyond normal maintenance procedures to reopen.

Access and travel management (ATM) roads--Forest-development roads managed under one of the following categories established by the Siuslaw Access and Travel Management Guide (September 1994):

- Primary forest road, all highway vehicle travel is encouraged;
- Secondary forest road (low clearance), passenger car travel acceptable; or
- Secondary forest road (high clearance), passenger car use is discouraged.

Adaptive management--Changing practices based on management activities that are planned, monitored, and evaluated, with learning considered along with resource objectives. Because learning from forest practices often takes many years, adaptive management must initially focus on providing information for future decisions. Adding aspects of the scientific method to management practices can increase confidence in the interpretation of outcomes.

Aquatic ecosystem--Any body of water, such as a stream, lake, or estuary, and all organisms and nonliving components within it, functioning as a natural system.

Best management practices (BMP)--Methods, measures, or practices designed to prevent or reduce water pollution or other environmental damage.

Biodiversity--The variety of life forms and processes, including a complexity of species, communities, gene pools, and ecological functions.

Biological opinion--The document resulting from formal consultation with the U.S. Fish and

Wildlife Service or the National Marine Fisheries Service, stating a finding about whether a federal action is likely to jeopardize the continued existence of listed species or result in destroying or adversely modifying critical habitat.

Canopy closure--The degree to which the canopy (the forest layers above people's heads) blocks sunlight or obscures the sky.

Classified road--A road in National Forest system lands planned or managed for motor vehicle access, including state, county, and private roads, as well as permitted and Forest-development roads.

Closed road--A road on which vehicle traffic has been excluded (year-long or seasonal) by natural blockage, barricade, or by regulation. A closed road can still operate and remains on the Forest-development transportation system (see "decommissioned road").

Coarse woody debris--Portions of a tree usually at least 20 inches in diameter that has fallen or been cut and left in the woods.

Code of Federal Regulations (CFR)--A codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the federal government.

Commercial thinning--The removal of generally merchantable trees from an even-aged stand, usually to encourage growth of the remaining trees.

Conservation strategy--A management plan for a species, group of species, or ecosystem that prescribes standards and guidelines which, if implemented, provide high likelihood that the species, groups of species, or ecosystem, with its full complement of species and processes, will continue to exist, well-distributed, throughout a planning area.

Critical habitat--For listed species, specific parts of the geographic area occupied by a federally listed species that have physical and biological features essential to conserving the species, and that may require special management consideration or protection; also specific areas outside the geographical area occupied by a species but essential for its conservation. Designated critical habitats are described in 50 CFR 17 and 226.

Crown--The upper part of a tree that carries the main system of live branches and foliage.

Crown ratio--The percentage of total tree height comprising live branches and foliage.

Debris flow--A rapidly moving mass of rock fragments, soil, and mud, with more than half of the particles larger than sand.

Decommissioned road--A road closed and removed from the ATM system, usually by removing unstable portions of embankments, partially or completely removing stream-crossing culverts and accompanying fill material, decompacting road surfaces, water-barring roadbeds, seeding to reduce erosion and provide forage, and closing road entrances (see “closed road”).

Developed recreation--Recreation that requires facilities, resulting in concentrated use of an area, such as for a campground. Facilities might include roads, parking lots, picnic tables, toilets, drinking water, and buildings.

Dispersed recreation-- Recreation use outside developed recreation sites, including activities like hunting, fishing, scenic driving, hiking, bicycling, horseback riding, and recreation in primitive environments.

Ecosystem management--At the core of ecosystem management is the idea that ecosystems are complex assemblages of organisms interacting with their environment and changing in complex ways over time. Science-based knowledge of how ecosystems work is important to managing forests to maintain their biodiversity and long-term productivity. The first step has often been to reallocate or rezone forests to meet new primary objectives. Concepts of joint production are emerging, however, that attempt to manage for multiple objectives, with no single objective considered primary, and focusing on finding compatible groupings of objectives where possible. An alternative concept to reallocation being proposed and tested is disturbance-ecology-based management. This idea centers on the concept that organisms are more adapted to the historical disturbance patterns than to specific successional states, and that management could more closely emulate natural disturbances and ecosystem responses to disturbance, as a way to maintain diversity and long-term productivity and at the same time continue limited resource extractions.

Floodplain--Level lowland bordering a stream or river onto which the flow spreads at flood stage.

Forest-development road--A forest road under the jurisdiction of the Forest Service.

Forest ecosystem--The entire assemblage of organisms (trees, shrubs, herbs, bacteria, fungi, and animals, including people) together with their environmental substrate (the surrounding air, water, soil, organic debris, and rocks), interacting inside a defined boundary. Because ecosystem boundaries are arbitrarily set as a research tool, they can be defined at many scales, from a leaf surface to the entire planet. Forest ecosystems are often studied in bounded watersheds draining to a monitored stream.

Fragmentation--Reducing size and connectivity of stands that compose a forest.

Fuel--Live or dead vegetation available for consumption by fire.

Hardwoods--A term used to describe the deciduous trees known to occupy the project planning area, including red alder, Oregon bigleaf maple, cascara, and wild cherry.

Heritage resource--The remains of sites, structures, or objects resulting from past human activity that have important sociocultural value, whether historic, prehistoric, archaeological, or architectural. For this project, "heritage resource" refers only to actual physical things--places, structures, or artifacts that are material evidence of a past way of life--rather than to traditions, customs, or modern life styles. Heritage resources are fragile and nonrenewable; their values, once destroyed, cannot be recreated.

Heritage site--Any definite place of past human activity with important sociocultural value--historic, prehistoric, archaeological, or architectural--identifiable through field survey, historical documentation, or oral evidence.

Inoculation--Introducing a native heart-rot fungus to a selected tree for the purpose of producing "soft-core" snag characteristics at an early age as the tree continues to grow.

Known pairs or resident singles (owls)--Northern spotted owl activity centers identified as of January 1, 1994.

Knutson-Vandenberg (KV) Act--This act--created in 1930 and later amended by the National Forest Management Act of 1976--is the authority for requiring purchasers of National Forest timber to make deposits to finance primary actions (**essential KV** actions) that ensure reforestation of harvested areas and secondary actions (**non-essential KV** actions) to enhance tree health and growth in stands, wildlife habitat, watershed health, fish habitat, and recreation.

Landing--Any place on or adjacent to the logging site where logs are collected for further transport.

Landscape--A heterogeneous land area with interacting ecosystems repeated in similar form throughout.

Large woody debris--Pieces of wood larger than 10 feet long and 6 inches in diameter, in a stream channel.

Late-successional forest--Forest in the seral stages that include mature and old-growth age-classes.

Late-successional reserve--A mature or old-growth forest reserved under the record of decision for the Northwest Forest Plan.

Listed species--Those species listed in the Federal Register as threatened or endangered.

Management pathway-- An alternative means to achieve a common goal--in this document, the goals of the Northwest Forest Plan.

Mature conifer stand--A mappable stand of trees for which the annual net rate of growth has peaked. Stands are generally older than 80-100 years and younger than 180-200 years. Stand age, diameter of dominant trees, and stand structure at maturity vary by forest cover types and local site conditions. Mature stands generally contain trees with smaller average diameter, less age-class variation, and less structural complexity than do old-growth stands of the same forest type.
Matrix--Federal lands outside reserves, withdrawn areas, and managed late-successional areas and primarily managed for timber harvest.

Mitigation measures--Modifications of actions to avoid adverse effects by not taking a certain action or parts of an action; minimizing adverse effects by limiting the scope or intensity of the action; rectifying adverse effects by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating adverse effects over time by preserving and maintaining operations during the life of the action; or compensating for adverse effects by replacing or providing substitute resources or environments.

Monitoring--A process of collecting information to evaluate whether the objective and anticipated or assumed results of a management plan or project are being realized or whether projects are being implemented as planned.

Multistoried--Forest stands that contain trees of various heights and diameter classes and therefore support foliage at various heights in the stand's vertical profile.

Non-ATM roads--Forest-development roads managed under the Siuslaw Access and Travel Management Guide's designation as "other forest road", including short-term, project, or special-use roads. These roads will receive various degrees of maintenance, depending on their current use or nonuse. Some roads will be closed for safety, some for resource protection.

Noxious weed--A plant specified by law as being especially undesirable, troublesome, and difficult to control.

Old-growth forest--A forest stand usually at least 180 or more years old, with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood; numerous large snags; and heavy accumulations of wood, including large logs on the ground.

Operator spur--A temporary road built by a timber-sale operator to access landing sites. Construction is administered by the timber-sale administrator.

Overstory--Trees that provide the uppermost layer of foliage in a forest with more than one roughly horizontal layer of foliage.

Peak flow--The highest amount of stream or river flow in a year or from a single storm event.

Precommercial thinning--Cutting and leaving some of the trees less than merchantable size in a stand so that remaining trees will grow faster.

Quarter-township--An area about 3 miles square containing nine sections of land.

Road maintenance--Ongoing minor restoration and upkeep of a road necessary to retain the road's approved traffic service level.
Riparian area--A geographic area containing an aquatic ecosystem and adjacent upland areas that directly affect it; it includes floodplain, woodlands, and all areas within a horizontal distance of about 100 feet from the stream channel's normal high-water line or from the shoreline of a standing body of water.

Riparian reserve--Designated riparian areas outside late-successional reserves and reserved under the record of decision for the Northwest Forest Plan.

Ripping--The process of breaking up or loosening compacted soil from temporary roads and landings to better assure penetration of roots of forest vegetation.

Sensitive species--Species mentioned in the Federal Register as proposed for classification or under consideration for official listing as endangered or threatened species, on an official state list, or recognized by the Forest Service or other management agency as needing special management to prevent their being placed on federal or state lists.

Seral--A biotic community that is a developmental, transitory stage in an ecological succession.

Site productivity--The ability of a geographic area to produce biomass (total quantity of living organisms), as determined by conditions (for example, soil type and depth, rainfall, temperature) in that area.

Snag--Any standing dead, partially dead, or defective tree at least 10 inches in diameter at breast height and at least 6 feet tall.

Soil compaction--An increase in bulk density (weight per unit volume) and a decrease in soil porosity resulting from applied loads, vibration, or pressure. The actual physical change is primarily reduction of noncapillary pore space, which in turn reduces infiltration, permeability, and gaseous exchange.

Soil displacement--The removal and horizontal movement of soil from one place to another by mechanical forces such as a bulldozer blade.

Special forest products--Forest products sold for commercial use such as fern, salal, and moss; also others offered for personal use such as shrubs for transplanting, Christmas trees, and firewood.

Stand (tree stand)--An aggregation of trees occupying a specific area and sufficiently uniform in composition, age, arrangement, and condition to be distinguishable from the forest in adjoining areas.

Stand diversity--The diversity in stands measured by the variety of tree and shrub species, tree ages and sizes, and structure.

Standards and guides--The primary instructions for public land managers. Standards address mandatory actions, and guides are recommended actions necessary to a land management decision.

Stand exams--An inventory process used to determine stand composition including the amount and type of tree and shrub species, tree heights and diameters, and stand structural components.

Stream class--A US Forest Service classification system: class I--perennial or intermittent streams used by many fish for spawning, rearing, or migration; used domestically; or are major tributaries to other class I streams; class II--perennial or intermittent streams used by moderate numbers of fish for spawning, rearing or migration; or are tributaries to class I and II streams; and, class III--all other perennial streams not meeting the criteria for class I and II streams.

Stream order--A hydrologic system of stream classification: each small, unbranched tributary is a first-order stream; two-first order streams join to make a second-order stream; each third-order stream has only first- and second-order tributaries, and so forth.

Stream reach--An individual first-order stream or a segment of another stream that has beginning and ending points at a stream confluence. Reach points are normally designated where a tributary confluence changes the channel character or order. Stream reaches are normally 0.5 to 1.5 miles long.

Structural diversity--The diversity of forest structure, both its horizontal and vertical elements, that provides a variety of forest habitats resulting from layering or tiering of the canopy and the die-back, death, and ultimate decay of trees.

Structure--The various horizontal and vertical physical elements of the forest including trees, canopy layers, snags, and coarse woody debris.

Subsoiling--The process of breaking up or loosening compacted soil from temporary roads and landings to help restore productivity of forest soils.

Subwatershed--A land area (basin) bounded by ridges or similar topographic features, encompassing only part of a watershed.

Succession--Forest succession is a sequence of changes in the plant species composition (with associated animals and microbes) and stand structures over time, at a stand or larger scale--without major external disturbances like wind and fire that restart the sequence. Natural successional sequences are thought to have predictable patterns of development, and in the Pacific Northwest are thought to begin with disturbance-adapted species, move to dense conifers that exclude understory vegetation, and often end in late-seral stages (with large trees, canopy gaps, understory vegetation, logs, snags). An anomaly for the Pacific Northwest is Douglas-fir, where an individual tree can persist in all stages. New research is pointing out that natural disturbances are more diverse than previously thought, leading to more diverse and complex patterns of development than had been recognized. Also, natural disturbances are more often being found that reset the sequence more frequently than previously recognized.

Survey-and-manage species--Species listed in the record of decision (table C-3) for the Northwest Forest Plan; in this document, those with ranges in the Five Rivers watershed.

System road--A road in the National Forest necessary to protect, administer, or use the Forest or it resources.

Temporary roads--Short-term-use roads--not part of the permanent road system--reopened or built to accomplish a management objective, such as thinning older plantations or maintaining meadows. After the project is completed, these roads may be decompacted and water barred, stream-crossing culverts and fills removed (if any), and road entrances barricaded (if necessary).

Threatened species--Those plant or animal species likely to become endangered throughout all or a significant portion of their range in the near future. A plant or animal identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.

Unclassified road--A road not intended to be part of, and not managed as part of, the National Forest transportation system such as a temporary road, an unplanned road, an off-road vehicle track, and an abandoned travelway.

Underplant--A management activity designed to create a second-story stand and to enhance species diversity in homogeneous stands such as older plantations.

Understory--Trees and other woody species growing under the canopies of larger adjacent trees and other woody growth.

Water bar--A berm or ditch-and-berm combination that cuts across roads at an angle so that all surface water running on the road and in the road ditch is intercepted and deposited over the outside edge of the road. Water bars normally allow high-clearance vehicles to pass.

Watershed--The drainage basin contributing water, organic matter, dissolved nutrients, and sediments to a stream or lake.

Watershed analysis--A systematic procedure for characterizing watershed and ecological processes to meet specific management and social objectives. Watershed analysis provides a basis for ecosystem management planning to be applied to watersheds of about 20 to 200 square miles.

Wildfire--Any wildland fire that does not meet management objectives, thus requiring a fire-suppression response. Once a fire is declared wild, it is no longer considered a prescribed fire.

Yarding--The removing of logs from the stump to a central concentration area or landing.

List of Preparers

The Team

Name, Experience (years) and Education	Primary Responsibilities
Bruce Buckley (27) BS, general science	Project design criteria, unit summary tables, harvest systems, economic analysis
Courtney Cloyd (24) BA, geology	Soils and hydrologic effects, temporary and system roads stability assessment
Dan Mummey (25) BS, civil engineering	Access and travel-management tables and effects
Ed Obermeyer (30) BS, forestry management	Silvicultural prescription and effects
Jack Sleeper (16) BS, wildlife; MS, fisheries	Fisheries effects
Paul Thomas (24) BS, fisheries and wildlife	Team leader, wildlife biological assessment, wildlife effects

Contributors

The following personnel also contributed to developing this final EIS:

Kathy Barry	US Fish and Wildlife representative
Bernard Bormann	Study plan, format consultant
Martha Brookes	Writing, editing consultant
Mike Clady	Fisheries biological assessment
Jessica Dole	Scenery effects
Jerry Eaton	Temporary roads and landings reviewer
Barbara Ellis	Geographical information support
Martha Jensen	US Fish and Wildlife representative
Stu Johnston	Stand-exam information manager
Denise Lach	Social-issues guide
Ken McCall	Recreation-heritage resource report
Jan Robbins	Water Quality Restoration Plan

Owen Schmidt	Legal advice, process consultant
Dan Segotta	Botanical resource report
Craig Snider	NEPA guide
Eric Stolsig	Stand exam, survey-and-manage surveys coordinator
Doris Tai	Process guide, public-involvement coordinator

List of People, Organizations, and Agencies Who Were Sent Copies of This EIS

People

Peter Alford
Dick Beers
Jack Brandis, Jr.
Daniel Dillon
Leah Donivan
Rennie Ferris
Connie Field
Roger Frederick
Walter Haswell
Kelly Hockema
George Ice
Dorothy Josellis
Peter Karassik
Bill Kenitzer
John Kirkham
Daniel Krueger
Connie Lonsdale
Mike Morgan
Evelyn Murry
Neil Phillips
Wayne Phillips
JoAnne Quinn
Mauricio Ribera
Dana Salsbery
Louis Swing
Steve Trask
Craig Whedon

Organizations

Alsea Watershed Council
Coast Range Association
Confederated Tribes of Coos, Lower Umpqua & Siuslaw
Confederated Tribes of Siletz
Consumers Power, Inc.
Corvallis Area Forest Issues Group
Forest Guardians
Mid Coast Watershed Council
Northwest Environmental Defense Center
Northwest Hardwoods
Oregon Natural Resources Council
Oregon Shores Conservation Coalition
Pioneer Telephone Cooperative
Rocky Mountain Elk Foundation
Roseburg Resources Company

Federal Agencies

Advisory Council on Historic Preservation

Western Office of Review
Lakewood, CO

U.S. Department of Agriculture

OPA Publication Stockroom
Washington, DC

Deputy Director
BBEP, EAD (unit 149)

Animal & Plant Health Inspection Service
Riverdale, MD

Office of Equal Opportunity
Washington, DC

National Resource Conservation Service
Environmental Coordinator of Ecological Sciences Division
Washington, DC

Policy and Planning Division
Office of Civil Rights
Washington, DC

National Agricultural Library
Head, Acquisitions and Serials Branch
Beltsville, MD

Forest Service
Pacific Northwest Region
ATTN: Environmental Coordination
Portland, OR

U.S. Department of Commerce

Director, Ecology and Conservation Office
Washington, DC

National Marine Fisheries Service
Habitat Conservationists Division
Northwest Region
Portland, OR

U.S. Department of Defense

U.S. Army Engineers Division
North Pacific, CEND
Portland, OR

Naval Oceanography Division
U.S. Naval Observatory
Washington, DC

U.S. Department of Energy

Director, Office of Environmental Compliance
Washington, DC

Environmental Protection Agency

EIS Review Coordinator
Seattle, WA

Federal Aviation Administration

Northwest Region
Office of the Regional Administrator
Renton, WA

Federal Energy Regulatory Commission

Advisor on Environmental Quality
Environmental Compliance Branch
Washington, DC

Federal Highway Administration

Region 10, Regional Administrator
Portland, OR

General Services Administration

Office of Planning and Analysis
Washington, DC

U.S. Department of Housing and Urban Development

Roy Fcholl
Portland, OR

U.S. Department of Interior

Director, Office of Environmental Policy and Compliance
Washington, DC

Bureau of Land Management
Coos Bay, OR
Tillamook, OR
Salem, OR
Eugene, OR

Fish and Wildlife Service
Portland, OR
Service Transportation Board

Chief, Energy and Environment
Washington, DC

Northwest Power Planning Council

Portland, OR

U.S. Department of Transportation

Assistant Secretary for Policy
Washington, DC

Oregon Natural Resource Agencies

Department of Environmental Quality (Air)
Portland, OR

Department of Environmental Quality (Water)
Portland, OR

Department of Fish and Wildlife
Corvallis, OR

Department of Fish and Wildlife

Habitat Conservation Division
Portland, OR

Department of Geology and Mineral Industries
Portland, OR

Department of Land Conservation and Development
Portland, OR

Division of State Lands
Salem, OR

Executive Department
State Economist
Salem, OR

Forestry Department
Salem, OR
Toledo, OR
Governor's Forest Advisor
Salem, OR

Parks and Recreation Department
Planning and Development Section
Salem, OR

Rural Development Section
Salem, OR

Water Resources Department
Salem, OR

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Waldport Library
Waldport, OR

Counties

Lane County Department of Public Works
Eugene, OR

Lincoln County Road Department
Newport, OR

Lincoln Soil and Water Conservation District
Newport, OR

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Appendix A

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

Pacific Northwest Research Station
Ecosystem Processes Program

Plan For the
Five Rivers Landscape Management Study

Prepared by
B. Bormann, P. Cunningham, P. Thomas, M. Brookes, B. Buckley, C. Cloyd, M. Jensen, J. Linares, D. Mummey, E. Obermeyer, J. Sleeper, and C. Snyder

Bernard T. Bormann
Team Leader

Approve:

Hermann Gucinski
Program Manager

Introduction

In this study plan, we describe a management study proposed as an integral part of the final Five Rivers Landscape Project Environmental Impact Statement (EIS). The management study is the primary method the Forest Service will use to meet the need for learning identified in the EIS (EIS, page 2): “Not enough is known for people to agree on a single approach to meet the goals of the Northwest Forest Plan, partly a result of ineffective past monitoring strategies. Especially poorly known is how plantations, riparian zones, and roads can be efficiently managed together through time.” This study plan has been officially peer-reviewed; a reconciliation report is on file at the Forestry Sciences Laboratory, 3200 SW Jefferson Way, Corvallis, OR.

The Five Rivers EIS covers 16,000 acres for this study and 21,000 acres outside the study in the 37,000-acre Five Rivers watershed. The plan is an attempt to meet both the resource and adaptive management goals of the Northwest Forest Plan (ROD 1994) and, as such, must balance resource and learning objectives. Focused on questions facing land managers in coastal Oregon, the study will be implemented as normal business for the Waldport Ranger District, with limited support from the Siuslaw Supervisor's Office and the Corvallis Forestry Sciences Lab. The study is intended to stand alone, although funding for research projects that may help in interpreting the study is being sought separately; its design is based on adaptive management, using a parallel-learning model (Bormann et al. 1999).

The management study differs from a traditional research study in important ways. The questions have been officially posed by managers (with some input from others). And answers are being sought by comparing alternative management pathways applied as part of management. The study applies some techniques normally reserved for research studies, including a study plan, explicit hypotheses, an experimental design, replication, random allocation of treatments, and peer review. The alternative pathways are considered "treatments" in a statistical sense, and monitoring is considered as measuring response to treatments. Applied forestry research experiments often focus on constrained effects of single practices; these sets of practices, combined in time and space, are confounded in the chosen design. Confounding is lessened greatly when the pathways, rather than individual practices, are considered as the treatments. Cause and effect is difficult to establish in all field ecological research, although qualitative information on practices is likely, if sufficient emphasis is given to study design (Shrader-Frechette and McCoy 1993).

A learning strategy based on diversity of management pathways

The learning need can be restated as a series of questions to be answered by creating and comparing a set of management pathways, all geared to achieve late-successional conditions and aquatic conservation:

- Can late-successional habitat and aquatic conservation be achieved in more than one way by managing differently in densely spaced 5- to 60-year-old Douglas-fir plantations, associated roads, and stream reaches in the Five Rivers watershed?

- How fast will various management pathways, and their interactions with natural disturbances, achieve late-successional-habitat and aquatic-conservation objectives?
- Is our approach to integrated landscape planning that uses an EIS—rather than a series of environmental assessments—with a more concise format and with explicit learning objectives workable for implementing the Northwest Forest Plan?

Pathway objectives

Increasing late-successional habitat and improving health of watersheds and associated aquatic ecosystems are broad and difficult-to-achieve goals, given the lack of understanding of these systems. We start with general objectives for previously managed units. The following stand-scale, late-successional habitat characteristics identified by Franklin et al. (1981) are sought:

- At least 25 trees per hectare (10 trees per acre) greater than 70 cm in diameter at breast height;
- A multilayered tree canopy;
- At least 50 tons per hectare of decaying logs; and
- At least 25 standing snags per hectare (10 per acre).

The same stand-scale objectives are sought in the riparian areas to meet the aquatic conservation strategy, adding only that stream temperatures do not rise.

Similar objectives are sought for the mature stands surrounding the managed units, but we assume the mature stands will achieve, or may already have achieved, these conditions without intervention. Larger scale objectives are more difficult to state quantitatively. The Siuslaw late-successional reserve assessment (USDA, USDI 1997), based on the Northwest Forest Plan (ROD 1994), suggests that this area of the Coast Range should serve as a late-successional core area because of its proximity to intensively managed private lands. Thus, the large-scale objective is to achieve late-successional and aquatic conservation objectives on entire roadsheds.

Scientific and operational perspectives were merged into a series of pathways that, after monitoring, should be able to help answer our questions, while meeting the other identified problems (EIS, page 2). These pathways must represent a broad set of legal and legitimate ways to achieve both late-successional and aquatic-conservation objectives. Increasing learning efficiency and confidence in the findings depends a lot on the extent of differences between pathways and whether a science-based design can be used in distributing pathways across the Five Rivers project area.

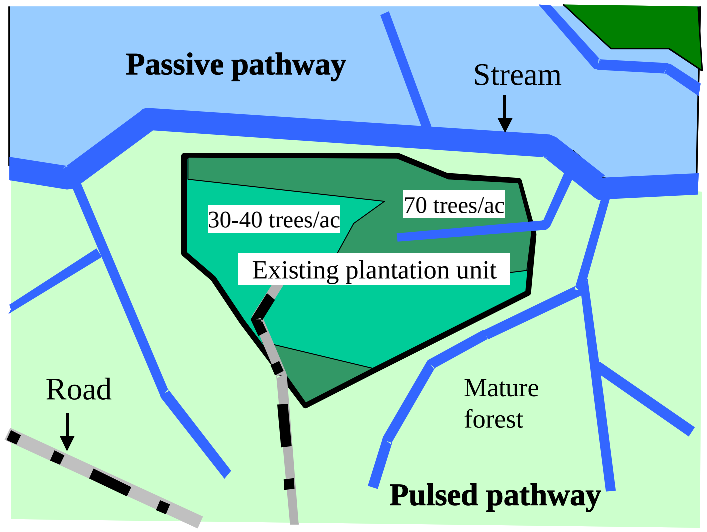
Pathway descriptions (treatments)

A synopsis of pathways is included here. More details are available in the EIS chapters 2 and 4, and also in appendices B and C.

Path A—Passive management. Many concerned citizens believe that any intervention, even in existing plantations, will only result in further environmental damage. Closing roads is associated with this belief. Existing evidence suggests that already dense plantations may stagnate, and individual trees may grow to the 70-cm-DBH, old-growth objective very slowly, if at all. But natural disturbances like windthrow, snow breakage, insects, and diseases may help thin these stands and allow old-growth conditions to develop. Unthinned but disturbed stands might attain old-growth characteristics different from those in thinned stands. Roads are thought by some to be largely incompatible with old-growth conditions and riparian conservation, and funds to maintain them might be better spent on other projects. **Decommissioning** means removing stream crossings and problem culverts and adding water bars and vehicle diversions. Access to two- and four-wheel-drive vehicles will be prohibited, but all-terrain vehicles, horses, and hikers will not be limited unless they are found to cause damage. The Team believes this pathway is applicable and allowed in all land allocations where it is placed.

Path B—Pulsed management. This pathway starts by managing the plantations and streams in an area during just a few years (partly limited by sale contracting rules), closing the road for at least 20 to 30 years, and then reopening it for another management pulse. Road closures are designed to be reversible and to lessen environmental and road maintenance costs. Actions during the pulses have to reflect the lack of access during the years of road closure. Thinning existing plantations to wide spacing (leaving as few as 40 trees per acre) is needed for plantations to promote the fastest diameter growth, avoid stagnation, and to support second-story conifers (fig. A-1). Even wider thinnings might speed growth of residuals further and better produce large-branch habitat for murrelets, but concerns with predation on spotted owls in open stands precludes this option. Alders and deciduous shrubs will be planted—or not removed—between residual trees to improve soil fertility and growth of residual conifers on poor sites. Where hardwoods are not wanted, vegetation control will likely be needed to establish conifer seedlings. Also, trees would be thinned in stages, starting with 50 to 70 trees per acre, followed by a second thinning 5 years later to make snags and fell trees for coarse woody debris objectives. Windthrow risk may be increased in some areas by thinning for several years, but windthrow will be considered a reintroducd natural disturbance, possibly important for some wildlife species and soil processes. Other resources, such as recreation, elk forage, and nontimber products may be affected by this pathway and will be considered, but they are not central to its goals. Road access policy during closures is similar to the passive-management pathway. The Team believes that the pulsed-management pathway is also applicable and allowed in all land allocations where it is placed.

Figure A-1. Example tree density objectives 5 years after thinning an existing plantation in a pulsed-pathway treatment area. Higher densities are used to meet aquatic conservation objectives and in areas prone to wind damage.



Path C—Continuous management. Continuous access permits actions to be distributed evenly through time, and thereby allows each individual action to be less intense. Thinning can be much lighter, but more frequent than in the pulsed-management pathway. Logs in streams can be added gradually instead of all at once. Windthrow risk may be increased in some areas by thinning for several years. This pathway has the advantages of allowing better access for recreation, emergencies, and response to unanticipated changes and catastrophes, for example, salvaging windthrown or insect-damaged trees. These advantages might be partly offset by higher road maintenance costs and environmental effects from roads than in the other pathways. This pathway is supported by foresters who believe in active management to achieve Northwest Forest Plan objectives. The Team believes this pathway is also applicable and allowed in all land allocations where it is placed.

What is known as the basis for these pathways?

Little is known about how a plantation of densely spaced 5- to 60-year-old Douglas-fir can become late-successional habitat, or about how to achieve aquatic conservation in the long-term. Ideas in the past, like pulling logs to improve fish passage, have proved wrong over time. What is known is indirect; a very brief summary follows.

How do roads affect late-successional habitat and aquatic conservation? A landscape-management plan to achieve old-growth and riparian objectives in an area dominated by young plantations must account for the environmental and management costs and benefits of existing roads. Roads provide access to plantations and streams for management activities to speed development of old-growth and riparian objectives, to aid in fire suppression, to do research, and for appreciating and understanding nature. Trombulak and Frissell (1999) suggest that roads are generally correlated to negative ecological effects, including road-building-caused mortality, road kill, modified wildlife behavior, altered physical and chemical environments, spread of exotics, and increased human use. They point out that causal mechanisms are poorly understood and that experiments are needed to complement correlative studies. The greatest potential effects on late-successional habitat and aquatic conservation in the Five

Rivers study area are likely to be changes in delivery of sediment and woody debris to streams. Nearly all roads associated with the proposed pathways are on ridgetops, which cause fewer problems than those along streams or on unstable slopes. Management costs may be paramount because resources for maintaining roads are severely lacking. Whether the net effect of roads is positive or negative is impossible to predict with great certainty, so having alternative approaches in different pathways should help us learn about the advantages and disadvantages of maintaining existing roads.

How do plantations respond to thinning? Densely spaced Douglas-fir plantations, at this age in this area, will very likely respond to thinning—until crowns close again (see, for example, Curtis et al. 1998). Crown closure is expected to be very rapid on these productive sites. More diameter-growth response is likely at wider spacing, up to about 30 feet between residual trees. Larger trees obviously should speed old-growth development, but uncertainties about windthrow, wind snap, thinning shock, and interactions with root disease and insects add uncertainty to predictions. Experience with long-term response to wide thinning (20 to 40 residual trees per acre) is limited, but examples at Black Rock Forest, near Mill City, and on the OSU McDonald Forest (Michael Newton, pers. comm., Oregon State University, Corvallis OR) suggest that widely spaced tree canopies will close faster than expected, so fast that most problems will center around establishing and maintaining a second story of trees. This conclusion is supported in studies of natural stands (Alaback and Tappeiner 1991, Deal et al. 1991).

How did old-growth trees become old growth? Many old-growth trees now growing in the Coast Range were free to grow during their first 100 years or so (Tappeiner et al. 1997). Other large conifers grew slowly at first under shrubs and hardwoods, but after overtopping them and with few other conifer competitors, they grew rapidly (Michael Newton, pers. comm.). Shrubs and hardwoods tend to build soil organic matter, and alders are known to fix nitrogen and weather rock particles, rapidly improving fertility of many soils (Bormann et al. 1993). Current plantations have an extremely different stand- and tree-growth trajectory, and whether plantations can reach old-growth dimensions at all, even with light thinning, has been questioned. Also unknown is what was growing between these trees and what kinds of disturbances contributed to maintaining their free-to-grow status.

How does thinning relate to aquatic conservation? General experience suggests that adding large logs to streams improves habitat for salmonids and other aquatic organisms. Growing large conifers near streams increases the chance that large logs, which last longer than small logs in streams, will be added over time. Thinning speeds growth of residual trees. Underplanting hardwoods may increase energy inputs into stream food chains and may support more beavers, whose dams can add to fish habitat. Thinning may increase landslides, benefiting habitat over the long run with coarse sediments and logs, but harming habitat in the near term with fine sediment.

What is the role of long-term development and disturbance? Based on studies of long-term fire histories, Long et al. (1998) concluded that the entire Coast Range historically ranged between 40 and 60 percent old growth; the scale of fires made smaller areas like the Five Rivers watershed range from 0 to 100 percent. Productive streams and old growth should be thought of as the result of dynamic processes that have produced a state that cannot be maintained indefinitely, without periodic disturbance (Reeves et al. 1995, Benda and Dunne 1997). Although steps are usually taken to minimize windthrow, windthrow-induced soil mixing every 200 to 300 years helps maintain the productivity of spruce-hemlock forests in southeast Alaska (Bormann et al. 1995). Management should seek to acknowledge the role of disturbance and try to incorporate this knowledge into management pathways. For example, activities thought to encourage landslides could be conducted on side streams where larger trees are grown; if the slopes fail, logs and sediment would likely be added to streams in a way that benefits streams over the long run (Benda 1990). Individual trees tend to be windthrown after thinning, before residual trees respond to their new wind environment (e.g., Seidel 1980, Hutte 1983, Lohmander and Helles 1987). Thus, stands could be initially thinned to a closer than desired spacing, with the expectation that windthrow would help achieve the desired spacing, reintroduce this natural process, and provide coarse woody debris. We have no basis for predicting the development of these dense plantations without thinning, but we suspect these stands will be subject to extensive snow damage or blow over in large patches.

How does disturbance play out across a complex landscape? The complex interactions of a wide variety of potential disturbances (including windthrow, landslides, Swiss needlecast, root disease, and fire), landscape features (including topography, soils, vegetation, and wind-exposure), and management interventions represent the greatest uncertainty about the relative success of the three management pathways. What seems initially certain is that thinning will produce larger trees faster, but the frequency and intensity of disturbances will likely also be important. Unanswered questions include these: Will windthrow make the wide thinnings ineffective on some aspects, soils, and slopes? Will Swiss needlecast interact with stand density or soil fertility? Will the passive treatment work better on exposed ridgetops, where windthrow is more likely to reduce stand densities? Will large unthinned stands be windthrown in large patches? Because the passive and pulsed pathways will be inaccessible to vehicles, some actions in response to disturbances thought appropriate to achieving Plan goals will be difficult or impossible, unlike the frequent responses possible on the continuous pathway roadsheds. Poor predictability of disturbances and lack of knowledge of these interactions supports the conclusion that all three pathways may work, but only by comparing them will we learn which one is best in what place and which component of each could be combined into new pathways in future decisions.

What is the role of landscape heterogeneity? Heterogeneity is thought to be positively related to biodiversity, but variables and patch sizes chosen for assessing heterogeneity will influence its relation to biodiversity (Pickett and White 1985). Uniform plantations have likely reduced biodiversity (especially understory plants and animals associated with them). Heterogeneity over 1,000-acre patches may reflect a diversity of historical disturbances and disturbance effects and, by doing so, benefit biodiversity.

Is the appearance of old growth important? Much of the environmental debate has been driven by concerns over land-use changes as observed by concerned citizens. We suspect that concerns would decline if more land looked “pristine.” All pathways may gain this appearance over time, but the relative rates are not easily predictable. If self-thinning and disturbance patches appear quickly in path A, growing plants on the decommissioned road and lack of new stumps from thinning (large old stumps may still persist) may help suggest pristine condition. If tree growth responds to thinning as predicted and the understory conceals stumps of thinned trees, path B may achieve a pristine feel sooner.

The Learning Design

Breadth of pathway comparisons

How much can be learned by comparing pathways depends first on how different the pathways are. If pathways are too similar, then differences will be difficult to detect or require more intensive monitoring to detect smaller differences. The Team concluded that the suite of tree- and plantation-growth trajectories, road management, and other effects created by these pathways is broad enough to expect that differences between them will be relatively easy to detect. Ideally, all pathways will achieve the objectives in a similar timeframe, increasing our confidence that an even broader range of options can be explored in the future.

Initial similarity and layout of pathways in the Five Rivers watershed

How much can be learned from an arrangement of pathways on the landscape depends on many factors, including how boundaries are drawn, size of areas compared, initial similarity of areas with different pathways, whether pathways are tested on more than one piece of ground (replicated), and whether biases enter into how pathways were allocated across the landscape. How much is learned has to be balanced against on-ground realities, including patterns of terrain, management history, and condition of existing roads and plantations. To reduce conflict between the learning and other needs, a few critical resource objectives were identified, including maintaining travel corridors identified in the Siuslaw NF transportation plan (USDA Forest Service 1994), removing a failing road improperly placed along a creek, and up a steep hill, and building a short new road to connect to a private-land inholding, as an alternative to the existing problem road.

The learning design first identifies areas in the landscape where different pathways can be placed to avoid conflict with critical resource objectives. Because the chosen pathways include different road management strategies and because the Forest Service policy precludes significant building of new roads, areas for comparison were designed around existing road systems. The concept of "roadsheds" being developed in the Siuslaw NF Transportation Plan was extended to this learning design. Here we identify **experimental roadsheds,** drawn around existing road systems, where different pathways can be placed. Three example roadsheds for this study are described (fig. A-2).

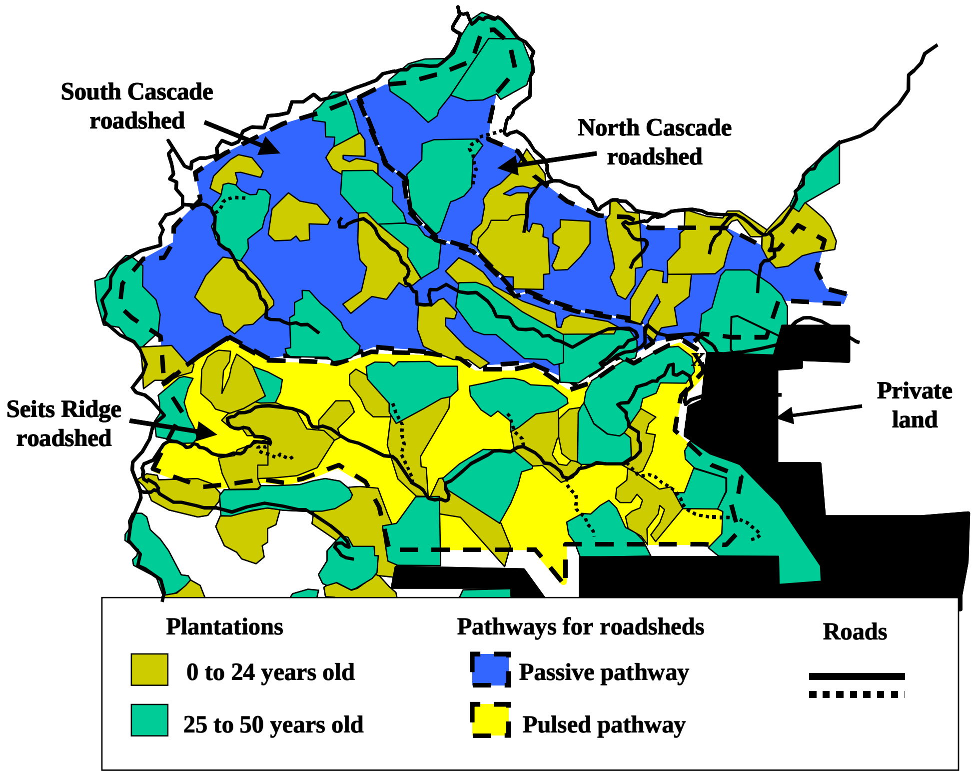


Figure A-2. Three of the 12 designated and chosen experimental roadsheds. Each roadshed has at least 3 plantations more than 25 years old and encloses about 1,300 acres. Note how the existing roads are mainly confined to the ridgetops.

We attempted to lay out experimental roadsheds so that halves of adjacent subwatersheds could receive the same treatments to allow pathways to be evaluated based either on roadsheds or watersheds. The limited size in the project area and the pattern of the existing roads precluded this possibility on half of the areas examined; thus, the design focuses on experimental roadsheds, achieving late-successional conditions, and questions of road management and closure. Some aquatic questions can be addressed on fewer areas or by examining the many stream reaches available.

The size of these experimental roadsheds is important to assessing whether the question posed can be adequately answered. Some old-growth-dependent species have extremely large home ranges (2,000 to 6,000 acres for spotted owls), too large for dividing this 37,000-acre project area. Although most old-growth habitat characteristics can be observed in small stands and plantation-size areas, this scale precludes analyzing management-scale costs and natural-disturbance effects that may interact with management practices. We chose an intermediate scale of 700 to 1,600 acres per roadshed to be able to analyze various combinations of practices including road management, thinning, and riparian practices, as they play out in different stands inside landscape areas (roadsheds). Thus, these experimental roadsheds are smaller, and their locations differ from the roadsheds referred to in the road management plan.

Initial similarity of the roadsheds is especially important for increasing confidence when emerging differences in pathways are interpreted. A major concern with any design is that differences can be attributed to effects of individual pathways and not to initial conditions. This concern was addressed by:

- Selecting 14 potential roadsheds—each with at least three plantations of an age where thinning is likely to be commercially viable (usually at least 25 years old)—to place three pathways, four times each (4 replicates), yielding 12 experimental roadsheds.
- Analyzing the similarity of potential roadsheds, accepting only roadshed groups (blocks) that we concluded were similar, and discarding the extra potential roadsheds (which will be managed like other areas outside the experimental roadsheds).
- Selecting, randomly, which pathway is placed on which roadshed within similar groups of roadsheds.

Similarity of roadsheds was assessed by comparing available GIS data specific to each roadshed. Data used were total area; miles of streams; miles of road; road miles per acre; area in managed stands (%); area with low, medium, and high risk for landslides (%); and area in each of three vegetation classifications (salal-rhododendron, swordfern, and salmonberry types; %). A multivariate, cluster analysis was tried and abandoned because different subsets of data and data transformations yielded different groupings—and no means to decide among the groups was available. A simpler approach was developed: First, all data were arrayed to determine if certain roadsheds had characteristics very different from the others (outliers). This analysis suggested that roadsheds had differences of up to two-fold in many of the variables, but that a smooth transition or gradient from smallest to largest values was usually found. The only exceptions we identified were that one roadshed was thought to have high road miles per acre, and one was thought to have a high area in managed stands (table A-1). Second, we assigned priority order to the available variables to select four groups of three roadsheds to minimize within-group variation. Priority was given first to percentage of area in managed stands because achieving old growth and aquatic conservation on roadsheds was thought to be mostly constrained by stand age. Unmanaged stands are older (about 115 years old) than managed plantations. The second priority was given to risk of landslides because this variable helps distinguish between areas with different slope and landform features. The low-risk-of-landslides variable was used because it represents the percentage of area in flatter, more planar landforms (and, by being opposite, also represents area in both moderate and high-risk landforms). The percentage of area at high risk for landslides was not used because it was always less than 10%. A third variable was given priority as well: percentage of area in the salmonberry-type vegetation class, which represents moist, low-lying areas and lower slopes. Salmonberry percentage was highly variable, and the quality of these data was questioned by some Team members. We also considered one operational factor: access to one roadshed limited by a road passing through another roadshed. That is, if a passive-management pathway was selected in the "down-road" roadshed, the "up-road" roadshed would not be usable. Final selection of groups (**blocks** in statistical parlance) was based on priority variables, outliers, and operational issues.

Table A-1. Data used to create groups (blocks) of initially similar watersheds where the three pathways can be compared

Roadshed number	Roadshed acres	Managed area percent	Low risk for slides	Medium risk for slides	High risk for slides	Salmonberry type	Rhody-salal type	Swordfern type	Road miles	Road miles per 100 ac	Stream miles	Group (block) descriptions
7	1592	37	52	45	4	44	8	46	11	7.2	20	I. Less managed, lower risk of landslides
6	847	39	44	50	6	19	21	57	3	3.2	11	
10	849	41	46	51	3	25	13	60	2	2.6	12	
2	1322	45	39	58	4	45	13	42	6	4.2	18	II. Less managed, higher risk of landslides
4	852	46	37	62	1	36	7	55	3	3.0	12	
3	1579	49	38	58	5	38	15	46	9	5.6	21	
5	1184	50	62	38	2	19	16	63	6	5.0	15	III. More managed, lower risk of landslides
11	698	51	62	34	4	32	16	50	4	6.1	8	
1	940	51	52	44	3	34	23	41	3	3.0	12	
12	1370	52	34	56	10	34	18	46	5	3.6	20	IV. More managed, higher risk of landslides
8	1064	53	33	60	7	21	12	64	3	2.4	16	
9	1026	68	46	49	4	39	4	56	3	3.3	15	
g	1192	48	48	46	6	24	14	61	5	4.5	14	Not used
k	1494	60	53	43	4	29	4	65	6	3.9	16	

To increase confidence in our analysis of the different pathways over time, the pathways were randomly assigned to the roadsheds within each group. This step is perhaps the most important one for reducing biases in assigning pathways. The final assignment reflects this random allocation (table A-2, fig. A-2).

Table A-2. Assignment of management pathways to roadsheds within groups (blocks) of initially similar roadsheds

Block	Road-shed	Management pathway	Block	Road-shed	Management pathway
I.	6	A. Passive	III.	1	A. Passive
I.	7	B. Pulsed	III.	5	B. Pulsed
I.	10	C. Continuous	III.	11	C. Continuous
II.	2	A. Passive	IV.	9	A. Passive
II.	3	B. Pulsed	IV.	8	B. Pulsed
II.	4	C. Continuous	IV.	12	C. Continuous

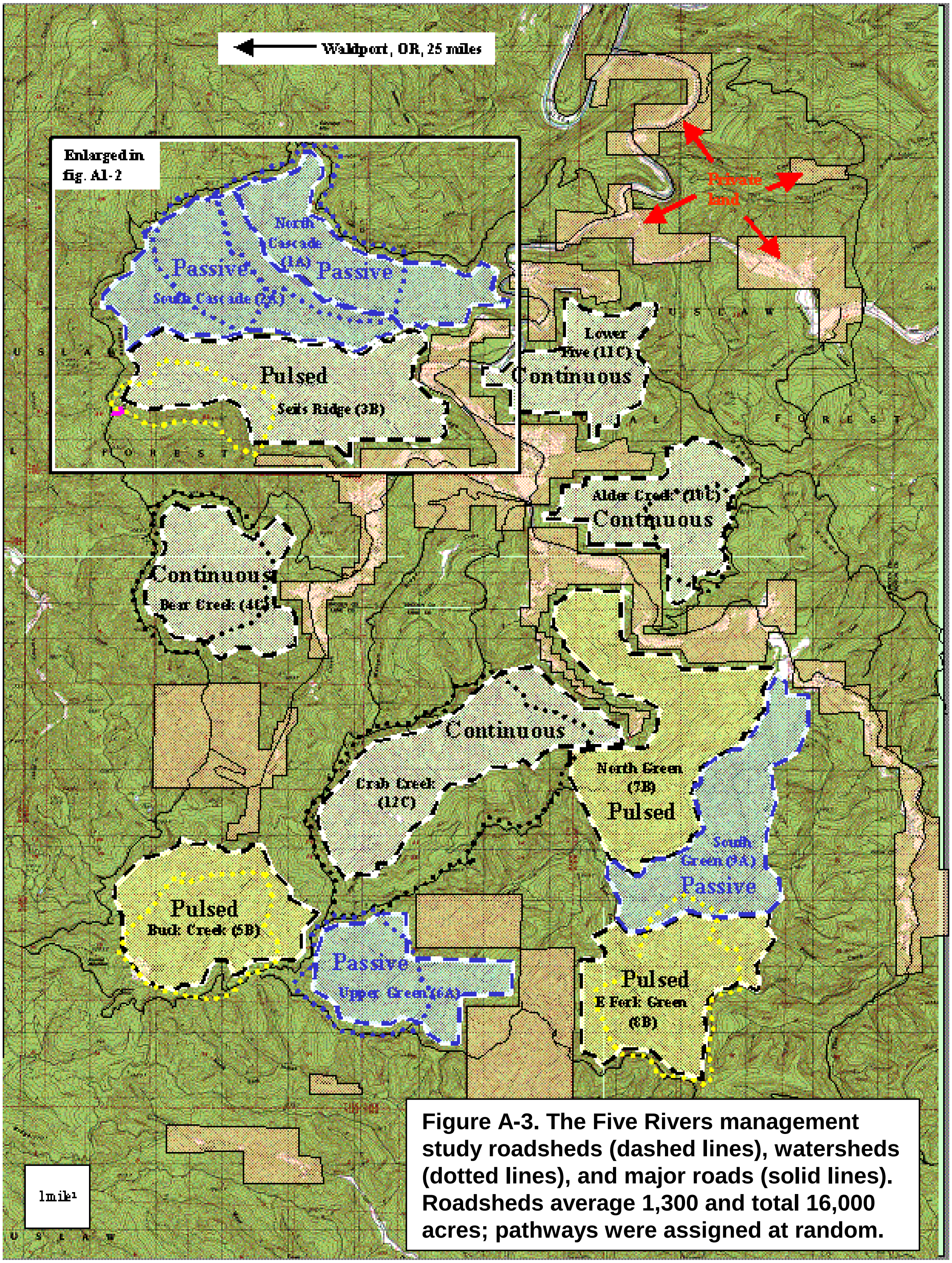


Figure A-3. The Five Rivers management study roadsheds (dashed lines), watersheds (dotted lines), and major roads (solid lines). Roadsheds average 1,300 and total 16,000 acres; pathways were assigned at random.

Analyzing pathway effects

Definitively answering the question—Can late-successional habitat and aquatic conservation be achieved in more than one way by managing differently in densely spaced 5- to 60-year-old Douglas-fir plantations, associated roads, and stream reaches in the Five Rivers watershed?—will take a long time. Just getting 37-year-old plantations to an average of 70 cm DBH should not be expected before 2040 with the widest thinning. Near-term analysis before this time is likely to be interesting, but confidence should remain low until actual results are achieved, given possibilities of unknown factors, especially episodic natural disturbance. Even long-term results may not apply to subsequent years because of possible climate and other changes. Near-term analysis, used with sufficient caution, will provide information previously unavailable, however. For example, if trees respond as predicted, and windthrow is minimal in thinned stands, even wider spacings might be tried in future plans. If species increase in areas with decommissioned roads both with and without thinning, then we would start to think that vehicle effects are important. As these patterns emerge, more detailed monitoring and research may be called for to try to better attribute responses to specific causes.

Deriving variables to monitor

Monitoring for this study is based on the philosophy that all monitoring proposed must be designed to answer a stated question (in other words, to learn something). Quantitative objectives are needed to identify if they have been achieved, although these objectives, described earlier, may need to be changed as knowledge is gained (Ford 2000).

Disturbances are expected to interact with stand-scale responses, and analysis of interactions will only be possible at roadshed and larger scales. For example, windthrow may slow or speed attaining tree-size, second-canopy, and downed-log objectives depending on whether large areas of stands or just isolated trees are blown down. Insect outbreaks and landslides may act similarly. Fires, if they occur, are likely to have large-scale effects. All of these disturbances are at present poorly predictable, but they are likely to be related to the position of individual stands on the landscape. For example, trees on south-facing ridges may be more prone to windthrow. Each pathway may influence subsequent disturbance patterns. The passive pathway might be expected to have more insect and disease problems because individual trees are likely to have small live-crown ratios.

Core monitoring proposed must be achievable with anticipated tight budgets for the Forest Service, and it will follow guidelines in the Siuslaw NF monitoring guide (USFS 1999) and Regional effectiveness monitoring guides (Hemstrom et al. 1998, Lint et al.1999, Madsen et al.1999). Monitoring priorities for the Siuslaw NF relating to this project will focus first on how well the variety of strategies for managing plantation and riparian areas work to achieve late-successional habitat and aquatic conservation (tables A-3 to 5). Of highest priority, therefore, are measures of changes in growth trajectory of trees and understory species in the managed and unmanaged plantations, changes in riparian and stream habitat, and the interaction of management with natural disturbances of windthrow, landslides, flooding, and insects and diseases. For example, we expect the frequency distribution of tree DBHs to change quite differently in the three pathway roadsheds (fig. A-4). Priorities will be set for proposed monitoring beyond the core, and they will be pursued if funds become available. For example, sediment budgets would greatly help the Team in understanding and evaluating changes to stream systems, but currently no resources are available to do them.

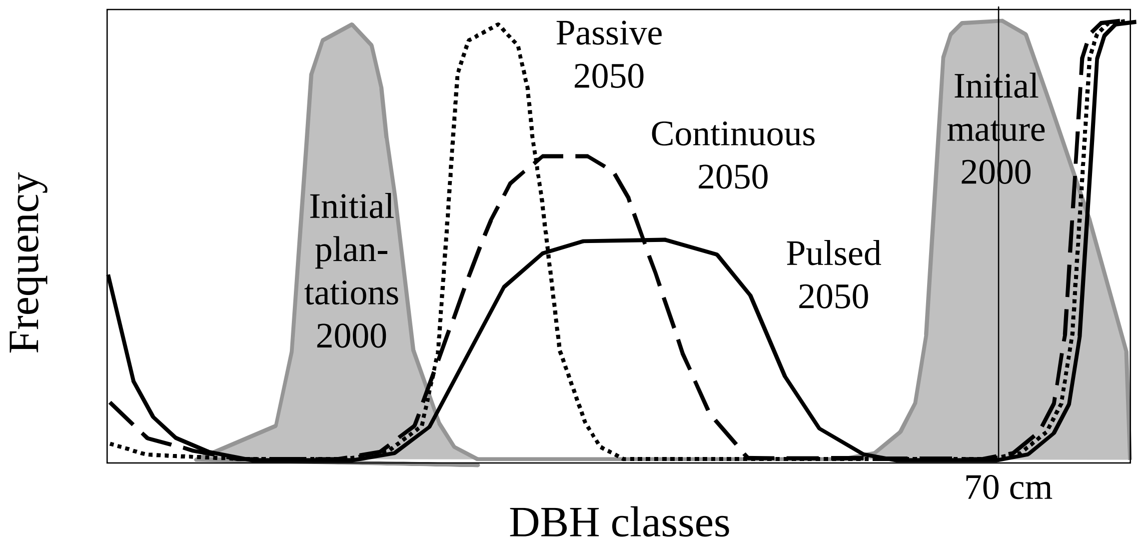


Figure A-4. Expected changes in diameter distribution from year 2000 to 2050 in the three pathway roadsheds.

Table A-3. Road monitoring: Initial conditions and relative effects on roadsheds with different management pathways

Initial conditions and effects	Primary monitoring (units), assured as part of the management study	Secondary monitoring (units), not part of the management study[a]
Pre-installation road conditions		
Road location and type	Measure the location, number, type, and condition of all roadshed roads.	
Road density	Calculate using the GIS data base (miles/roadshed per acre)	
Culverts	Measure the location, number, and condition of each stream-crossing culvert in the roadsheds (culverts/roadshed).	Calculate stream densities, using Jones et al. 1999 (miles/roadshed per acre by stream type).
Pathway-related road effects		
Vehicle access and road traffic	Sample representative project-maintained roads to estimate resident, recreational, and project use to compare pathways and evaluate if road objectives were met (vehicle entries/roadshed per year).	Study road use by monitoring all vehicle traffic and handing out questionnaires (entries/roadshed per year).
Road maintenance costs	Monitor and record all road-maintenance actions and costs into the GIS-based database ($/mile per roadshed by action type) associated with pathway, resident, recreational, and project use.	Study the costs and benefits of integrated stand and road management.
Blockages of debris above culverts, road-related erosion, slope failures, waterbars, and hydrological effects	Survey roads after large storms (using the Forest's flood emergency maintenance plan) on ATM and pathway roads or, at a minimum, every 2 years. Monitor high-risk failure sites, waterbars, and rate of vegetation development. (volume of debris/roadshed and volume/mile of road; slides/roadshed; see Jones et al. 1999).	Study stream temperature effects above and below blockages (temperature).
Access issues	Monitor how road closures limit research and monitoring and responses to insect outbreaks and windthrows.	Study positive and negative effects of access on late-successional and aquatic conservation objectives.
Disturbance to wildlife		Study links between management and wildlife behavior (for example, changes in monitored activity of radio-collared owls).
Vectors for invasive weeds		Study weed ecology as affected by road and plantation management (species, individuals per mile of road)
Community approval	Monitor; record comments into the data base.	Survey local, regional, and possibly national opinions on road and plantation management strategies.
Recreation		Study hiking, hunting, and other uses.
Road succession	Monitor plant succession on closed roads.	Study microclimate changes on closed roads.

[a] To be conducted by managers, researchers, or volunteers if funding is available.

Table A-4. Forest monitoring: Initial conditions and relative effects on roadsheds with different management pathways

Initial conditions and effects	Primary monitoring (units), assured as part of the management study	Secondary monitoring (units), not part of the management study[a]
Pre-installation conditions		
Tree and stand characteristics in plantations	Start by establishing permanent stand-exam plots on 10 to 15% of the plantation units, randomly selected from the roadsheds (about 125 of the 1,500 completed stand exams). Compare stand averages (previous and permanent exams), and add more permanent plots as needed. Measure by species and canopy strata: trees/acre, DBH, dominants' height, basal area, live-crown ratio, and woody debris (various units).	Predict how stands will change though time with ORGANON, CLAMS, and other available models.
Natural stands (mature forest)	Establish permanent plots on 5 stands or more or use the continuous vegetation survey plots in mature stands to monitor the same variables as in plantations (various units).	
Owl-dispersal habitat	Evaluate "dispersal habitat" (especially acres/roadshed with canopy cover <40%).	
Pathway-related stand-development effects		
Growth of prospective old-growth trees in plantations	Monitor trajectory of dominant trees in plantations (slope of the line of average DBH of the 10 largest trees/acre per year) and predict the date when old-growth habitat will be reached (year/roadshed). Monitor permanent plots in plantations 5 years after thinning and every 10 years thereafter.	Study the relative effects of different understory species, established in openings, on growth of residual Douglas-fir trees.
Coarse woody debris	Monitor permanent plots for decomposition-class changes every 10 years.	Study effects of grouped versus dispersed small logs, decomposition and succession on woody debris, and bark-beetle responses to woody debris.
Species	Monitor permanent plots for changes in plant species (planted and naturally regenerated) every 10 years; track owls and murrelets.	Study old-growth-associated species (such as, *Lobaria*, amphibians, small mammals) and early-succession-related species (elk, deer, bears).
Owl-dispersal habitat	Monitor permanent plots for how fast crown cover is restored after thinning (% crown cover/year).	Study actual owl and owl-predator behavior in thinned and unthinned stands.
Forest management costs	Total all costs associated with management ($/roadshed).	Study the costs and benefits of integrated stand and road management.
Mature forest	Monitor permanent plots for changes in mature stands and evaluate their development toward late-successional and aquatic conservation goals.	Study possible management of mature stands to speed development of old-growth or aquatic habitat.
Social perceptions		Conduct surveys of people walking interpretive trails built into each of the three pathways.

[a] To be conducted by managers, researchers, or volunteers if funding is available.

Table A-5. Monitoring stream and riparian management, disturbance, and learning

Initial conditions and effects	Primary monitoring (units), assured as part of the management study	Secondary monitoring (units), not part of the management study[a]
Pathway-related stream, riparian, and water-quality effects		
Stream shade	Monitor effects and duration on stream shade before and after thinning.	
Sediment budgets		Study sediment stores as a way to understand changes in sediment and logs over time.
Fish habitat	Monitor changes in pools, riffles, large woody debris, using the method of Hankin and Reeves (1988).	
Fish populations	Monitor population size and species composition, using a level II survey by OR Department of Fish and Wildlife.	
Disturbance effects and interactions		
Landslides	Analyze available aerial photos (every 5 years or less) for large landslides, document them on the ground, and compare them to predicted danger class and proximity to stand and road management.	Study and model the interactions of topography, road management, and thinning intensity.
Windthrow	Analyze available aerial photos (every 5 years or less) for large windthrows, document on the ground, and compare to predicted exposure (Kramer, in press) and proximity to stand and road management.	Study and model the interactions of exposure to storms, stand density, time since thinning, thinning intensity, and soil conditions.
Insects and diseases	Analyze available aerial photos (every 5 years or less) for Swiss needlecast, root rot, bark beetles, and other possible agents and document on the ground.	Study insect and disease agents and their interactions with windthrow, thinning, snags, and coarse woody debris
Fire	Monitor fuel conditions.	Model fire potential and road-closure effects.
Large-scale habitat		Study effects of edge density (based on size, location, and seral-stage classes from the wildlife guide) on actual habitat use.
Institutional learning		
Integrated landscape planning with learning objectives and a more concise format	Monitor how well the landscape planning, learning objectives, and format are accepted, if lawsuits are filed, and cases where the plan concepts were used in other projects.	Evaluate the effectiveness of including learning objectives in the NEPA process, compare environmental assessments required for all actions proposed under the EIS, and document new resource interactions otherwise ignored.
More effective researcher-manager collaboration	Monitor the number of research studies applied in Five Rivers.	Evaluate how science knowledge was applied and whether both management and science missions were simultaneously met with this new approach.

[a] To be conducted by managers, researchers, or volunteers if funding is available.

Statistical design

A simple analysis of variance is proposed to analyze path effects on individual variables starting with the null hypothesis that variables will not differ by pathway, using alpha equals 0.10 (table A-6).

Table A-6. Analysis of variance table for individual variables

Source of variation	Degrees of freedom
Pathways	2
Blocks	3
Error	6
Total	11

Individual-variable effects will be combined to assess how pathways are achieving late-successional habitat and aquatic conservation goals (table A-7). Weighting of variables will reflect managers' assessment of the relative importance of individual variables. This analysis differs by trying to determine if the pathways are the same. This perspective shifts the emphasis on concern about type one error (that differences are not real even though they appear to be) to concern about type two error (that differences are real but cannot be detected with this sampling). Our design responds by having four rather than three replications, emphasizing initial similarity, and by increasing alpha to 0.15 from the more typical 0.05 to 0.10 for the combined-variable analysis.

Committing to monitoring

The federal budget cycle does not permit long-term funding allocation to monitoring, and often historically unbudgeted commitments to monitoring have failed. We propose several strategies to be implemented in the first 5 years to increase the chances that monitoring will be continued, perhaps as long as a century, to fully evaluate these pathways:

Having an interesting comparison. The design itself creates a new incentive for long-term monitoring and retrospective research. Monitoring here will be more meaningful than monitoring areas without a design. Interpretations from monitoring will have much greater confidence than simply monitoring alternative pathways placed without a design. Retrospective research is the failsafe approach for monitoring, if other forms fail. The Black Rock study serves as an example of how important knowledge can be retrieved even from abandoned trials, when trials were set up with an experimental design.

Establishing permanent plots. To complement the extensive stand exam data, about 10 permanent plots will be established in each of 15 plantations units and 5 mature stands (200 plots) to provide repeatable high-quality stand data and for better interpreting aerial photos or remote sensing. More plots will be added if stand-exam and permanent-plot data do not agree. Permanent stream sampling points will also be established on side streams exiting roadsheds, and these streams will be classified for landslide potential.

Table A-7. Ranking predictions: 0 = does not meet, 1 = partially meets, and 2 = meets objectives; different numbers indicate a prediction for a statistically significant difference using ANOVA, except for the average scores—where no significant differences are expected

Variable and years ahead measured		Passive pathway	Pulsed pathway	Continuous pathway
Tree diameter exceeds 70 cm	5	0	0	0
(10 largest per acre)	50	0	2	1
	100	1	2	2
Two or more tree canopy layers	5	0	1	0
	50	0	2	1
	100	0	2	2
Lack of >¼-acre windthrow patches	5	2	0	1
	50	1	2	2
	100	1	1	2
50 tons/ha of downed logs	5	0	0	0
	50	0	1	1
	100	1	1	1
Presence of murrelets	5	0	0	0
	50	0	1	0
	100	1	2	1
Sediment diverted from streams	5	2	1	0
	50	2	1	0
	100	2	1	0
Road management costs	5	2	1	0
	50	2	1	0
	100	2	1	0
Landslides	5	0	1	1
	50	0	1	1
	100	0	1	1
Potential for large wood in landslides	5	0	0	0
	50	0	1	1
	100	1	2	1
Stream temperature	5	1	1	1
	50	1	1	1
	100	1	1	1
Numbers of pools, riffles, wood	5	1	1	1
	50	1	1	1
	100	1	1	1
Juvenile and spawning fish	5	1	1	1
	50	1	1	1
	100	1	1	1
Average score (unweighted)	5	0.8	0.6	0.4
	50	0.7	1.3	0.8
	100	1.0	1.3	1.1

Synthesizing historical knowledge and data. We propose to electronically compile all known data collected in the Five Rivers watershed, for example from past research studies, stand record cards, recorded harvest volumes, management-practice information, stand exams, and stream monitoring. We will also digitize all previous aerial and fire-tower oblique photos, and compile data on human history in the area.

Predicting future changes. The coastal landscape and management simulation study (CLAMS) will be used to predict changes in the entire watershed. These predictions will be used as a reference for unfolding patterns.

Creating an accessible corporate GIS data base. Historical knowledge, data, images, treatment histories, CLAMS predictions, and reports of developing trends will be assembled into a ARC-view data base, published periodically on CD-ROMs, and placed on the Siuslaw NF web page.

Creating public access. Short interpretive trails will be completed into each pathway to help people come and assess the changes for themselves. After all, the forest policy debate in most people's minds may center more around the feel of different management practices than on mountains of data.

Priorities for supplemental research

The management study just described is a stand-alone learning endeavor—installed and monitored by the Siuslaw National Forest—that we expect to yield important findings useful to managers and scientists alike. Researchers will have access to the monitoring data and will help in evaluating how well each pathway, and individual pathway practices, achieve the goals of the Northwest Plan. The experimental framework and scale of this study create opportunities for rigorous and relevant research—beyond the management study objectives—not previously available. As yet, no support has been identified, but supplemental research in several areas appears to hold promise.

Research on the planning model. The workability of the integrated landscape planning approach—which includes writing an EIS rather than a series of environmental assessments, writing with a new style that is more concise and readable to a broader audience, and including specific learning objectives along with other traditional resource needs—is a question of key importance. An assessment of the planning approach will help inform future planning-direction decisions in the Forest Service. The method of case studies, as outlined by Shrader-Frechette and McCoy (1993), is appropriate to evaluate workability and potential applicability because comparisons with alternative approaches are difficult and cannot be replicated. This research will include in-depth interviews by outside evaluators to determine the reasons for success and failure. Inference about workability to other locales**—**with different forest conditions, groups of managers and researchers, and agency representatives**—**will remain limited with the case-study method, until the approach is tried in a diversity of other settings.

The following simple criteria will be used to assess workability of the planning model:

- Whether a record of decision (ROD 1994) is signed for the EIS,
- Whether the ROD is appealed or appeals are dismissed,
- Whether the monitoring plan is implemented, and
- Whether the approach is tried in other places.

If all of these criteria are met, our confidence in the approach is further enhanced by understanding the difficulty of institutional changes in a large organization, especially because of the large number of simultaneous and fundamental changes embodied in this approach. If some criteria are met and others not, then more effort will be needed to interpret potential success of the approach. Failure to meet any criteria will be interpreted as a failure in the planning approach, for this case. If the ROD is not signed, then assessment of the other criteria, and the approach in general, will be highly limited. Thus, only qualitative assessment, through interviews, is available to identify responsible factors and alternative approaches that might be tried later. For example, if the ROD is rejected because of the complexity of the EIS, then subsequent approaches might return to the traditional method of a series of highly focused environmental assessments.

Research on disturbance-management interactions. The extent that natural disturbances will help to achieve or hinder Northwest Plan objectives is uncertain. This area is thought to be influenced by winds, flooding, landslides, root pathogens, Swiss needlecast, and Douglas-fir beetle. These forests are thought to have a 400-year return interval of intense fires—evidenced by the hot fires of the late 1800s that left few residual trees and little woody debris. Management actions are directed at Plan objectives (for example, thinning to speed growth of individual trees and adding logs to streams) with relatively little consideration of potential disturbances. But poorly predictable disturbances will likely interact with management actions in both positive and negative ways. For example, without substantial wind-, insect-, and disease-caused mortality, unthinned plantations will proceed very slowly toward late-successional conditions, and near-term mortality will slow progress toward Plan objectives in widely spaced plantations. Mortality from various disturbances is likely to vary depending on wind exposure, topography and parent materials, landslide history, adjacent stand conditions, and many other factors. Further, disturbances are likely to interact with each other; for example, accumulations of woody debris may increase bark beetle activity. Complex hypotheses can be constructed based on experience with stands and the limited knowledge of interactions. Only by applying pathways to a landscape of this scale, however, can repeated patterns be expected to emerge that can be used to rigorously test these hypotheses. Also, other unexpected patterns may emerge only when a large area is managed in a similar fashion, helping to formulate new hypotheses.

Findings from this research are likely to help to refine future pathways by placing practices in certain locations and incorporating disturbance probabilities in long-term plans.

Role of understory and second-canopy plants. Retrospective studies suggest that nearly all trees in current, old-growth stands in the Oregon Coast Range were widely spaced and had little conifer competition through most of their lives (Tappenier et al. 1997). Conventional knowledge would attribute attaining large size to the lack of competition, but the story is likely more complicated. Mature, fire-origin, widely spaced Douglas-fir stands with substantial red alder and deciduous-shrub understories are not hard to find. Alder, a known symbiotic N_2 fixer, could be vital to the long-term N availability. Other studies suggest deciduous plants in general may contribute to soil organic matter, soil structure, and base-element nutrient availability in ways Douglas-fir and other conifers cannot. This study could determine the relative role of spacing and understory species on the prolonged growth of conifer dominants. Stand-scale research is envisioned that would vary the composition of understory species planted or allowed to establish in thinned plantations. Replication in areas with different initial soil-nutrient and organic matter status may help to understand mechanisms responsible for observed responses. For example, ridge shoulders often have moderately deep, highly weathered soil, but concave landforms are more affected by landslides and other soil disturbances that provide new weatherable mineral particles to the rooting zone—and understory species are likely to respond differently to these different conditions.

Research on heterogeneity-biodiversity interactions. General theory suggests that biodiversity increases with structural and temporal heterogeneity (Pickett and White 1985). Data to evaluate this theory are scarce at larger scales, especially in the Pacific Northwest, yet concepts such as fragmentation and connectivity are being widely applied. The three-pathway, replicated Five-Rivers experiment may allow for such a test and may help managers reevaluate the desirability of various practices. Although better understanding of the effects of landscape heterogeneity on spotted owl and murrelet populations would be ideal, the size of the roadsheds (1,300 acres) appears too small. Effects of heterogeneity on smaller home-range species such as amphibians and small mammals, however, are quite feasible to study in this experiment (Ross Kiester, pers. comm., Corvallis Forestry Sciences Laboratory). Wildlife-habitat models based on edge density could also be tested (Tom Spies, pers. comm., Corvallis Forestry Sciences Laboratory). Study of interactions between heterogeneity, biodiversity, and disturbance will also be possible.

Roads research. Road management has gained recent attention as part of a policy debate surrounding undeveloped forest tracts and because of the increasing expense of maintaining the extensive federal forest road system with reduced funding. Environmental effects of roads have been evaluated largely with a piecemeal approach. No science of roads exists; various scientific disciplines have been applied to individual road problems, but no general theory of roads that accounts for interactions of individual problems has yet been attempted (Gucinski et al., in press). Many questions can be asked that go far beyond the base monitoring in the management study. This study is perhaps the first experiment to focus on roads and allow landscape analyses of their effects. For example, possible research includes: effects of road closures on water quality, Public acceptance of road policy, economics of road maintenance and closures, and effects of roads on weed dispersal.

Watershed studies. Minor modifications to management of adjacent areas in 9 of the 12 experimental roadsheds will create a replicated watershed study of similar scale. More extensive stream monitoring, for example by adding weirs and conducting sediment budgets, would help to better address effects of management, road policy, disturbances, and their interactions on water quality and aquatic species responses.

Modeling and remote sensing. Research at the landscape scale is severely limited by the costs of data collection at this scale. Landscape models are rarely tested because no experiments are conducted at this scale. The Five Rivers study, with its extensive management-oriented monitoring program associated with a replicated experimental design, may provide new opportunities to more rigorously test remote-sensing technology and landscape models.

Peer Review

Hermann Gucinski (Program Manager, Ecosystem Processes Program, Pacific Northwest Research Station, Corvallis, OR) arranged for an independent peer review by Tom Spies (Pacific Northwest Research Station), John Cissel (Willamette National Forest), and John Tappeiner (USDI, USGS, BRD). Additional review comments from U.S. Fish and Wildlife, Mike Newton, and Steve Acker (Oregon State University) were considered. A reconciliation report is on file, Forestry Science Laboratory, 3200 SW Jefferson Way, Corvallis, OR 97331.

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Appendix B

Project Design Criteria

These design criteria for the Five Rivers Landscape Management Project were developed to ensure that standards and guides of the 1990 Siuslaw Forest Plan (SFP) as amended by the 1994 Northwest Forest Plan (NFP) are met. Where applicable, pertinent standards and guides from these Plans are cited. The design criteria apply to Alternatives 1 and 2, unless otherwise specified. Appropriate specialists will be consulted before any design criteria for proposed activities are changed.

I. Design Criteria Common to All Activities

1. Coho salmon

a. Reduce the density or adverse effects of existing system or nonsystem roads in the Lobster-Five Rivers Watershed by at least an equivalent mileage or adverse effect of proposed new permanent roads. Roads to be decommissioned or effects to be reduced will be identified before or at the same time new permanent roads are built.

b. Reduce the density or adverse effects of existing system or nonsystem roads in the Lobster-Five Rivers Watershed by at least an equivalent mileage or adverse effect of temporary roads not decommissioned in the same dry season they are built. Roads to be decommissioned or effects to be reduced will be identified before or at the same time new temporary roads to remain for more than one dry season are built. Roads to be decommissioned that serve a sale unit may be decommissioned up to five years after the sale closes. The National Marine Fisheries Service has identified any temporary road not built, used, and decommissioned in the same dry season (July 1- September 15) as a semipermanent road.

2. Northern spotted owl and marbled murrelet habitat

a. Comply with the standards of the 13 May 1997 biological opinion addressing the effects of implementing the Northwest Plan standards and guides on designated murrelet critical habitat (USDI 1996) for all thinning and individual hazard-tree removals that may affect critical habitat or suitable habitat of the marbled murrelet.

b. Except for hazard trees, do not remove individual known nest trees or trees with nesting structure from areas where, in the opinion of the unit biologist, the loss of such a tree would limit nesting. A known nest tree may be removed only when it is a hazard tree **and** when the tree is unoccupied by nesting birds or young.

c. For all projects affecting listed species, include a wildlife biologist in their planning and design.

3. Bald eagle, northern spotted owl, and marbled murrelet disturbance

Pending final terms and conditions issued by the U.S. Fish and Wildlife Service, implement the following criteria:

a. Do not implement any project within 0.25 miles or a 0.5-mile sight-distance of a known bald eagle nest site between January 1 and August 31.

b. Do not treat any area within 0.25 miles of a spotted owl nest site or activity center of any known pair, or within 0.25 miles of an occupied murrelet site, during the critical nesting period. The distance and timing may be modified by the unit wildlife biologist, based on site-specific information, but all changes must be appropriately documented and the Fish and Wildlife Service notified before they are implemented.

c. Do not begin activities associated with projects within 0.25 miles of occupied or unsurveyed suitable marbled murrelet habitat between April 1 and September 15 until two hours after sunrise; end activities two hours before sunset.

d. Do not use blasting for part of any proposed action from March 1 through September 30.

e. Restrict helicopter operations to August 6 through February 28 to reduce potential disturbance to listed species such as the northern spotted owl and the marbled murrelet.

4. Other requirements

a. Follow Siuslaw Plan standards and guides (FW-114 through FW-118) to meet water-quality standards outlined in the Clean Water Act for protecting Oregon waters, and apply practices as described in General Water Quality Best Management Practices, Pacific Northwest Region, November 1988. Design criteria, including these practices, are incorporated throughout the project, such as in project location, design, contract language, implementation, and monitoring. The State has agreed that compliance with these practices will ensure compliance with State Water Quality Standards (Forest Service Manual 1561.5, R-6 Supplement 1500-90-12).

b. For projects requiring heavy equipment, develop a spill plan and assure materials will be available to prevent and control the entry of fuel, hydraulic oil, or other chemicals into streams. Have a “spill response kit” on the project whenever equipment is operating; it must be sufficient to absorb 34 gallons of oil, designed to float on the surface, while absorbing oil and repelling water. The kit will meet or exceed the physical properties of a “New Pig Products Spill Kit #408” (SFP: FW-119, 120, 122).

c. The literature was searched for the project planning area for possible heritage resources (historical or archaeological sites). No known sites were identified that could be affected by this project. In accordance with the Siuslaw National Forest’s 1995 Programmatic Agreement with the State Historic Preservation Office (SHPO), conduct field inventories by certified heritage technicians and receive concurrence from the State Office after project design, but before the two actions are implemented on previously undisturbed ground. These actions include building new road to access private land in the Green River subwatershed and placing large wood in streams. Riparian planting will not be allowed in areas identified as homestead building sites. Other actions will all be on previously disturbed ground and will not require field inventories. Should any heritage resources be discovered as a result of any project activities, the site will be preserved or treated in accordance with the National Historic Preservation Act.

d. Follow the Vegetation Management Analysis to guide the managing of competing and unwanted vegetation. The plan was developed in compliance with the Record of Decision for the "Managing Competing and Unwanted Vegetation" FEIS (November 1988) and the subsequent Mediated Agreement.

II. Commercial Thinning and Postharvest Activities

1. Thin and harvest operations

Proposed, Endangered, Threatened, and Sensitive (PETS) Species:

a. Base thinning prescriptions in the late-successional reserves on the management triggers, criteria, and appropriate activities outlined in table 7 of the Late-Successional Reserve Assessment, Oregon Coast Province-Southern Portion (USDA 1997).

b. Do not fall individual trees exceeding 20 inches dbh except to create openings, provide other habitat structure such as downed logs, reduce spread of laminated root rot, eliminate safety hazard from a standing tree, or in cutting minimal yarding corridors. Where trees larger than 20 inches dbh are felled, they will be left in place to contribute toward meeting the coarse woody debris objective.

c. Units proposed for heavy thinning (30 to 40% minimum average canopy cover) are estimated to comprise 12% of all commercial thinning. In this thinning regime, base time frames and corresponding thinning areas (in percent acres) accordingly: October 1 - February 28, 8%; March 1- June 30, 0%; July 1 - August 5, 12%; August 6 - September 30, 80%.

d. Units proposed for light-to-moderate thinning (40% or greater minimum average canopy cover) are estimated to comprise 88% of all commercial thinning. In this thinning regime, base time frames and corresponding thinning areas (in percent acres) accordingly: October 1 - February 28, 22%; March 1- June 30, 5%; July 1 - August 5, 38%; August 6 - September 30, 35%.

e. Add provisions (such as CT6.25 and CT9.52) to contracts to protect any of these species that may be discovered when the project is implemented. The Forest wildlife biologist will determine the need for reinitiating consultation with the U.S. Fish and Wildlife Service, and the Forest fish biologist will determine the need for reinitiating consultation with the National Marine Fisheries Service (SFP: FW-035, 037).

f. Include applicable hourly and seasonal operating restrictions in the contract.

g. Provide a minimal 100-foot buffer to protect the loose-flowered bluegrass *Poa laxiflora* conservation-strategy population (#44) adjacent to the bottom of unit 305 from harvest operations. Consult with the Forest botanist before sale layout for assistance in locating the unit boundary.

Survey and Manage Species:

a. Conduct surveys before contracts are awarded or work begins. Because the survey-and-manage species list and survey protocols change over time (for example, new information is being developed by species specialists), review the species list and survey protocols before conducting surveys.

b. Follow current management recommendations for known sites of survey and manage species.

c. As a minimum starting point in developing protection buffers for terrestrial mollusks, use the following: buffer radius, rounded up to the nearest five feet = 2(average stand height) X (pretreatment % canopy - posttreatment % canopy)/pretreatment % canopy. Considering microsite conditions (slope, aspect, microclimate), adjust buffer up to 30% to protect key habitat features, such as deciduous trees, accumulations of coarse wood, and shade.

Stand and Species Diversity (NFP: p. C-12):

a. Emphasize variable spacing in distributing leave trees to mimic natural stands.

b. Retain western hemlock, western redcedar, Pacific yew, and native hardwoods in stands, to maintain existing species diversity. Buffer wet areas, hardwood clumps, and other unique features to maintain existing stand diversity.

c. Retain trees with unique phenotypical differences (such as large limbs) compared to the rest of the stand for future wildlife habitat. Up to 5% of the trees are expected to be in this category.

d. After retaining trees identified in “b” and “c” above, favor the largest, healthiest trees in selecting leave trees.

e. In the thinning stands in pathway B, retain 30 to 40% canopy cover (40 trees/acre) except within ¼ mile of known northern spotted owl or marbled murrelet sites, where the canopy cover will be kept above 40%. All heavily thinned stands must retain a canopy cover greater than 30%.

Snags (NFP: 2; p. C-14):

a. Where safe and feasible, retain existing snags that provide suitable wildlife habitat.

Soils and Aquatic Resources (NFP: p. B-11, 8, 9; p. C-15; TM-1, p. C-31, 32; RA-1 & 2; FW-1, p. C-37):

Streams and Riparian Vegetation

a. Implement protective vegetation leave areas or buffers around all streams, potentially unstable areas, and wet sites to maintain stream temperature, maintain stream-adjacent slope stability (including headwalls), and protect riparian vegetation. These areas will not be harvested.

b. Determine width of buffers based on site-specific factors such as stream order, presence or absence of conifers, and slope-stability conditions. Buffers will generally include the inner gorge adjacent to streams, the active flood plain, and one or two conifer rows above the slope break (SFP: FW-087, -088, -089, -112).

c. Limit skyline corridors to between 10 and 15 feet wide. Where skyline corridors pass through riparian buffers, remove no more than 20% of the canopy in a given 1,000-foot reach of stream (SFP: FW-091).

d. Directionally fell trees away from buffers to protect riparian vegetation from damage. Trees accidentally felled into buffers may be removed if stream sedimentation or damage to riparian vegetation can be avoided (SFP: FW-091).

e. Locate post-harvest canopy openings farther than 200 feet from flood plains and stream valley floors to maintain conifer in the stream-influence zone.

f. To reduce sedimentation from aggregate-surfaced roads during wet weather, apply mitigating actions such as requiring "constant reduced tire pressure" (tires are inflated to the tire manufacturer's recommended minimum pressure), avoiding blading of ditches, monitoring roads during periods of heavy rain, and using straw bales to trap sediment where needed to log haul routes.

g. To minimize soil disturbance, use standing skyline cable or aerial logging systems for all thinning sales. Ground-based logging systems such as harvesters may be used if they operate from roads.

h. Where cable yarding is planned, design logging systems to yard away from stream channels to minimize soil disturbance on stream-adjacent slopes. If this strategy is not feasible, maintain full suspension of logs over streams (SFP: FW-091, -092).

Soils and Woody Debris

a. Do not use whole-tree yarding unless it's agreed to by an interdisciplinary team. Decisions on whether to implement whole-tree yarding will be made case by case.

b. Retain existing logs in stands to benefit soil nutrient cycling; moss, fungi, and lichen habitat; travel corridors for small mammals; and foraging sites for various animal species.

c. Retain limbs and tops in stands on sites where little or no ground vegetation exists to reduce potential for soil erosion and enhance soil nutrient cycling.

d. Where applicable to reduce potential for theft of dead and down structural material, close roads as soon as possible after harvest.

e. Outside of areas designated for full log suspension and lateral yarding, use one-end log suspension on all areas designated for cable yarding systems to reduce soil displacement and compaction (SFP: FW-107).

f. Where slopes are greater than 60% immediately below side-cast roads or roads to be decommissioned, retain two rows of conifers (where feasible) to maintain slope stability (SFP: FW-112).

Temporary (Nonsystem) Roads and Landings (NFP: RF-2 & 5, p. C-32, C-33):

a. A team comprising planners and engineers will review road project sites before preparing road design plans for timber sale contracts. Planners and engineers will review any changes in design plans before incorporating them into contracts.

b. Do not reuse existing temporary roads where road stability is a major concern.

c. Limit new temporary spur roads to stable ridges to minimize soil disturbance. No new permanent system roads will be built. Where operationally and economically feasible, design logging systems to minimize the need for new temporary roads (SFP: FW-162, 163).

d. Do not designate temporary roads (new or reopen) or system roads as specified construction or reconstruction unless recommended by an interdisciplinary team and approved by the line officer.

e. If the horizontal alignment of temporarily reopened roads needs adjustment, favor the cut bank side of the road prism to minimize disturbance to side-cast areas and established vegetation.

f. Scatter slash created through road building in the stands.

g. Surface temporary roads used during the wet season with rock aggregate where needed. Surfacing depth should allow for log trucks using constant reduced tire pressures. Consider the length of temporary roads when determining the season of use.

h. Build skyline cable and helicopter service landings in stable areas with stable cut bank slopes. Use existing landings where feasible (SFP: FW-115, 117).

i. Water bar and close temporary roads between operating seasons or as soon as the need for the road ceases, to minimize sedimentation from roads. Spread landing slash by machine over landing sites (unless tree planting is planned) and spur roads. Seed remaining exposed soils with native species (if available). This practice will be more cost effective than machine piling and burning of landing piles and will help to stabilize disturbed soils (SFP: FW-162).

j. Evaluate temporary roads used for timber removal (especially those used during the wet season) to determine whether roads need to be decompacted. Evaluations will be made by a watershed specialist (such as a hydrologist, soil scientist, or geologist) to determine need for and type of (ripping or subsoiling) treatment. Through agreement, ripping can be done by the timber-sale operator. Avoid subsoiling in areas where residual tree roots may be adversely affected.

k. Do not locate helicopter service landings near streams to minimize potential for petroleum spills affecting water quality.

l. Because the number of large helicopter log-landing sites is insufficient, use existing roads as log drop zones for helicopter logging by small ships such as the K-Max and the Bell 204. Design log drop zones to allow workers to be at least 1.5 times the length of the longest log from drop zones. Place landings to within 0.5 miles from units. Design landings to allow the loader to swing logs, and be level enough to allow for accurate monitoring of loaded truck weight.

Existing System Roads (NFP: RF-2 & 5, p. C-32, C-33):

a. Where water bars are temporarily removed from project-maintained roads to facilitate harvest operations, add rock if needed at these sites to maintain a hardened road surface and reduce the potential for erosion.

b. Replace water bars and close project-maintained roads when they are no longer needed. Appropriate closure devices generally include earthen mounds or large boulders. Purchasers will be responsible for replacing closure devices that were removed for harvest operations.

Insects, Disease, and Wind (NFP: p. C-12, C-13)

a. For stands considered vulnerable to storm winds, implement untreated "wind buffer" areas.

b. Follow the silviculture prescription guidelines when marking around laminated-root-rot areas.

c. To help document possible pockets of laminated root rot, <u>include</u> "Treatment of Stumps" (CT6.412) in the timber sale contract.

2. Post-harvest "Essential" KV activities

These treatments focus on incorporating management elements for understory planting in commercially thinned units. <u>Refer</u> to the Silviculture Prescription in the project file for unit-specific information.

Stand and Species Diversity (NFP: p. C-12):

a. <u>Underplant</u> pathway B acres where residual trees approximate 40 tpa. These acres are the highest priority for underplanting.

b. <u>Plant</u> about 3 to 5% of thinned and harvested acres in natural or created openings of from one-half to one acre.

c. <u>Underplant</u> shade-tolerant conifers (western hemlock and western redcedar) and hardwoods (red alder, Oregon big-leaf maple, cascara, and other native hardwoods). If necessary, <u>fell</u> conifer trees required for coarse woody debris to provide more light.

d. <u>Implement</u> animal control measures such as tubing or capping to benefit tree survival and growth.

e. <u>Release</u> planted trees from red alder or brush as needed for up to 10 years after the sale is closed to benefit tree survival and growth.

3. Post-harvest mitigation activities

These treatments focus on incorporating management elements for fire and fuels, coarse woody debris, snags and wildlife trees, stand and species diversity, and noxious weeds. Each commercially thinned unit, regardless of the sale contract used, must meet the payment to counties, roads and trails, and collect KV funds for its allotment of snag and coarse woody debris mitigation before any collections for the salvage sale fund.

Fire and Fuel Management :

a. <u>Follow</u> Fire Management Plan for LSR RO268 for all wildfire suppression or presuppression prevention programs. <u>Treat</u> all fuels (logging residue) according to the guidelines of the Oregon Smoke Management Plan.

b. Design fuel treatment activities to meet Aquatic Conservation Strategy objectives and to minimize disturbance to riparian vegetation. Refer to the Northwest Forest Plan (FM-1, 3, 4, 5; pp. C-35, 36) for additional information.

c. Where fuel borders county roads and system roads maintained open for general use, provide fuel breaks to reduce the risk of human-caused fire. Measure fuel breaks from the edge of the road into the thinned units. System roads such as 32, 3210, 3225, 3250, 3259, 3505, 3510, 37, 3705, and 58 will require a minimum 25-foot fuel break for each side of the road bordered by fuel (about 40 acres total).

d. Create fuel breaks by (in the order of least to most expensive cost) leaving untreated buffers adjacent to roads, directional felling of trees away from roads, underburning adjacent to roads, and hand piling and burning slash adjacent to roads. High cut banks (with no slash) can be considered adequate fuel breaks.

e. If scattering of landing piles will not adequately address the fire hazard, burn landing slash within 25 feet of open system roads.

f. Where practical, close project-maintained system roads (roads kept open only for the duration of the commercial thinning project) to vehicle traffic during the dry season where landing piles and other logging slash borders these roads. Determine case-by-case if road closure alone will adequately address the fire hazard. If these roads are to be kept open during the dry season, consider reducing the fuel loading through prescribed burning to address the fire hazard.

g. After harvest operations are completed on any given unit, conduct fuel treatments where necessary and as soon as practical to minimize exposure to fire hazard.

h. To reduce the potential for fire spread and the difficulty in controlling it, place coarse woody debris in small pockets of heavier concentration rather than scattering it more evenly across units. Where large amounts of coarse wood will be created or where thinned units are close to each other, place heavier concentrations of coarse wood on north slopes and lower 1/3 slopes.

i. To reduce the potential for wildfire, do not fell trees for coarse woody debris in designated fuel breaks unless the tops are kept outside of the breaks.

Coarse Woody Debris Mitigation (NFP: 8, 9; p. C-15; C-12 & 13):

a. Provide coarse woody debris by using the following prescriptions based on the Late-Successional Reserve Assessment, Oregon Coast Province, Southern Portion (R0268), version 1.3, p. 66-69: pathway A plantations--Alternative 4; pathway B plantations--Alternatives 2 and 3; pathway C plantations--Alternative 3; plantations outside pathways and in late-successional reserve--Alternative 3.

b. Maintain these trees-per-acre (tpa) prescriptions for coarse woody debris: pathway 3B, 30 tpa; pathways 5B, 7B, and 8B, 15 tpa; pathway C, 5 tpa; plantations outside pathways and in LSR, 5 tpa; and 0 tpa in plantations outside of pathways and LSR.

c. Defer creating coarse wood in pathway B units until five years after the sale contract is closed to allow for canopy recovery. At that time, monitor the canopy cover before the trees are felled to ensure canopy cover remains at or above the 30 to 40% range.

c. Use trees that blow down within 5 years after harvest towards meeting the woody debris allotment.

d. Fell trees for woody debris in areas that would enhance density variability within stands.

e. To reduce the potential for Douglas-fir bark beetle infestations, fell trees to provide woody debris outside of the adult beetle flight season (May through June 15).

Creating Snag and Wildlife Trees (NFP: 2; p. C-14):

a. To mitigate for past losses of mature snags, top mature trees or inoculate them with native fungi (*Phellinus pini* and *Fomitopsis canjanderi*) in natural stands adjacent to commercially thinned managed stands. Top or inoculate about 1,240 trees to ensure subwatersheds contain at least 1.4 snags/acre or 10% above their existing number.

b. In thinned portions of plantations, inoculate about 6,500 (including 20% mitigation for past harvest practices) trees with native fungi (*Phellinus pini* and *Fomitopsis cajanderi*) to ensure subwatersheds average 2.4 snags/acre. Inoculation will allow for continued tree growth and increase snag diameter while providing cavity habitat. Inoculation numbers are based on the net acres of managed stands commercially thinned.

c. Do not create snags and wildlife trees through tree topping between March 1 and September 30, to avoid potential disturbance to spotted owls and murrelets.

d. Do not cut trees that appear to contain red tree vole or raptor nests.

e. Do not create snags where they appear likely to fall over or slide into public-traveled roads, to avoid increasing hazardous conditions in the range of the roadway and theft of snag material for firewood.

Noxious Weed Prevention and Mitigation:

a. To prevent the spread of noxious and undesirable weeds, maintain canopy cover to the extent possible when reopening and building roads or stabilizing and closing them. Seed disturbed sites lacking canopy cover (landings and roads) with available native grass and forb species.

b. To prevent spread of noxious weeds, include provision “Cleaning of Equipment”, C6.343 (Option 2) in the timber sale contract for all ground-based equipment associated with logging operations.

c. Develop noxious weed treatment prescriptions for harvested units and their adjacent areas from information obtained from previous monitoring. Limit treatments to manual, mechanical, and biological methods (including additional seeding). The funding source for treatments will be KV mitigation collections.

Original Logging-Spur-Road Stabilization (Original Logging Roads Not Used for Commercial Thinning Operations):

a. Where warranted, place existing logging spurs not used for thin and harvest operations but within ¼-mile of commercial thinning units in the KV plan to become eligible for KV funds. Use these funds (if available) to hydrologically stabilize the roads, where warranted. If KV funds are not available, another funding source will need to be identified.

b. Generally apply road-decommissioning design criteria to these roads.

c. Where log culverts were used, retain logs in streams.

d. Remove failing sidecast material where the potential for material entering streams is moderate to high.

4. Post-harvest enhancement activities

Stand and Species Diversity (NFP: p. C-12):

a. Plant shade-tolerant conifers (western hemlock and western redcedar) and hardwoods (red alder, Oregon big-leaf maple, cascara, and other native hardwoods) in suitable areas outside of those required for essential KV. If necessary, fell additional trees to provide more light. Felled trees will contribute toward the downed wood requirement.

b. Plant hardwoods (and possibly western redcedar) in root-rot-infested patches to reduce effects of the disease.

c. Use animal control measures such as tubing or capping to benefit survival and growth rates of planted trees.

d. Release planted trees from alder and brush as needed for up to 5 years after the sale is closed to benefit survival and growth.

Creating Snag and Wildlife Trees (NFP: 2; p. C-14):

a. In unthinned portions of plantations, inoculate about 4,200 trees with native fungi (*Phellinus pini* and *Fomitopsis cajanderi*) to ensure subwatersheds average 2.4 snags/acre. Inoculation will allow for continued tree growth and increase snag diameter while providing cavity habitat.

b. Do not create snags and wildlife trees through tree topping between March 1 and September 30, to avoid potential disturbance to spotted owls and murrelets.

c. Do not cut trees that appear to contain red tree vole or raptor nests.

d. Do not create snags where they appear likely to fall over or slide into public-traveled roads, to avoid increasing hazardous conditions in the range of the roadway and theft of snag material for firewood.

Tables 1 and 2 identify KV projects for Alternatives 1 and 2. The tables list the projects in order of priority and identify some as essential or for mitigation. Those not identified as essential or for mitigation are non-essential or enhancement projects. Estimated costs are included.

Table 1. Alternative 1 KV projects

Prioritized action	Essential	Mitigation	Unit of measure	Unit number	Cost/unit	Total cost
Heavy thin, plant	Yes		Acres	312	645	201,240
Heavy thin, release	Yes		Acres	312	300	93,600
Plant openings	Yes		Acres	92	645	59,340
Release openings	Yes		Acres	92	300	27,600
Stream shade monitoring		Yes	Miles	6	2,000	12,000
Snag creation by mature-tree topping		Yes	Trees	1,241	100	124,100
Snag creation by plantation-tree inoculation[a]		Yes	Trees	1,302	35	45,570
Downed wood creation		Yes	Trees	25,065	5	125,325
Nonsystem road decommissioning[b]		Yes	Feet	8,500	3	25,500
Noxious weed control		Yes	Acres	58	135	7,830
Understory planting			Acres	1,185	645	764,325
Understory release			Acres	296	300	88,800
Snag creation by plantation-tree inoculation 1[c]			Trees	5,209	35	182,315
Noncommercial thinning			Acres	1,847	275	507,925
Snag creation by plantation-tree inoculation 2[d]			Trees	4,250	35	148,750
Riparian natural conifer release			Acres	100	400	40,000
Riparian planting			Acres	50	800	40,000
Riparian release			Acres	50x2	400	40,000
Riparian plant, walk-in			Acres	50	900	45,000
Riparian release, walk-in			Acres	50x2	500	50,000
Large wood for streams			Project	2	150,000	300,000
Meadow maintenance			Acres	51	400	20,400
Meadow creation			Acres	14	1,125	15,750
System road decommission			Miles	53	1,992	107,200
Green River bridge maintenance			Project	1	2,000	2,000
Total						**3,074,570**

[a]Snag creation-plantation tree inoculation mitigation = 20% of total inoculation inside commercially thinned portions of plantations.
[b]Nonsystem road decommissioning includes original logging spurs not used for commercial thinning but needing some stabilization work to eliminate chronic stream sedimentation or the potential for stream sedimentation.
[c]Tree inoculation 1 = total tree inoculation inside commercially thinned portions of plantations minus 20% mitigation.
[d]Tree inoculation 2 = total tree inoculation inside plantations, but outside commercially thinned portions of plantations.

Table 2. Alternative 2 KV projects

Prioritized action	Essential	Mitigation	Unit of measure	Unit number	Cost/unit	Total cost
Heavy thin, plant	Yes		Acres	82	645	52,890
Heavy thin, release	Yes		Acres	82	300	24,600
Heavy thin, plant, walk-in	Yes		Acres	206	734	151,204
Heavy thin release, walk-in	Yes		Acres	206	380	78,280
Plant openings	Yes		Acres	92	645	27,600
Release openings	Yes		Acres	92	300	50,400
Stream shade monitoring		Yes	Miles	6	2,000	12,000
Snag creation by mature-tree topping		Yes	Trees	1,241	100	124,100
Snag creation by plantation-tree inoculation[a]		Yes	Trees	1,256	35	43,960
Downed wood creation		Yes	Trees	24,655	5	123,275
Noxious weed control		Yes	Acres	26	135	3,510
Understory planting			Acres	1,150	645	741,750
Understory release			Acres	287	300	86,100
Understory plant, walk-in			Acres	35	734	25,690
Understory release, walk-in			Acres	9	380	3,420
Snag creation by plantation-tree inoculation 1[b]			Trees	5,026	35	175,910
Noncommercial thinning			Acres	1,634	275	449,350
Noncommercial thinning, walk-in			Acres	209	330	68,970
Snag creation by plantation-tree inoculation 2[c]			Trees	4,104	35	143,640
Riparian natural conifer release			Acres	100	400	40,000
Riparian plant			Acres	50	800	40,000
Riparian release			Acres	50x2	400	40,000
Riparian plant, walk-in			Acres	50	900	45,000
Riparian release, walk-in			Acres	50x2	500	50,000
Large wood for streams			Project	2	150,000	300,000
Meadow maintenance			Acres	51	400	20,400
Meadow creation			Acres	14	1,125	15,750
System-road decommission			Miles	53	1,992	107,200
Green River bridge maintenance			Project	1	2,000	2,000
Total						**3,046,999**

[a]Snag creation-plantation tree inoculation mitigation = 20% of total inoculation inside commercially thinned portions of plantations.
[b]Tree inoculation 1 = total tree inoculation inside commercially thinned portions of plantations minus 20% mitigation.
[c]Tree inoculation 2 = total tree inoculation inside plantations, but outside commercially thinned portions of plantations.

III. Road Decommissioning and Closure

1. Road Decommissioning (NFP: RF-3c, 5, & 6; p. C-32, 33):

a. Review, using a team of planners and engineers, the road project sites before preparing design plans for road-decommissioning contracts. Any changes in design plans will be reviewed by planners and engineers before being incorporated into contracts.

b. Design fill-removal activities to minimize sediment entering stream channels. The objective is to restore stream processes and floodplain access by removing all fill material on the valley floor. Excavate slopes to approximate 1.5:1, where practical; do not encroach on natural slopes. Allow disturbed slopes to revegetate naturally or use erosion control measures (such as tree limbs and tops, native seed mixtures or plants), where a moderate to high potential for surface erosion exists. Where feasible, restore the natural flood plain. Consult with watershed and/or fisheries staff where technical feasibility or economics limit meeting fill removal objectives (SFP: FW-123).

c. Place material excavated from stream crossings and unstable side-cast road fills, and asphalt surfacing material on stable areas at least 60 feet away from stream channels or active flood plains. Suitable areas include roadbeds adjacent to cutbanks, or on previously designated waste areas (if locally available). Remove any alder or conifer from the cut bank before placing excavated material, to enhance soil-to-soil contact and long-term soil stability. Contour waste piles to approximate 1.5:1 to 2:1 slopes and allow to revegetate naturally. Seed piles with a mixture of native species where a moderate to high potential exists for surface erosion, or where noxious weed infestation is likely. Avoid using straw except in extreme circumstances (SFP: FW-117, 171).

d. Place woody debris, if locally available, in stream channels where sediment is expected to erode from channels at amounts that equal or exceed three (3) cubic yards. This strategy will help reduce sediment rates as streams adjust to gradients during the next year's high flows.

e. Install water bars on both sides of excavated stream banks to route surface water away from newly excavated slopes (SFP: FW-123).

f. Stabilize unstable areas (such as road side-cast material) before a road is decommissioned, to prevent fine sediment from entering stream channels. Excavate side-cast fill material adjacent to stream crossings, where fill material could fail, enter streams, or both. Focus on areas where downhill slopes adjacent to roads are greater than 60%, and road fills are within 200 feet slope-distance of streams (SFP: FW-108, 117).

g. Design water bars to facilitate proper drainage of surface water and to prevent ponding. Place water bars in areas where drainage will not destabilize road fills. To keep streams within their channels when culverts are obstructed, build water bars immediately above existing culverts to become the overflow point. Use the Siuslaw National Forest Water Bar Construction Guide to determine water-bar spacing and design (SFP: FW-123).

h. Decompact surfaces of decommissioned roads where necessary, to allow water to percolate through the soil and accelerate the recovery of woody vegetation. Although subsoiling is the preferred method, use ripping if subsoiling is not feasible or economical. Consult a geotechnical specialist to determine feasibility of subsoiling (SFP: FW-162).

i. Transport off-site culverts removed from stream crossings and ditches to be recycled, reused, or disposed of at a landfill.

j. Do not apply specified reconstruction to roads that will be decommissioned.

2. Road Closure (ML1):

a. Close roads placed in ML1 status by one of three methods: growing roadside vegetation, placing an earthen mound or other natural material at or near the road entrance, or installing a guard rail. Closure type will be determined case by case.

b. Stabilize closed roads by reopening culvert inlets where necessary, repairing water bars, or building additional water bars. Build drain dips immediately above stream crossings, to ensure water is kept within stream channels when culvert inlets are obstructed. Harden drain dips with rock to minimize sedimentation of streams when culverts fail.

c. Design and place water bars based on specifications for decommissioned roads.

d. Excavate failing side-cast fill material at stream crossings and at other areas where material could enter streams. Focus on areas where downhill slopes adjacent to roads are greater than 60% and road fills are within 200 feet slope-distance of streams.

IV. Hydrologic Function and Water-Quality Restoration (NFP: RA-1 & FW-1; WR-1, 3; p. C-37)

Wildlife biologists, with technical assistance from U.S. Fish and Wildlife Service biologists, will select trees to be placed in streams for enhancing hydrologic function and water quality. First priority for tree selection will be to use suitable hazard trees or trees blown down across ATM roads. To protect interior forest habitat, existing or potential nesting structure, and neighboring trees with nesting structure from incidental damage, use the following criteria to select additional trees for placement in streams:

1. Select trees that will be dispersed within the first two lines of trees along the periphery of permanent openings such as road rights-of-ways and power line corridors, or along the periphery of nonpermanent openings such as plantation edges;
2. Select trees that will be less than or equal to 36 inches in diameter at breast height and lack existing or potential nesting structure (that is, for murrelets, limbs or other platforms greater than or equal to four inches in diameter);
3. In general, select individual trees; however, on rare occasions, select small groups of no more than three trees where appropriate;

4. Select trees (or small groups of trees defined above) that will be spaced about 100 feet apart; and
5. To the greatest extent possible, select trees to avoid any damage to existing or potential nesting structure in the stand during felling and removal operations.

The following trees will **not** be selected for removal:

a. Trees with potential nesting platforms;
b. Known nest trees;
c. The largest trees in areas where the number of large trees is limited;
d. Trees with the best opportunity to develop future nesting structure.

To evaluate the effectiveness and feasibility of tree selection criteria associated with large wood for stream enhancement, the Forest Service will request technical assistance from the U.S. Fish and Wildlife Service before felling or removing any standing trees not posing an immediate hazard. This technical assistance may include meetings and field reviews as needed and would be both before and during the tree selection process. Additional assistance may also be needed during felling and helicopter operations.

a. To avoid artificially anchoring large wood in streams, large wood length should be at least 1.5 times bank-full width, and large wood diameters (measured at breast height on a tree) should approximate 2 times bank-full depth.

b. Place logs in streams by helicopter only from August 6 through February 28 to reduce potential disturbance to listed species, such as the northern spotted owl and the marbled murrelet.

c. If ground-based equipment is used, place large woody debris (partial- and whole-tree length) in streams during the summer-to-fall low-flow period to minimize disturbance to fish and to lessen safety risks (SFP: FW-117).

d. Plant western redcedar or other shade-tolerant conifer and willow or other native hardwoods in designated riparian areas. Plant trees within 200 feet of stream channels. Include, at least, a fish biologist and a silviculturist in selecting planting sites. Implement animal control measures such as tubing or capping to benefit tree survival and growth. Maintain planted trees as needed for up to 5 years after the sale is closed to facilitate tree survival and growth.

e. Where buffers contain a dense conifer component, thin (but do not harvest) these areas within 5 years after harvest operations are completed, to accelerate developing large wood for streams. Develop thinning prescriptions governed by stream shading requirements and slope stability concerns. Use a silviculturist and a hydrologist or fish biologist in preparing prescriptions. Fell some trees across stream channels to provide additional stream structure; other trees may become snags.

V. Other Activities

1. Treatment of Managed Stands 5 to 15 Years Old (NFP: p. C-12):

The project area contains an estimated 4,082 acres of stands currently ranging from 5 to 15 years old. Of these stands, 1,300 acres have been thinned, about 2,366 acres will be thinned, and about 416 acres will be left to develop on their own.

About 1,847 acres are within 0.25 miles of proposed thinning and harvest units and will be eligible for KV fund collections (revenue collected from the sale of timber). If KV funds are insufficient, other appropriated funds will be needed to fully fund these treatments. Other appropriated funds will need to be available to treat the remaining 519 acres.

a. Leave felled trees on the ground and use a variable tree-density pattern. Omit understory planting at this time. Thinning prescriptions will retain 100 to 200 trees per acre.

b. Leave about 3% of the area in each stand as untreated 3/4-acre clumps. Clumps are expected to total about 70 acres for all stands. A wildlife biologist and silviculturist will determine clump locations.

c. Protect all western hemlock, western redcedar, Pacific yew, cascara, willow, big-leaf maple, chinquapin, and wild cherry.

d. Protect any red alder clumps needed to help stabilize stream channels or other disturbance sites. Consider selective felling of alder near streams if it would benefit the growth and development of nearby conifer.

e. Maintain about 20 red alder per acre where available.

2. Stocking Control:

a. Conduct manual release of conifer during June and July when treatments are most effective.

b. Follow the terms and conditions associated with the appropriate disturbance biological opinion.

3. Creating Early-Seral Habitat, Maintaining Existing Meadows, and Managing Noxious Weeds:

a. Create early-seral habitat in existing plantations in matrix. Where available, use existing laminated root-rot pockets as a core area for early-seral habitat. Follow guidelines in the silviculture prescription to determine appropriate boundaries of early-seral habitat when using root-rot pockets.

b. Remove encroaching conifers, woody vegetation, and other unwanted vegetation such as noxious weeds and non-native plants from existing meadows to maintain meadow habitats. This activity will be coordinated by a wildlife biologist, a botanist, and a fish biologist.

c. Control non-native or unwanted vegetation in meadows during periods identified to be most effective for the target species. Use biological methods over manual methods, if they are available and more effective in controlling unwanted vegetation.

4. Roadside Hazard Trees:

a. Identify hazardous trees by the principles outlined in "Long Range Planning for Developed Sites in the Pacific Northwest" (USDA 1992), "Oregon guidelines for selecting reserve trees" (USDA, USDI, et al. 1995), and Oregon Administrative Rules 437-006-0001.

b. Evaluate hazard trees by including a road manager, a wildlife biologist, and a silviculturist (or another person trained in hazard-tree identification) along ATM roads and timber-sale haul routes to determine which trees, snags, or both need to be felled or topped to remove roadside hazards. Give priority to using felled or topped materials in place for coarse woody debris or for stream restoration before selecting them as saw logs, wood fiber, or firewood.

5. ATM Road Maintenance: Remove conifers and hardwoods on ATM road cut banks or road fills through sales or service contracts. Where possible, use planned commercial thinning sales as a means for removal before using a "road corridor" sale.

6. Green River Bridge: Maintain the Green River bridge investment.

7. Waste Areas:

a. Use an interdisciplinary process to determine sites for waste areas.

b. Place material removed from road failure sites in stable areas at least 60 feet away from stream channels. When necessary, use previously designated waste areas. Contour waste piles should approximate 1.5:1 to 2:1 slopes. Allow piles to revegetate naturally or use erosion control measures where a moderate to high potential exists for surface erosion, or where noxious weed infestation is likely. Avoid using straw except in extreme circumstances (SFP: FW-117, 171).

c. Level and seed long-term (multiyear use) waste areas after each season of use. Short-term (one-time use) waste areas should be shaped or graded to contour, seeded, and--where other resource objectives are not compromised--planted with appropriate tree species.

VI. Special-Use Road Permits

1. Private Road Permit: Roseburg Forest Products will be granted a private road special-use permit (FS-2700-4c) to construct, maintain, and use a road across National Forest land in section 26, T15S, R10W. This permit will serve to mitigate the loss of access to their property located in sections 25 and 26 because of decommissioning road 3231. The new road will be about 1/2-mile long and on or near a ridge system.

Limits for the road design include maximum 12-foot-wide aggregate running surface, average 20-foot clearing limit, and leaving cut trees on site as coarse woody debris.

2. Hauling Permits: The existing Forest System roads that access private land may be used for private hauling of timber. Road-use permits (FS-7700-41) may be issued to allow hauling after any required consultation with the US Fish and Wildlife Service and the National Marine Fisheries Service for actions proposed by private land owners is completed.

VII. Monitoring Objectives

Typically, about 5% of Forest funds is used for monitoring Forest projects. The Team regards the management study as an opportunity to use the funds intended for monitoring on the Forest more effectively. Because of its identified monitoring strategies and priorities, the management study is expected to be a high priority for Forest funding relative to other Forest projects.

Monitoring items include those required for implementation and effectiveness monitoring. Implementation monitoring determines if the project design criteria and both the Northwest and Siuslaw Plans standards and guides were followed. Effectiveness monitoring evaluates whether applying the management activities achieved the desired goals, and if the objectives of the standards and guides were met. Findings resulting from project observations and monitoring are expected to help influence designing future projects and developing future monitoring plans.

1. Implementation Monitoring

Forest Plan Standards and Guides

> Before the contract is advertised, review project contracts for consistency with the standards and guides of both the Northwest and Siuslaw Plans and project design criteria.

USFWS Biological Opinion Terms and Conditions

> The standards common to all actions described on pages 3 to 5 of the habitat modification biological opinion are incorporated as terms and conditions (p. 32). The Fish and Wildlife Service believes that incidental take for listed species has been minimized if these standards are adhered to, to the extent that additional terms and conditions are not required.

Contract and Operations

Involve appropriate specialists when developing contracts (for example, with plan-in-hand reviews) or conducting District operations work to ensure activities are implemented as designed. The appropriate specialists will also participate periodically during contract work, especially when unusual circumstances arise that may require a contract modification.

2. Effectiveness Monitoring

Management Study

Refer to Appendix A of the final EIS, tables A-3 through A-5 for monitoring information.

Vegetation Management

a. Monitor treated stands as part of the Forest Monitoring Plan, Vegetation Condition section. Focus observations on tree survival and growth and on planted trees.

b. Monitor trees planted in the understory for survival and growth, as part of the Forest Monitoring Plan, Vegetation Condition section.

c. Monitor created snags and wildlife trees as part of the Forest Monitoring Plan, Wildlife Habitat section. This site offers opportunities to observe effects of fungal injection. Observations will focus on the location and rate of decay, and use by cavity nesters.

d. Observe all thinned stands to determine if residual trees are being damaged by Douglas-fir bark beetles. This activity will be tiered to the Forest insect and disease monitoring program.

e. Evaluate riparian leave areas as to their effectiveness in maintaining stream shading.

f. Observe areas treated for controlling noxious weeds the first year after treatment and as needed thereafter to determine if additional treatments are necessary.

g. For a period of three years after harvest, annually monitor high and moderate risk (to weed infestation) thinned and harvested units to determine effectiveness of preventive strategies. Monitoring information will be used to develop prescriptions for future noxious-weed treatments in and adjacent to units.

h. Conduct a field review of the buffered loose-flowered bluegrass population adjacent to the bottom of unit 305 one year after the unit is harvested to evaluate post-harvest population status and response.

Road Treatments

a. Field-review excavated slopes from road stabilization activities and note areas where eroded materials enter stream channels. Make observations after the first major rainfall and seasonally thereafter until vegetation reoccupies disturbed sites (about 2 to 5 years). If the surface is eroding and could adversely affect fish habitat, take steps to eliminate or reduce erosion.

b. Observe road surface treatments such as water bars to determine effectiveness and effects on the stability of the outer portion of the road prism.

c. Review the effectiveness of road closures to determine whether another form or location of closure will be required at or near road entrances.

d. Tier monitoring to the Forest Monitoring Plan, Aquatic Resources section.

Fish Habitat Treatments

a. Use Oregon Department of Fish and Wildlife and U.S. Forest Service stream surveys to assess changes from measured baseline data in fish habitat characteristics of streams where large wood was added.

b. Tier monitoring to the Forest Monitoring Plan, Aquatic Resources section.

Five Rivers Landscape Management Project

Cascade Plantation Stand-Exam Summary

Stand Number	Plantation Acres	Stand Exam Acres	Trees Per Acre	Tree Diameter	Tree Height	Year of Origin
021	57	42	171	14.5	71	1967
031	25	13	152	12.6	62	1967
042	75	59	198	13.5	67	1967
048	30	21	237	12.8	81	1967
050	54	47	302	10.2	62	1969
079	70	46	278	12	92	1961
083	75	75	254	11.6	68	1971
088	72	54	303	12.2	89	1960
104	28	20	91	21.7	125	1964
106	46	46	205	12.4	101	1956
111	91	81	145	15.1	94	1957
114	67	67	225	11.7	80	1962
121	32	22	202	13.2	74	1961
	722	**593**	**223**	**13.3**	**82**	

Crab

Stand Number	Plantation Acres	Stand Exam Acres	Trees Per Acre	Tree Diameter	Tree Height	Year of Origin
224	24	16	210	13.1	91	1960
245	59	59	158	13.7	96	1961
252	43	37	260	10.1	66	1971
267	99	84	150	14.3	94	1960
273	59	49	158	15.2	93	1961
278	8	8	218	14.5	123	1950
305	46	39	248	12.6	88	1964
307	35	35	147	14.6	87	1964
309	66	53	227	11.8	82	1966
323	13	13	263	11.2	78	1965
327	24	16	242	10.5	57	1969
343	143	122	170	14.9	108	1958
344	53	53	259	11.8	73	1968
352	62	44	235	13.5	91	1960
364	22	14	203	13.8	85	1965
381	74	74	187	13.4	88	1964
384	90	90	151	15.1	99	1961
385	72	72	180	14.1	97	1963
415	9	3	478	9.2	75	1966
420	62	62	193	13.2	98	1962
	1063	**943**	**217**	**13**	**89**	

Green River

Stand Number	Plantation Acres	Stand Exam Acres	Trees Per Acre	Tree Diameter	Tree Height	Year of Origin
283	74	66	269	12.8	97	1962
331	9	9	141	13.5	89	1958
341	70	44	246	10.1	63	1972
349	28	12	226	11	70	1972
365	35	35	206	11.2	75	1962
372	373	173	197	13.3	93	1961
400	104	75	139	14.4	93	1964
417	79	64	128	15.2	100	1962
439	6	6	279	11.2	83	1955
449	11	11	163	16.4	102	1964
450	31	31	128	16.4	110	1957
451	28	25	264	12.4	87	1964
468	69	50	242	11.9	76	1970
472	143	79	199	13.6	90	1959
474	72	66	214	12.1	80	1967
476	80	80	211	13.8	88	1964
479	67	67	218	13.1	90	1965
481	69	43	197	14.5	88	1966
492	61	53	268	11.8	73	1967
493	18	16	200	12	74	1971
499	50	50	196	13.9	103	1960
500	18	15	136	11.9	80	1961
	1495	**1070**	**203**	**13**	**87**	

Lower Buck

Stand Number	Plantation Acres	Stand Exam Acres	Trees Per Acre	Tree Diameter	Tree Height	Year of Origin
146	135	80	207	12.1	91	1959
155	68	68	178	12.9	93	1960
161	56	40	239	13.3	90	1966
167	44	43	218	12.2	77	1965
182	48	34	138	15.1	88	1960
183	30	18	177	13.5	88	1960
195	15	15	165	14.6	98	1964
218	17	14	107	19.6	128	1941
220	36	33	267	11.5	68	1968
227	8	7	229	11.9	81	1960
229	149	111	219	11.6	87	1960
230	59	59	211	12	64	1970
246	90	53	185	14	93	1957
250	19	14	332	11.1	82	1967
257	33	14	211	12.9	80	1957
	807	**603**	**206**	**13.2**	**85**	

Lower Five

024	50	47	205	13.6	92	1964
122	31	27	224	11.4	73	1969
124	48	17	203	13.8	106	1958
160	40	40	246	10.8	70	1969
175	88	80	159	14.6	97	1960
187	62	51	266	11.2	84	1967
	319	**262**	**217**	**12.6**	**87**	

Middle Five

Stand Number	Plantation Acres	Stand Exam Acres	Trees Per Acre	Tree Diameter	Tree Height	Year of Origin
186	52	39	267	12.2	82	1967
199	18	15	266	12.2	92	1964
213	33	33	247	13.1	94	1960
235	34	34	144	15.1	100	1960
270	80	73	145	15.3	96	1962
275	21	14	192	14.3	91	1961
281	34	15	211	13.6	103	1956
316	32	32	244	12.6	87	1965
322	15	10	188	14.3	107	1958
366	29	29	227	12.8	107	1958
	348	**294**	**213**	**13.6**	**96**	

Upper Buck

Stand Number	Plantation Acres	Stand Exam Acres	Trees Per Acre	Tree Diameter	Tree Height	Year of Origin
271	61	44	224	13	97	1961
272	52	52	174	14.3	88	1961
280	11	9	205	12.6	80	1957
282	9	7	208	12.9	78	1966
303	35	35	295	11.2	81	1967
312	38	38	318	11.1	76	1965
353	63	45	136	14.9	95	1961
376	18	18	292	10	74	1967
418	29	29	244	11.1	76	1967
425	44	44	230	11.2	79	1969
440	50	50	176	13.5	92	1960
465	20	16	163	13.6	94	1966
475	68	68	167	14.8	88	1961
	498	**455**	**218**	**12.6**	**84**	

Upper Five

Stand Number	Plantation Acres	Stand Exam Acres	Trees Per Acre	Tree Diameter	Tree Height	Year of Origin
326	50	41	232	12.9	91	1964
342	37	36	86	16.8	93	1961
350	13	13	285	13.1	101	1954
358	42	29	218	14.2	98	1957
396	42	21	195	12.1	90	1965
421	61	61	191	12.8	97	1964
456	59	46	288	11.1	68	1969
459	72	48	261	12.4	99	1959
460	84	53	190	13	85	1959
508	29	24	189	14.5	96	1959
511	10	10	180	13.3	88	1966
512	73	62	211	13.4	82	1967
516	112	86	168	13.4	94	1959
519	33	24	190	11.9	87	1965
520	30	30	140	14.3	89	1959
523	53	53	251	12.2	91	1959
524	14	14	205	11.7	84	1965
	814	**651**	**205**	**13.2**	**90**	
Grand Totals	**6,066**	**4,871**				

Cascade Alternative 1 Harvest Plan Summary

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 1 Skyline Acres	Skyline Landing #	Alternative 1 Helc. Acres	Begin Operations
021	1A	0							
		16	0	0	0	16	4	0	March 1
031	2A	0							
		4	0	0	0	4	1	0	March 1
042	1A	0							
048	2A	0							
050	2A	0							
079	2A	0							
		30	0	0.08	0	30	6	0	October 1
083	1A	0							
		16	0	0	0	8	1	8	March 1
088	2A	0							
104	1A	0							
		8	0	0	0	4	2	4	March 1
106	2A	0							
111	3B	63	0	0.1	0	63	7	0	August 6
		2	0	0	0	2	0	0	August 6
114	3B	54	0	0	0	27	1	27	August 6
121	3B	8	0	0.05	0.04	4	1	4	August 6
		10	0	0.02	0.04	5	2	5	August 6
		211	**0**	**0.25**	**0.08**	**163**	**25**	**48**	

Crab

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 1 Skyline Acres	Skyline Landing #	Alternative 1 Helc. Acres	Begin Operations
224		13	0	0.07	0.04	13	4	0	October 1
245		47	0	0	0	47	4	0	October 1
252	7B	30	0.17	0	0	30	2	0	October 1
267		67	0	0.19	0.04	67	4	0	August 6
273		39	0.11	0	0	39	2	0	August 6
278		0							
305	12C	26	1.08	0	0.04	26	3	0	October 1
		5	0	0	0	5	0	0	October 1
307		28	0.19	0	0	28	6	0	August 6
309	12C	42	0	0	0	34	1	8	August 6
323	12C	10	0	0	0	0	0	10	August 6
327	12C	13	0	0	0	13	1	0	August 6
343	7B	98	0	0.27	0	98	9	0	October 1
344	12C	42	0	0.05	0	42	3	0	August 6
352		35	0	0.15	0	28	4	7	August 6
364	12C	11	0.21	0	0	11	2	0	October 1
381	12C	39	0.1	0	0	33	1	6	October 1
		20	0.15	0	0.04	20	1	0	October 1
384		72	0	0.05	0	72	8	0	October 1
385	12C	58	0	0.07	0.04	46	2	12	August 6
415	12C	0							
		2	0	0	0	0	0	2	October 1
420		50	0	0.21	0	50	4	0	August 6
		747	**2.01**	**1.06**	**0.2**	**702**	**61**	**45**	

Green River

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 1 Skyline Acres	Skyline Landing #	Alternative 1 Helc. Acres	Begin Operations
283	7B	44	0	0.07	0	22	1	22	August 6
		9	0	0	0	4	1	5	August 6
331	7B	7	0	0.06	0	7	1	0	August 6
341	9A	0							
349		10	0	0	0	10	1	0	July 1
365	9A	0							
372	9A	0							
		70	0	0.13	0.07	42	6	28	October 1
400	9A	0							
417	9A	0							
439		5	0.06	0	0	5	1	0	July 1
449		9	0	0.05	0	9	1	0	July 1
450		25	0	0.01	0	25	2	0	July 1
451		20	0	0.03	0	20	2	0	July 1
468	6A	0							
472	8B	60	0	0.19	0	60	5	0	July 1
		3	0	0	0	3	0	0	July 1
474	6A	0							
476	8B	59	0.58	0	0	59	7	0	July 1
		5	0	0		5	2	0	July 1
479	8B	54	0	0.27	0	54	4	0	July 1
481	6A	0							
		8	0	0	0	0	0	8	July 1
492	6A	0							
		16	0	0.19	0	16	4	0	August 6
493	8B	13	0.25	0	0	13	1	0	July 1
499	8B	20	0	0.11	0	20	3	0	July 1
		20	0	0	0	20	0	0	July 1
500		12	0	0	0	12	3	0	July 1
		469	**0.89**	**1.11**	**0.07**	**406**	**45**	**63**	

Lower Buck

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 1 Skyline Acres	Skyline Landing #	Alternative 1 Helc. Acres	Begin Operations
146	3B	32	0.25	0	0	32	4	0	July 1
		32	0	0	0	32	0	0	July 1
155		54	0	0.3	0	54	4	0	July 1
161	3B	22	0	0.42	0	22	5	0	August 6
		10	0	0	0	10	0	0	August 6
167		37	0	0.1	0	37	4	0	October 1
182		27	0	0.19	0	27	2	0	March 1
183		14	0	0.07	0	14	2	0	March 1
195		12	0	0.1	0	12	3	0	March 1
218	4C	0							
220		26	0	0.03	0	26	2	0	July 1
227		6	0	0	0	6	1	0	March 1
229		89	0	0.8	0.07	89	9	0	July 1
230	4C	47	0	0	0.1	47	4	0	July 1
246	4C	42	0.38	0	0	29	5	13	August 6
250	4C	2	0.32	0	0	2	1	0	August 6
		9	0	0	0	9	0	0	August 6
257	4C	5	0	0	0	5	0	0	August 6
		6	0	0.08	0	6	2	0	August 6
		472	**0.95**	**2.09**	**0.17**	**459**	**48**	**13**	

Lower Five

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 1 Skyline Acres	Skyline Landing #	Alternative 1 Helc. Acres	Begin Operations
024		38	0	0.08	0.02	38	5	0	July 1
122	11C	22	1.61	0	0.11	22	1	0	August 6
124	11C	14	0	0.32	0	14	3	0	July 1
160		32	0.51	0	0	32	2	0	August 6
175	10C	64	0	0	0	64	3	0	August 6
187	10C	26	0	0	0.02	26	3	0	August 6
		15	0	0	0	15	0	0	August 6
		211	**2.12**	**0.4**	**0.15**	**211**	**17**	**0**	

Middle Five

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 1 Skyline Acres	Skyline Landing #	Alternative 1 Helc. Acres	Begin Operations
186	10C	16	0	0.5	0.04	16	3	0	August 6
		15	0	0	0	15	0	0	August 6
199		12	0	0	0	12	2	0	October 1
213		26	0	0.18	0	26	3	0	October 1
235	10C	15	0	0	0	15	0	0	July 1
		12	0	0	0.03	12	2	0	July 1
270	7B	40	0	0.17	0	40	6	0	August 6
		18	0	0	0	18	0	0	August 6
275		10	0	0.04	0	10	1	0	August 6
281		12	0	0.02	0	12	1	0	August 6
316		26	0	0.42	0	26	2	0	July 1
322		8	0	0.23	0	8	2	0	July 1
366		23	0	0	0	23	1	0	July 1
		233	**0**	**1.56**	**0.07**	**233**	**23**	**0**	

Upper Buck

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 1 Skyline Acres	Skyline Landing #	Alternative 1 Helc. Acres	Begin Operations
271		35	0.42	0	0	35	3	0	August 6
272		42	0	0.02	0	42	4	0	March 1
280		7	0	0	0	7	2	0	August 6
282	4C	2	0	0	0	2	0	0	August 6
		4	0	0	0	4	1	0	August 6
303		28	0	0.57	0	0	0	28	August 6
312		30	0	0.07	0	30	2	0	August 6
353		36	0	0.35	0	36	4	0	October 1
376		14	0	0	0	14	1	0	October 1
418	5B	11	0.04	0	0	11	1	0	August 6
		14	0.1	0	0	14	1	0	August 6
425	5B	35	0.2	0.04	0	35	2	0	August 6
440	5B	34	0	0	0	34	0	0	October 1
		6	0	0.05	0	6	3	0	October 1
465	5B	4	0	0	0	4	0	0	August 6
		9	0	0	0	9	2	0	August 6
475	5B	18	0	0.3	0	18	2	0	August 6
		38	0	0.1	0	33	4	5	August 6
		367	**0.76**	**1.5**	**0**	**334**	**32**	**33**	

Upper Five

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 1 Skyline Acres	Skyline Landing #	Alternative 1 Helc. Acres	Begin Operations
326		33	0	0.19	0	33	2	0	July 1
342		29	0	0	0.15	29	4	0	July 1
350		10	0	0	0	10	1	0	July 1
358		23	0	0	0	0	1	23	July 1
396		17	0	0	0	17	3	0	July 1
421		49	0	0.32	0	49	4	0	August 6
456		37	0	0.27	0	37	3	0	August 6
459		38	0	0.05	0	38	6	0	August 6
460		42	0	0.23	0	29	1	13	July 1
508		19	0	0	0	10	3	9	July 1
511		8	0	0	0	8	1	0	July 1
512		50	0	0.1	0	35	2	15	July 1
516		69	0	0	0	55	11	14	July 1
519		19	0	0.1	0	19	2	0	July 1
520		24	0	0.17	0.08	24	2	0	July 1
523		42	0	0.19	0.05	34	4	8	July 1
524		11	0	0	0	11	1	0	July 1
		520	**0**	**1.62**	**0.28**	**438**	**51**	**82**	
Grand Totals		**3,230**	**6.73**	**9.59**	**1.02**	**2,946**	**302**	**284**	

Five Rivers Landscape Management Project

Cascade Alternative 2 Harvest Plan Summary

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 2 Skyline Acres	Skyline Landing #	Alternative 2 Helc. Acres	Begin Operations
021	1A	0							
		16	0	0	0	16	4	0	March 1
031	2A	0							
		4	0	0	0	4	1	0	March 1
042	1A	0							
048	2A	0							
050	2A	0							
079	2A	0							
		30	0	0	0	26	6	4	October 1
083	1A	0							
		16	0	0	0	2	1	14	March 1
088	2A	0							
104	1A	0							
		8	0	0	0	4	2	4	March 1
106	2A	0							
111	3B	63	0	0	0	50	5	13	August 6
		2	0	0	0	2	0	0	August 6
114	3B	54	0	0	0	11	1	43	August 6
121	3B	8	0	0	0	0	0	8	August 6
		10	0	0	0	0	0	10	August 6
		211	**0**	**0**	**0**	**115**	**20**	**96**	

Crab

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 2 Skyline Acres	Skyline Landing #	Alternative 2 Helc. Acres	Begin Operations
224		13	0	0	0	9	2	4	October 1
245		47	0	0	0	5	1	42	October 1
252	7B	30	0	0	0	0	0	30	October 1
267		67	0	0	0	13	1	54	August 6
273		39	0	0	0	0	0	39	August 6
278		0							
305	12C	0	0	0	0	0	0	0	
307		28	0	0	0	0	0	28	August 6
309	12C	42	0	0	0	0	0	42	August 6
323	12C	0	0	0	0	0	0	0	
327	12C	13	0	0	0	13	1	0	August 6
343	7B	98	0	0	0	29	5	69	October 1
344	12C	42	0	0	0	0	0	42	August 6
352		35	0	0	0	28	4	7	August 6
364	12C	11	0	0	0	0	0	11	October 1
381	12C	39	0	0	0	0	0	39	October 1
		20	0	0	0	0	0	20	October 1
384		72	0	0	0	22	3	50	October 1
385	12C	58	0	0	0	0	0	58	August 6
415	12C	0							
		2	0	0	0	0	0	2	October 1
420		50	0	0	0	20	2	30	August 6
		706	**0**	**0**	**0**	**139**	**19**	**567**	

Green River

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 2 Skyline Acres	Skyline Landing #	Alternative 2 Helc. Acres	Begin Operations
283	7B	44	0	0	0	44	1	0	August 6
		9	0	0	0	9	1	0	August 6
331	7B	7	0	0	0	0	0	7	August 6
341	9A	0							
349		10	0	0	0	10	1	0	July 1
365	9A	0							
372	9A	0							
		70	0	0	0	42	6	28	October 1
400	9A	0							
417	9A	0							
439		5	0	0	0	0	0	5	July 1
449		9	0	0	0	0	0	9	July 1
450		25	0	0	0	13	1	12	July 1
451		20	0	0	0	20	2	0	July 1
468	6A	0							
472	8B	60	0	0	0	15	1	45	July 1
		3	0	0	0	1	0	2	July 1
474	6A	0							
476	8B	59	0	0	0	0	0	59	July 1
		5	0	0	0	0	0	5	July 1
479	8B	54	0	0	0	0	0	54	July 1
481	6A	0							
		8	0	0	0	0	0	8	July 1
492	6A	0							
		16	0	0	0	16	4	0	August 6
493	8B	13	0	0	0	0	0	13	July 1
499	8B	20	0	0	0	9	1	11	July 1
		20	0	0	0	9	0	11	July 1
500		12	0	0	0	12	3	0	July 1
		469	**0**	**0**	**0**	**200**	**21**	**269**	

Lower Buck

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 2 Skyline Acres	Skyline Landing #	Alternative 2 Helc. Acres	Begin Operations
146	3B	32	0	0	0	0	0	32	July 1
		32	0	0	0	0	0	32	July 1
155		54	0	0	0	22	2	32	July 1
161	3B	22	0	0	0	3	1	19	August 6
		10	0	0	0	0	0	10	August 6
167		37	0	0	0	26	3	11	October 1
182		27	0	0	0	0	0	27	March 1
183		14	0	0	0	0	0	14	March 1
195		12	0	0	0	10	2	2	March 1
218	4C	0							
220		26	0	0	0	0	0	26	July 1
227		6	0	0	0	0	0	6	March 1
229		89	0	0	0	22	4	67	July 1
230	4C	47	0	0	0	0	0	47	July 1
246	4C	42	0	0	0	0	0	42	August 6
250	4C	0	0	0	0	0	0	0	
257	4C	5	0	0	0	2	0	3	August 6
		6	0	0	0	5	1	1	August 6
		461	**0**	**0**	**0**	**90**	**13**	**371**	

Lower Five

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 2 Skyline Acres	Skyline Landing #	Alternative 2 Helc. Acres	Begin Operations
024		38	0	0	0	27	4	11	July 1
122	11C	0	0	0	0	0	0	0	
124	11C	14	0	0	0	0	0	14	July 1
160		32	0	0	0	0	0	32	August 6
175	10C	64	0	0	0	38	3	26	August 6
187	10C	26	0	0	0	17	2	9	August 6
		15	0	0	1	12	0	3	August 6
		189	**0**	**0**	**0**	**94**	**9**	**95**	

Middle Five

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 2 Skyline Acres	Skyline Landing #	Alternative 2 Helc. Acres	Begin Operations
186	10C	16	0	0	0	0	0	16	August 6
		15	0	0	0	0	0	15	August 6
199		12	0	0	0	12	2	0	October 1
213		26	0	0	0	26	3	0	October 1
235	10C	15	0	0	0	0	0	15	July 1
		12	0	0	0	5	1	7	July 1
270	7B	40	0	0	0	20	5	20	August 6
		18	0	0	0	9	0	9	August 6
275		10	0	0	0	0	0	10	August 6
281		12	0	0	0	0	0	12	August 6
316		26	0	0	0	0	0	26	July 1
322		8	0	0	0	0	0	8	July 1
366		23	0	0	0	23	1	0	July 1
		233	**0**	**0**	**0**	**95**	**12**	**138**	

Upper Buck

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 2 Skyline Acres	Skyline Landing #	Alternative 2 Helc. Acres	Begin Operations
271		0	0	0	0	0	0	0	
272		42	0	0	0	8	3	34	March 1
280		7	0	0	0	7	2	0	August 6
282	4C	2	0	0	0	2	0	0	August 6
		4	0	0	0	4	1	0	August 6
303		28	0	0	0	0	0	28	August 6
312		30	0	0	0	30	2	0	August 6
353		36	0	0	0	7	1	29	October 1
376		14	0	0	0	0	0	14	October 1
418	5B	11	0	0	0	0	0	11	August 6
		14	0	0	0	0	0	14	August 6
425	5B	35	0	0	0	0	0	35	August 6
440	5B	34	0	0	0	2	0	32	October 1
		6	0	0	0	6	1	0	October 1
465	5B	4	0	0	0	0	0	4	August 6
		9	0	0	0	9	1	0	August 6
475	5B	18	0	0	0	8	0	10	August 6
		38	0	0	0	12	4	26	August 6
		332	**0**	**0**	**0**	**95**	**15**	**237**	

Upper Five

Stand Number	Study Pathway	Harvest Acres	Reopen System Road Miles	Reopen Temporary Road Miles	New Temporary Road Miles	Alternative 2 Skyline Acres	Skyline Landing #	Alternative 2 Helc. Acres	Begin Operations
326		33	0	0	0	0	0	33	July 1
342		29	0	0	0	12	2	17	July 1
350		10	0	0	0	10	1	0	July 1
358		23	0	0	0	0	1	23	July 1
396		17	0	0	0	0	0	17	July 1
421		49	0	0	0	5	1	44	August 6
456		37	0	0	0	7	1	30	August 6
459		38	0	0	0	19	5	19	August 6
460		42	0	0	0	0	0	42	July 1
508		19	0	0	0	10	3	9	July 1
511		8	0	0	0	8	1	0	July 1
512		50	0	0	0	0	0	50	July 1
516		69	0	0	0	39	8	30	July 1
519		19	0	0	0	0	0	19	July 1
520		24	0	0	0	0	0	24	July 1
523		42	0	0	0	8	1	34	July 1
524		11	0	0	0	11	1	0	July 1
		520	**0**	**0**	**0**	**129**	**25**	**391**	
Grand Totals		**3,121**	**0**	**0.00**	**0**	**957**	**134**	**2164**	

Silviculture Prescription Summary

Cascade

Stand Number	Study Pathway	Commercial thinning (acres)	Post-harvest stocking (tpa*)	Coarse wood creation (trees)	Residual tree stocking (tpa*)	Stand Planting (acres)	Snag creation in natural stands (trees)	Tree inoculation inside stand (trees)	Tree inoculation outside stand (trees)
021	1A	0							
		16	60 to 80	0	60 to 80	13	11	27	7
031	2A	0							
		4	60 to 80	0	60 to 80	0	3	7	14
042	1A	0							
048	2A	0							
050	2A	0							
079	2A	0							
		30	105	150	100	1	21	51	24
083	1A	0							
		16	100	0	100	1	11	27	0
088	2A	0							
104	1A	0							
		8	60 to 80	0	60 to 80	0	6	14	24
106	2A	0							
111	3B	63	70 to 90	1,890	40 to 60	63	45	108	56
		2	70 to 90	60	40 to 60	2	1	3	2
114	3B	54	70	1,620	40	54	38	92	31
121	3B	8	70 to 90	240	40 to 60	6	6	14	15
		10	70 to 90	300	40 to 60	8	7	17	19
Totals		**211**		**4260**		**148**	**148**	**359**	**192**

*tpa=trees per acre

Crab

Stand Number	Study Pathway	Commercial thinning (acres)	Post-harvest stocking (tpa*)	Coarse wood creation (trees)	Residual tree stocking (tpa*)	Stand Planting (acres)	Snag creation in natural stands (trees)	Tree incoculation inside stand (trees)	Tree inoculation outside stand (trees)
224		13	85	65	80	1	4	27	26
245		47	45 to 85	235	40 to 80	44	14	99	29
252	7B	30	75 to 95	450	60 to 80	24	9	63	31
267		67	60	0	60	67	20	141	77
273		39	65	195	60	39	12	82	48
278		0							
305	12C	31	85 to 105	155	80 to 100	1	9	65	36
307		28	65 to 85	140	60 to 80	23	8	59	17
309	12C	42	65 to 85	210	60 to 80	11	13	88	58
323	12C	10	65 to 105	50	60-100	3	3	21	7
327	12C	13	85	65	80	1	4	27	26
343	7B	98	75	1470	60	98	29	206	108
344	12C	42	85 to 105	210	80 to 100	1	13	88	26
352		35	80	0	80	1	11	74	65
364	12C	11	65 to 85	55	60 to 80	6	3	23	26
381	12C	39	65 to 85	195	60 to 80	20	12	82	24
		20	65 to 85	100	60 to 80	11	6	42	12
384		72	65 to 85	360	60 to 80	68	22	151	43
385	12C	58	65 to 85	290	60 to 80	14	17	122	34
415	12C	0							
		2	65 to 85	10	60 to 80	0	1	4	17
420		50	80	0	80	3	15	105	29
Totals		**747**		**4255**		**436**	**225**	**1569**	**739**

*tpa=trees per acre

Green River

Stand Number	Study Pathway	Commercial thinning (acres)	Post-harvest stocking (tpa*)	Coarse wood creation (trees)	Residual tree stocking (tpa*)	Stand Planting (acres)	Snag creation in natural stands (trees)	Tree inoculation inside stand (trees)	Tree inoculation outside stand (trees)
283	7B	44	75	660	60	44	31	75	42
		9	75	135	60	9	6	15	8
331	7B	7	55 to 75	105	40 to 60	7	5	12	5
341	9A	0							
349		10	80 to 100	0	80 to 100		7	17	43
365	9A	0							
372	9A	70	60 to 80	0	60 to 80	35	49	119	420
400	9A	0							
417	9A	0							
439		5	60 to 80	0	60 to 80		4	9	2
449		9	80	0	80		6	15	5
450		25	60	0	60	25	18	43	14
451		20	100	0	100	1	14	34	19
468	6A	0							
472	8B	60	55 to 75	900	40 to 60	60	42	102	182
		3	55 to 75	45	40 to 60	3	2	5	10
474	6A	0							
476	8B	59	75	885	60	59	41	100	35
		5	75	75	60	5	4	9	3
479	8B	54	75	810	60	54	38	92	31
481	6A	0							
		8	85 to 105	40	80 to 100		6	14	60
492	6A	0							
		16	105	80	60-100	1	11	27	29
493	8B	13	55 to 75	195	40 to 60	13	9	22	12
499	8B	20	75	300	60	20	14	34	12
		20	75	300	60	20	14	34	12
500		12	80 to 100	0	80 to 100		8	20	14
Totals		**469**		**4530**		**356**	**329**	**798**	**958**

*tpa=trees per acre

Lower Buck

Stand Number	Study Pathway	Commercial thinning (acres)	Post-harvest stocking (tpa*)	Coarse wood creation (trees)	Residual tree stocking (tpa*)	Stand Planting (acres)	Snag creation in natural stands (trees)	Tree inoculation inside stand (trees)	Tree inoculation outside stand (trees)
146	3B	32	70	960	40	32	10	67	85
		32	70	960	40	32	9	67	85
155		54	60 to 80	0	60 to 80	15	16	113	34
161	3B	22	90	660	60	22	7	46	40
		10	90	300	60	10	3	21	18
167		37	85 to 105	185	80 to 100	1	11	78	17
182		27	40 to 60	0	40 to 60	27	8	57	50
183		14	60 to 80	0	60 to 80	4	4	29	38
195		12	60 to 80	0	60 to 80	10	4	25	7
218	4C	0	N/A	0	N/A	0	0	0	41
220		26	80 to 100	0	80 to 100	1	8	55	24
227		6	80 to 100	0	80 to 100	0	2	13	5
229		89	80 to 100	0	80 to 100	3	27	187	144
230	4C	47	105	235	100	2	14	99	29
246	4C	42	85 to 105	210	80 to 100	1	13	88	115
250	4C	11	115	55	100	0	3	23	19
257	4C	5	85	25	80	0	1	10	24
		6	85	30	80	0	2	13	29
Totals		**472**		**3620**		**160**	**141**	**991**	**804**

*tpa=trees per acre

Lower Five

Stand Number	Study Pathway	Commercial thinning (acres)	Post-harvest stocking (tpa*)	Coarse wood creation (trees)	Residual tree stocking (tpa*)	Stand Planting (acres)	Snag creation in natural stands (trees)	Tree inoculation inside stand (trees)	Tree inoculation outside stand (trees)
024		38	85	190	80	1	11	80	29
122	11C	22	85 to 105	110	80 to 100	1	7	46	22
124	11C	14	85	70	80	0	4	29	82
160		32	105	160	100	1	10	67	19
175	10C	64	65 to 85	320	60 to 80	58	19	134	58
187	10C	26	85 to 105	129	80 to 100	2	8	54	31
		15	85 to 105	76	80 to 100		4	32	19
Totals		**211**		**1055**		**63**	**63**	**443**	**260**

Middle Five

Stand Number	Study Pathway	Commercial thinning (acres)	Post-harvest stocking (tpa*)	Coarse wood creation (trees)	Residual tree stocking (tpa*)	Stand Planting (acres)	Snag creation in natural stands (trees)	Tree inoculation inside stand (trees)	Tree inoculation outside stand (trees)
186	10C	16	85 to 105	80	80 to 100	1	5	34	26
		15	85 to 105	75	80 to 100		4	31	24
199		12	105	60	100	0	4	25	14
213		26	105	130	100	1	8	55	17
235	10C	15	65 to 85	76	60 to 80	12	4	32	10
		12	65 to 85	59	60 to 80	12	4	25	7
270	7B	40	55 to 75	600	40 to 60	40	12	84	37
		18	55 to 75	270	55 to 75	18	5	38	16
275		10	65	50	60	10	3	21	26
281		12	85	60	80	0	4	25	53
316		26	85	130	80	1	8	55	14
322		8	85	40	80	0	2	17	17
366		23	85 to 105	115	80 to 100	1	7	48	14
Totals		**233**		**1745**		**96**	**69**	**489**	**275**

*tpa=trees per acre

Upper Buck

Stand Number	Study Pathway	Commercial thinning (acres)	Post-harvest stocking (tpa*)	Coarse wood creation (trees)	Residual tree stocking (tpa*)	Stand Planting (acres)	Snag creation in natural stands (trees)	Tree inoculation inside stand (trees)	Tree inoculation outside stand (trees)
271		35	80 to 100	0	80 to 100	1	11	74	62
272		42	80	0	80	1	13	88	24
280		7	85 to 105	35	80 to 100	0	2	15	10
282	4C	2	85	10	80	0	1	4	2
		4	85	20	80	0	1	9	5
303		28	100	0	100	1	8	59	17
312		30	105	150	100	0	9	63	19
353		36	65 to 85	180	60 to 80	30	11	76	65
376		14	85	70	80	1	4	29	10
418	5B	11	75 to 95	165	60 to 80	7	4	23	4
		14	75 to 95	210	60 to 80	9	4	30	6
425	5B	35	55 to 75	525	40 to 60	35	11	74	22
440	5B	34	75	510	60	34	10	71	20
		6	75	90	60	6	2	13	4
465	5B	4	55 to 75	60	40 to 60	4	1	8	5
		9	55 to 75	135	40 to 60	9	3	19	12
475	5B	18	55 to 75	270	40 to 60	18	5	38	9
		38	55 to 75	570	40 to 60	38	12	80	20
Totals		**367**		**3000**		**194**	**112**	**773**	**316**

*tpa=trees per acre

Upper Five

Stand Number	Study Pathway	Commercial thinning (acres)	Post-harvest stocking (tpa*)	Coarse wood creation (trees)	Residual tree stocking (tpa*)	Stand Planting (acres)	Snag creation in natural stands (trees)	Tree inoculation inside stand (trees)	Tree inoculation outside stand (trees)
326		33	105	165	100	1	10	69	41
342		29	105	145	100	0	9	61	19
350		10	105	50	100	0	3	21	7
358		23	85	115	80	1	7	48	46
396		17	65 to 85	85	60 to 80	9	5	36	60
421		49	85 to 105	245	80 to 100	2	15	103	29
456		37	85 to 105	185	80 to 100	1	11	78	53
459		38	105	190	100	1	11	80	82
460		42	65 to 85	210	60 to 80	10	13	88	101
508		19	65 to 85	95	60 to 80	16	6	40	24
511		8	65 to 85	40	60 to 80	7	2	17	5
512		50	65 to 85	250	60 to 80	13	15	105	55
516		69	65 to 85	345	60 to 80	59	21	145	103
519		19	85	95	80	1	6	40	34
520		24	65	120	60	24	7	50	14
523		42	85	210	80	1	13	88	26
524		11	85	55	80	0	3	23	7
Totals		**520**		**2600**		**146**	**156**	**1092**	**706**

*tpa=trees per acre

Appendix D
Public and Agency Comments on the Draft EIS and Forest Service Responses

Introduction

As part of scoping, a field trip was offered to the public, resulting in a trip conducted on July 10, 1999. The Provincial Advisory Committee was briefed about the Project on October 7, 1999. The public comment period for the draft environmental impact statement, Five Rivers Landscape Management Project (draft EIS) officially began October 16, 1999. During the week of October 18-22, 1999, copies of the draft EIS were distributed and news releases concerning its availability were published in local newspapers. Information included a website address where interested persons could review the electronic version of the draft EIS. An additional news release was published in local newspapers during the week of December 6-10, 1999, reminding people that the comment period closed on December 30, 1999. About 260 written comments were received from about 20 agencies, organizations, groups, and individuals.

Meetings were held with some agencies, organizations, and individuals as a means to clarify their concerns, and facilitate responding to those concerns in the final EIS. Meeting participants included (with meeting dates in parentheses): U.S. Fish and Wildlife Service (2/10/00), Walter T. Haswell III (2/16/00), and Oregon Shores Conservation Coalition (4/1/00). Informal discussions were held with other commenters such as Mauricio Ribera and the Environmental Protection Agency.

The Environmental Protection Agency has a legal obligation under Section 309 of the Clean Air Act to review and comment on environmental impact statements. Their letter reviewing the draft EIS appears after the comments and responses table (table D-1). Our response to their concerns follows their letter.

Organization of Appendix D

After analyzing the comments, the District Ranger and the Forest Environmental Coordinator identified the substantive comments and grouped related topics to avoid cumbersome text duplication of the responses. The comments and responses are intended to be only explanatory in nature. If any inadvertent contradictions appear between appendix D and the text of the final EIS, the final EIS direction prevails.

Several commenters requested more detailed information, more disclosure of information, or clarification of information contained in the draft EIS. In response to these concerns, more specific information on items such as roads cost analyses, sedimentation, silviculture treatments, KV priorities, water quality, heritage resources, and operating season restrictions have been included in the final EIS and appendices.

Table D-1 provides a list of commenters with reviewer (reference) numbers to help readers determine who provided comments in table D-3. Table D-2 serves as an index to table D-3. Table D-3 summarizes the comments and responses with emphasis on the concerns that were not included in meeting notes or letters, or not included in the final EIS or appendices. Agency correspondence is included after table D-3.

Table D-1. Commenters reference table

Appendix D
Public and Agency Comments on the Draft EIS and Forest Service Responses

Reviewer Number	Name of individual, organization, or agency
1	Leland Gilsen, Oregon State Historic Preservation Office*
2	Dorothy Josellis
3	Louis M. Swing
4	David C. Friedlein, Roseburg Resources Co.
5	Walter T. Haswell III
6	Fran Recht, Oregon Shores Conservation Coalition
7	Peter M. Lacy, Northwest Environmental Defense Center
8	Wayne H. Phillips
9	Connie Lonsdale
10	Daniel Krueger et al., Five Rivers Residents Petition
11	Daniel Dillon, Prindle Creek Farm
12	Kelly Hockema
13	Steve Trask, Alsea Citizens Monitoring Team
14	Doug Heiken, Oregon Natural Resources Council
15	Oliver Snowden, Lane County Public Works*
16	Mauricio Ribera
17	Bill Richardson, Rocky Mountain Elk Foundation
18	Richard B. Parkin, Environmental Protection Agency*
19	Peter Karassik et al.
20	Preston Sleeger, USDI Regional Environmental Officer*

*Agency correspondence is included after table D-3.

Table D-2. Where to find comments and Forest Service responses

Concerns and responses	Page	Concerns and responses	Page
New information	3	Range of alternatives	12
Roads and motorized access	3-7	Private access	12
Vegetation management	7	Botanical report	12
Stand management	7-8	NMFS consultation	12
Fire hazard	8	Heritage report	12-13
Management study plan	8-10	Silviculture data	13
Partnerships	10	Survey-and-manage species	13
Meadow, early-seral management	10-11	No-action alternative	13
Need more specific information	11	Other documents	13
Large trees for stream enhancement	11-12		

Table D-3. Comments and responses summary

Concern	Reviewer number	Comments and Forest Service responses
New information	5,14	**What specific approach and criteria will the Siuslaw use to accommodate this (modify projects or EIS plans based on new scientific or on-the-ground information) in a way that engenders public trust and confidence?** It is the line officer's responsibility to ensure that prior decisions are in line with current legal, scientific, and management direction before a project is implemented, and to keep the public informed.
Roads and motorized access	2	**Adequate road marking or signing, particularly at major road junctions, is lacking**. The Siuslaw recognizes this problem needs correcting on the Forest. Actions to improve hazard and route signing are expected to be implemented within the next 5 years.
	2	**Concerned about hazard trees next to Five Rivers Road**. The maintenance of the Five Rivers Road is under the jurisdiction of Lincoln and Lane county road departments. We recommend that you contact the county road departments and let them know your concerns.
	9	**There are too many roads that have to be maintained. All unnecessary roads should be decommissioned**. After commercial thinnings are accomplished, Alternatives 1 and 2 stabilize and close system roads not required for vehicle access until needed for management purposes. Roads not needed for a period of 10 to 20 years or greater and roads highly susceptible to failure without maintenance will be decommissioned. Under Alternative 1, all temporary roads (new and reopened) will be stabilized and closed after use. See appendix B, page B-7.
	10	**Road 32 is our only route to the nearest grocery and hospital and is our only reasonable connection to Lane County. The effects of closing Road 32 are more far reaching than merely "less convenient".** The final EIS discloses use of road 32 to access adjacent communities such as Florence and Eugene and the alternative

		route to these communities, should road 32 be decommissioned. Alternatives 1 and 2 provide a mechanism for Lane County to take over responsibility for maintaining road 32 through a public road easement. See final EIS pages 7, 37, 38, 73, 74 and 75.
	10	**Road 32 should be part of the Management Study to show how best to maintain multipurpose roads within the forest**. The management study is intended to help answer questions related to plantation access and management issues. Because the portion of road 32 proposed for decommissioning is not required to access our plantations, maintaining it as part of the study would not help answer these questions.
	11	**Closing road 32 will diminish public safety (hospital and police services are from Lane County), increase road maintenance costs, increase costs for individuals and public utilities, and decrease quality of travel. Road 32 is the only road for north-south traffic including emergency vehicles**. See second to last response above. The alternative north-south ATM route also could save about $32,000 annually on maintenance and repair. Public access considerations, more than the additional 2.4 miles of road with graveled surfaces, need to weigh long-term benefits of roads that have less potential for failure and lengthy closure periods.
	11	**The Forest Service should maintain the Herman Creek Road instead of Gibson Creek Road as it would reduce road maintenance for the Forest Service and provide a better quality travelway for motorists**. Herman Creek road, 2160, is outside the scope of this project, as well as Gibson Creek road, 3278. In the past, road 2160 has proved to be a high-cost road to maintain and repair. Its linkage to Indian Creek has already been severed by decommissioning to stabilize the road and reduce adverse effects to the fish habitat. ATM road 2116, just west of 2160, serves the same general access and travel need. Gibson Creek road serves as a low-risk ATM link to the county road along Indian Creek.
	11	**Road 32 has no impact on the river (Five Rivers). Destroying the Five Rivers fish ladder and rerouting the river back to an**

		old streambed would destroy the wetlands that exist there and would require mitigation.
		There is no proposal to decommission this segment of road 32, to remove the fish ladder, or to reroute the river. Road 32 decommissioning would begin at the 3240 road junction.
	15	**Lane County opposes the closure and decommissioning of upper Five Rivers road (road 32).**
		Historic and current access in Five Rivers is discussed in the final EIS on pages 37 and 38. Projected use and costs to maintain the future transportation system is discussed on pages 55, 73, 74, and 75. This assessment is based on using roads that parallel road 32 for managing Forest resources. Alternatives 1 and 2 have been modified so that a public road easement will be issued to Lane County if the County accepts the 32 road as part of their transportation system. If Lane County will not accept the fiscal responsibility to operate and maintain the 32 road, then the road will be decommissioned when a natural event causes its failure.
	5	**How can Alternatives 1 and 2 have the same costs for road decommissioning?**
		Both decommission the same mileage of Forest-development roads. Also, unlike road decommissioning, road abandonment under Alternative 2 ceases all road maintenance activity, repairs, and stabilization work beyond and including the failed roadway segment. Refer to the final EIS, page 75 (table 23), for additional information on road costs under both alternatives.
	5	**Alternative 2 does not specify adverse effects and does not show road costs to prevent effects**.
		Abandoned road segments do not cross streams and do not pose a significant adverse risk to streams. By abandoning all non-ATM roads that fail, however, Alternative 2 may adversely affect streams if roads are not decommissioned or closed before the failure occurs. Refer to the final EIS, page 71.
	5	**You should look at the total (road) cost of the alternatives**.
		Total road costs were analyzed in the final EIS, pages 73, 74,

		and 75.
	6, 7	**Road reopening will increase sediment and other impacts to streams**.
		Most of the roads proposed for reopening are on ridgetops and not expected to affect streams. Reopening mid-slope roads are likely to affect streams in the short term, but these effects are not expected to be significant. All roads will be waterbarred and closed after actions are completed. (final EIS, pages 49, 50, 51, and 52; appendix B, pages B-6 and B-7).
	6, 7	**Abandoned roads will contribute to water degradation by contributing sediment and causing landslides and debris torrents**.
		Currently, the abandoned road segments under Alternative 2 do not cross streams and are not likely to fail and cause sediment to enter streams. Should other roads fail in the future before they are decommissioned or closed, Alternative 2 would abandon these road segments, and, depending on the failure sites, sedimentation of streams may occur. Refer to the final EIS, page 71.
	5, 14	**Low-tire pressure should be required and central tire inflation (CTI) used**.
		Constant reduced tire pressure has been a provision of timber sale contracts and will apply to haul roads. The primary objective is to reduce sedimentation and eliminate the costs and resource effects of placing rock on these roads. Because this method has been effective without incorporating CTI, CTI is not a required component of contracts.
	5, 14	**Road reopening and building should be avoided in riparian reserves.**
		The Northwest Forest Plan does not forbid road building or reopening in riparian reserves. We are minimizing building temporary roads in riparian reserves as the Plan requires by placing the roads on ridges. About 80% of the total new road miles (1.0 mile) will be outside of riparian reserve. About 46% of the total reopened miles (9.6 miles) will be outside riparian reserve. New and reopened temporary roads will be decommissioned after use. On a landscape scale, the final EIS proposes a general reduction in road mileage (about 49 miles)

		and associated effects on aquatic and terrestrial habitats. Thus, we concluded that new and reopened temporary roads meet the Aquatic Conservation Strategy objectives.
Vegetation management	3	**Concerned about use of herbicides**.
		Prevention of the spread of noxious and undesirable weeds will be limited to manual, mechanical, and biological methods. No herbicide use is planned. Refer to appendix B, page B-11.
Stand management	3	**Concerned about use of large-scale burning**.
		No large-scale burning is planned. Burning will be limited to specific areas adjacent to roads maintained open. See final EIS, pages 53 and 54; appendix B, page B-9.
	3	**Species diversity, including planting of Sitka spruce and hardwoods such as golden chinquapin, is important.**
		Existing shade-tolerant conifer and native hardwoods will be retained in stands. In addition, shade-tolerant conifer and native hardwoods will be planted in stands. Sitka spruce will not be planted because the project area is outside the Sitka spruce fog zone. Refer to appendix B, pages B-4 and B-8.
	3	**Thinning and removing alder over the long term is a negative practice.**
		No thinning and removal of alder and other native hardwoods is planned. Refer to appendix B, page B-4.
	14	**Leave older fragments within landscapes of early-seral forests.**
		No older fragments exist in our plantations proposed for commercial thinning. All trees are the same age in a given plantation or managed stand.
	5, 14	**Thinning efforts should be focused on trees younger than 40 years old.**
		Most of our commercial thinning would be done in stands less than 40 years old. Refer to appendix C-1 for age of individual

		stands.
	5, 14	**Do these species (bald eagles, northern spotted owls, and marbled murrelets) occupy trees of a size to be harvested in this EIS?**
		The plantations for commercial thinning do not contain the size and structure required for occupation (nesting) of these species. Only hazard trees with nesting structure can be removed and only when unoccupied. Refer to final EIS, pages 65, 66, and 67.
Fire hazard	10	**Chances of a severe fire happening here are going to increase**. **Closure of Road 32 would cut off our only evacuation route.**
		By reducing access into treated areas through road decommissioning and closures, the risk of fire ignitions is likely to be reduced from existing risks despite increased fuel loadings (final EIS, pages 53 and 54). An alternative route using the Summers Creek road (3505) will be maintained as an ATM road. The 3.3-mile segment of road 32 will remain open until a natural event closes the road or unless Lane County accepts a public-road easement from the Forest Service to maintain the road. See final EIS, pages 7, 73, and 74.
Management -study plan	3	**The size of the no-treatment area may not be large enough to provide all the data needed**.
		The research scientists who helped developed this study believe that all management pathways, including the no-treatment pathway, are large enough to provide statistically sound data. Refer to appendix A for additional information.
	14	**Please frame the proposed study question so the results are truly useful**.
		Refer to the study questions in appendix A, page 3 .
	20	**Why did the Forest Service choose a random approach to the management study design?**
		Randomization of the treatments is a critical part of the design and is necessary to be able to attribute any findings directly to the management actions.
	20	**How does pulse management and heavy thinning affect dispersal habitat?**

		Currently, dispersal habitat on federal land averages about 73% in the subwatersheds. Heavy thinning of plantations is expected to lose about 400 acres or 1.2% of dispersal habitat for a period of 3 to 5 years. As younger plantations mature, however, the immediate net effect on dispersal habitat is no change from the current condition. The average dispersal habitat in the subwatersheds is expected to increase by about 4% from the current condition within 5 years. (FEIS, pages 65, 66, and 67).
	20	**How does road management as discussed in the Lobster-Five Rivers Watershed Analysis relate to planned activities in the (draft) EIS?**
		The only road identified in the watershed analysis with specific recommendation to decommission was the Green River road. No clear recommendations were made on other roads, except to evaluate for continued need. Road management under Alternatives 1 and 2 reflect additional evaluation of the road system as recommended in the watershed analysis.
	14	**How will you ensure funding of management study monitoring?**
		Typically, about 5% of Forest funds is used on monitoring Forest projects. The Team regards the management study as an opportunity to more effectively use the funds intended for monitoring on the Forest. Because of its identified monitoring strategies and priorities, the management study is expected to be a high priority for Forest funding relative to other Forest projects.
	14	**The management study must be done on a smaller scale to ensure that negative and unexpected outcomes are not committed over the entire landscape.**
		Commercial thinning in study pathways comprises about 38% of the total commercial thinning in the watershed. Silviculture prescriptions for plantations are in the range of what has been implemented for plantations in other watersheds. Based on past observations, no negative or unexpected outcomes are anticipated. Monitoring will be done as projects are implemented and new information will be incorporated into design of remaining projects.
Partnerships	13	**We are interested in developing a working relationship with**

		the Forest Service to promote the success of beaver populations. We would like to assist in project planning and implementation. The Siuslaw National Forest is always open to opportunities for developing partnerships that promote healthy forest ecosystems. We recommend that you contact the District Ranger responsible for managing the planning area (currently the Waldport District Ranger).
	17	**We are willing to volunteer for projects that maintain openings and meadows for deer and elk**. See response above. We are also willing to work with you on these types of projects.
	19	**We would like to cooperate with the USFS to develop a restoration plan for Buck Creek without the limitations of property ownership. We suggest that you include our ownerships within the boundaries of the Five Rivers EIS to facilitate the future potential of project cooperation**. Thank you for your offer. Based on your feedback, the maps for Alternatives 1 and 2 have been modified to incorporate your property into the planning area.
Meadow and early-seral management	17	**Reduction of early-seral area from 240 to 40 acres is highly detrimental to elk, deer, neotropical birds, raptors, and other species that rely heavily on openings. Reseed road closures and abandonments with grass and forbs. Use matrix lands to create openings and edges. Maintain historical upper basin meadows in early-seral stages.** Our updated figures show 65 acres of meadows and early-seral habitat would be maintained on federal land in the planning area. About 14 acres of early-seral habitat would be created in matrix lands to mitigate the 14-acre loss from riparian planting in the 65 acres. Disturbed sites such as roads and landings may be seeded with a native seed mixture with emphasis on minimizing soil erosion. Refer to appendix B, pages B-18 and B-19.
	6, 7	**The draft EIS indicates that meadows and plantations will be maintained in early seral condition, which likely involves clearcuts.**

		We expect about 51 acres of existing meadows to be maintained after riparian planting. About 14 acres of early-seral habitat would be created in matrix lands where plantations contain pockets of laminated root-rot. These pockets consist primarily of shrubs, grasses, and dead or dying trees. A total of about 65 acres of meadows and early-seral habitat would be maintained in the watershed, which comprises about 0.02% of the land under federal ownership. Part of our mandate is to maintain at least some vegetation in early-seral stages.
Need more specific information	5, 14, 16, 18, 20	**Would like to see more specific information such as road costs, amount of sedimentation from roads; silviculture treatments and operating season restrictions; KV priorities; water quality; number of logs for stream enhancement; and heritage, recreation, and scenic effects.** Refer to the final EIS, pages 37, 38, 73, 74, and 75 for a summary of road costs; and pages 34, 35, 49, 50, 51, 52, 69, 70, and 71 for discussions on sedimentation (the project file contains individual road information). See appendix C for more specific information about silvicultural treatments and operating season restrictions. See the final EIS, page 60, for a discussion on KV priorities**.** Table 5 in the final EIS summarizes effects on water quality. The Water Quality Restoration Plan in the project file provides additional information on water quality. See tables 1 and 2 in the final EIS for information about the number of trees proposed for log placement in streams by subwatershed. See the final EIS, pages 54, 72, and 73 for additional information on effects to heritage resources, recreation, and scenery.
Large trees for stream enhancement	5, 14, 20	**What is the rationale for needing large trees (32 to 36 inches in diameter at breast height) for stream enhancement and is this consistent with the Northwest Forest Plan?** Large trees (>32 inches in diameter at breast height) are part of the natural hydrologic process on all streams. Based on the streams being treated, the 32- to 36-inch size-class was selected to provide trees that would remain relatively stable during 5-year flood events, yet be less likely to contain marbled murrelet nesting structure. The Team's biologists, as well as other Team members, believe that this proposal is consistent with the Northwest Forest Plan.
Range of alternatives	6, 7	**The range of alternatives is inadequate**.

		Based on our meeting, the concern about the range of alternatives seemed to be focused on our "no-action" alternative. Apparently, we were unclear that our no-action alternative meant no logging. Refer to the final EIS, page 18, which clarifies this meaning.
Private access	5	**The resolution of an additional road for private access is not specified in the EIS.** The private landowner dropped the request for an additional road.
Botanical report	5	**The Botanical Report mentions 1,400 feet of special-use road in areas of mature conifer.** This road is the same one mentioned in the EIS except the distance of 1,400 feet is incorrect. Only one special-use road was analyzed for this project. It is about 0.5 miles long and is in mature conifer habitat in the Green River subwatershed. Refer to final EIS, pages 9 and 16.
NMFS consultation	5	**The NMFS consultation indicates 66 failed road sites that will be repaired, but these sites are not listed in the DEIS.** Under Alternative 1, 14 road-failure sites on system roads would be repaired. In addition, about 52 temporary roads (sites) will be reopened (repaired) by removing vegetation and repairing minor road failures. Refer to appendix C-3 for a list of reopened system and temporary roads by stand.
Heritage report	5	**When, by whom, and how will the Heritage Resource Report and determination of effects be incorporated into the EIS?** In accordance with our 1995 Programmatic Agreement with the State Historic Preservation Office (SHPO), field inventories will be conducted by certified heritage technicians and concurrence from the State Office will be received after project design, but before two actions on previously undisturbed ground are implemented: new road building to access private land and placing large wood in streams. Other actions, such as commercial thinning and road decommissioning, will be on previously disturbed ground and do not require field inventories. Refer to appendix B, pages B-2 and B-3.
Silviculture data	5	**Appendix 2 to the DEIS indicates that canopy closure estimates are available for the various units, but this**

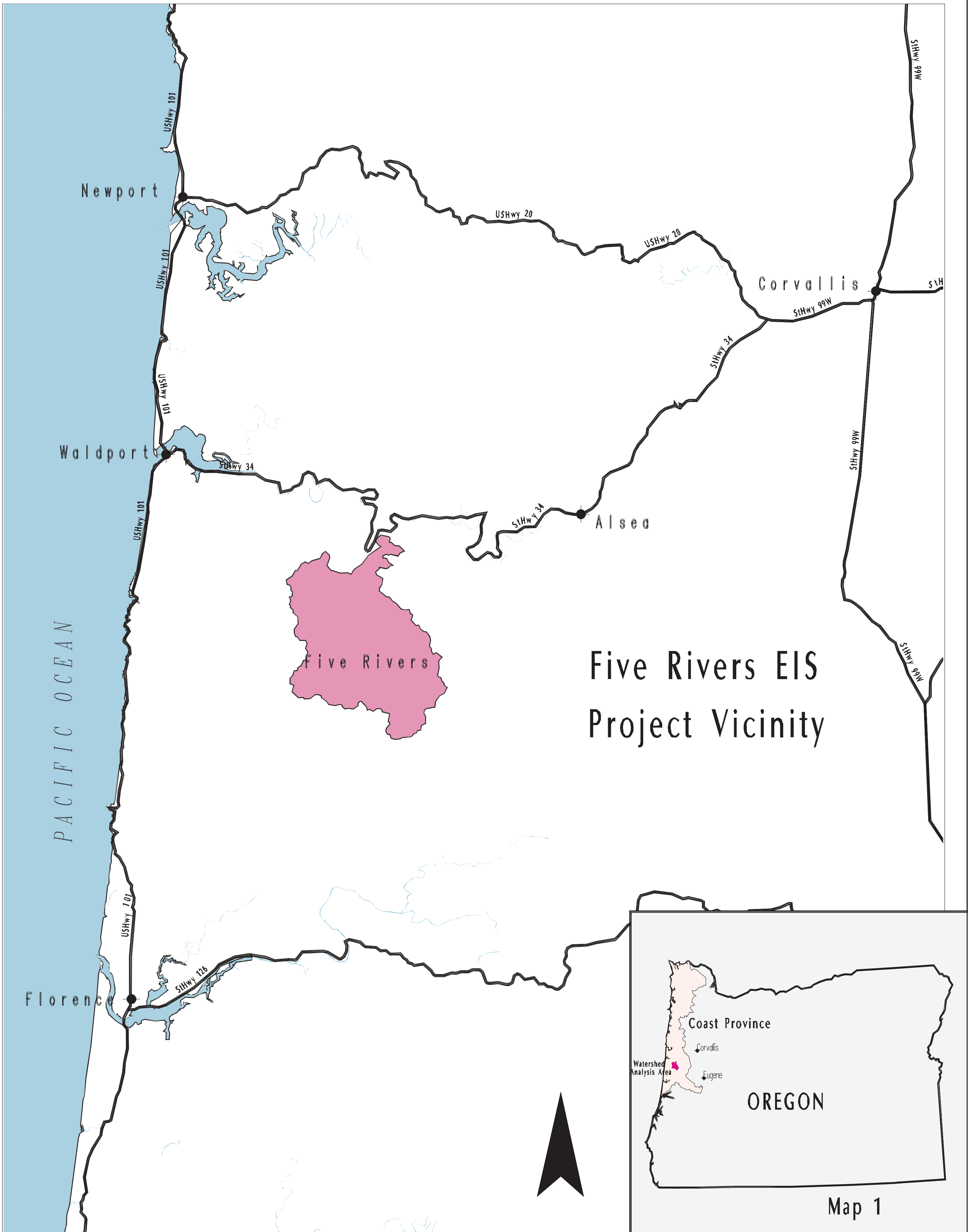
		information is not provided in the silviculture data. Refer to appendix C-2 for residual tree stocking levels. Those stands with 40 residual trees per acre are considered heavily thinned stands where resulting canopy closures will be between 30 and 40%. The remaining stands are moderately thinned (60 trees per acre or more) and these canopy closures will be above 40%.
Survey and manage species	14	**Survey-and-manage species surveys should be completed pre-NEPA, not post-NEPA.** Surveys are currently required before projects are implemented for red tree voles in stands with an average tree diameter at breast height greater than 16 inches; and for 5 fungal species, 3 terrestrial mollusk species, bryophytes, and lichens. As new information is developed by taxa specialists, the list of species requiring pre-project surveys is expected to change. Refer to the final EIS, pages 67 and 68; appendix B, page B-4.
No action alternative	14	**The DEIS shows inappropriate prejudice toward the no-action alternative on page 7-- "No action is not a reasonable alternative".** This statement has been omitted.
Other documents	5, 14	**The Forest Service must provide all the specialist reports and interagency consultation correspondence as appendices.** These documents are maintained in our project file (see contents section for final EIS for a listing) and can be made available on request. Traditionally, these documents are seldom requested because key information contained in them is provided in the text of the EA or EIS or appendices.

Appendix E
Common and Scientific Names of Organisms Mentioned in the Text

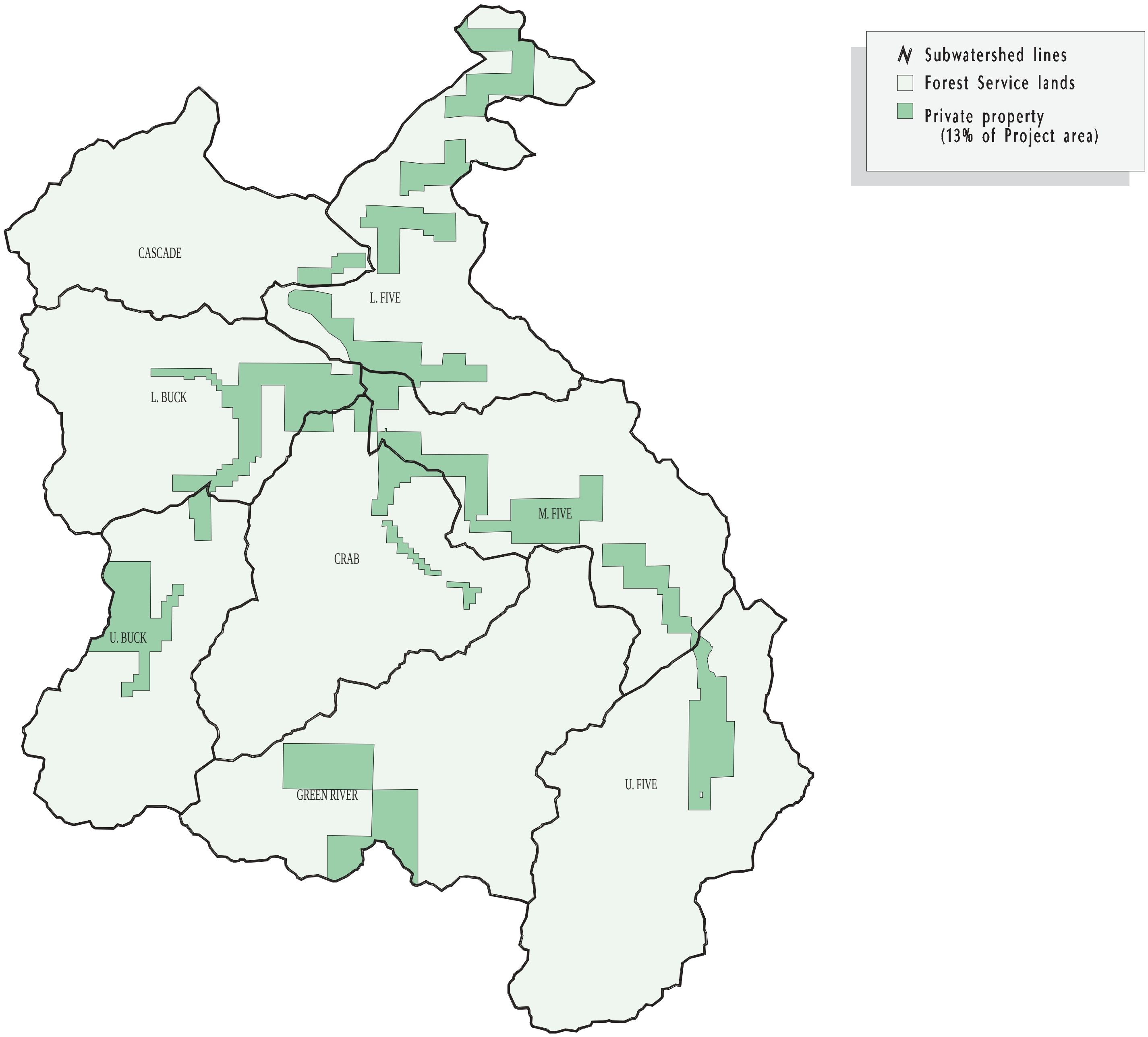
Common name	Scientific name
PLANTS AND FUNGI	
TREES AND SHRUBS	
Alder, red	*Alnus rubra* Bong.
Cascara	*Rhamnus purshiana* DC.
Douglas-fir	*Pseudotsuga menziesii* (Mirb.) Franco
Hemlock, western	*Tsuga heterophylla* (Raf.) Sarg.
Huckleberry, evergreen	*Vaccinium ovatum* Pursh
Maple, bigleaf	*Acer macrophyllum* Pursh
Oregongrape	*Berberis nervosa* Pursh
Redcedar, western	*Thuja plicata* Donn ex D. Don
Salal	*Gaultheria shallon* Pursh
Spruce, Sitka	*Picea sitchensis* (Bong.) Carr.
HERBS	
Bluegrass, loose-flowered	*Poa laxiflora* Buckley
Checker-mallow, Nelson's	*Sidalcea nelsoniana* Piper
Fern, sword fern	*Polystichum munitum* (Kaulf.) Presl
Lily, western	*Lilium occidentale* Purdy
MOSS	
Moss, giant-spored tree	*Ulota megalospora* Roell
DISEASES	
Brown cubical rot	*Phaeolus schweinitzii* (Fr.) Pat.
Laminated root rot	*Phellinus weirii* (Murr.) Gilbn.
Swiss needle cast	*Phaeocrytopus gaeumannii* (Rhode) Petr.
ANIMALS	
BIRDS	
Eagle, bald	*Haliaeetus leucocephalis*
Falcon, American peregrine	*Falco peregrinus anatum*
Goose, Aleutian Canada	*Branta canadensis leucopareia*
Murrelet, marbled	*Brachyramphus marmoratus*
Owl, northern spotted	*Strix occidentalis caurina*
Pelican, California brown	*Pelecanus occidentalis californicus*
FISH	
Dace, speckled	*Rhinicthys osculus*
Lamprey, Pacific	*Lampetra tridentata*
Salmon, chinook	*Oncorhynchus tshawytscha*

Appendix E
Common and Scientific Names of Organisms Mentioned in the Text

Salmon, coho	*Oncorhynchus kisutch*
Sculpins	*Cottus spp*.
Steelhead	*Oncorhynchus mykiss*
Trout, cutthroat	*Oncorhynchus clarki*
Trout, rainbow	*Oncorhynchus mykiss*
MAMMALS	
Elk	*Cervus elaphus*
Vole, red tree	*Arborimus longicaudus*
MOLLUSK	
Slug, papillose taildropper	*Prophysaon dubium*
INSECTS	
Beetle, Douglas-fir	*Dendroctonus pseudotsugae* Hopkins
Butterfly, Oregon silverspot	*Speyeria zerene hippolyta*



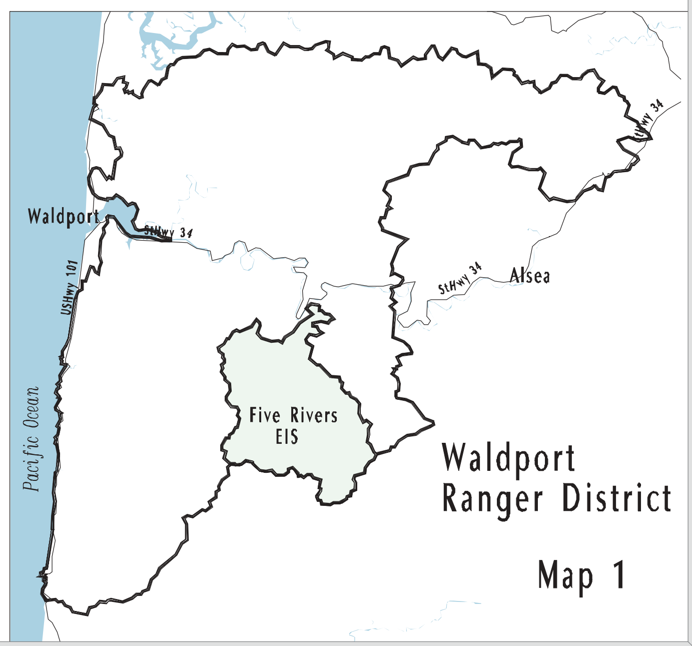
Newport
Waldport
Florence
Corvallis
Alsea
Five Rivers
PACIFIC OCEAN
USHwy 101
USHwy 20
StHwy 34
StHwy 99W
StHwy 126
Five Rivers EIS
Project Vicinity
Coast Province
Corvallis
Watershed Analysis Area
Eugene
OREGON
Map 1



Five Rivers Landscape Management Project

Final EIS
Vicinity Map

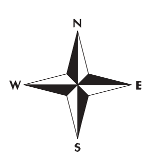
8 Subwatersheds in Project Area



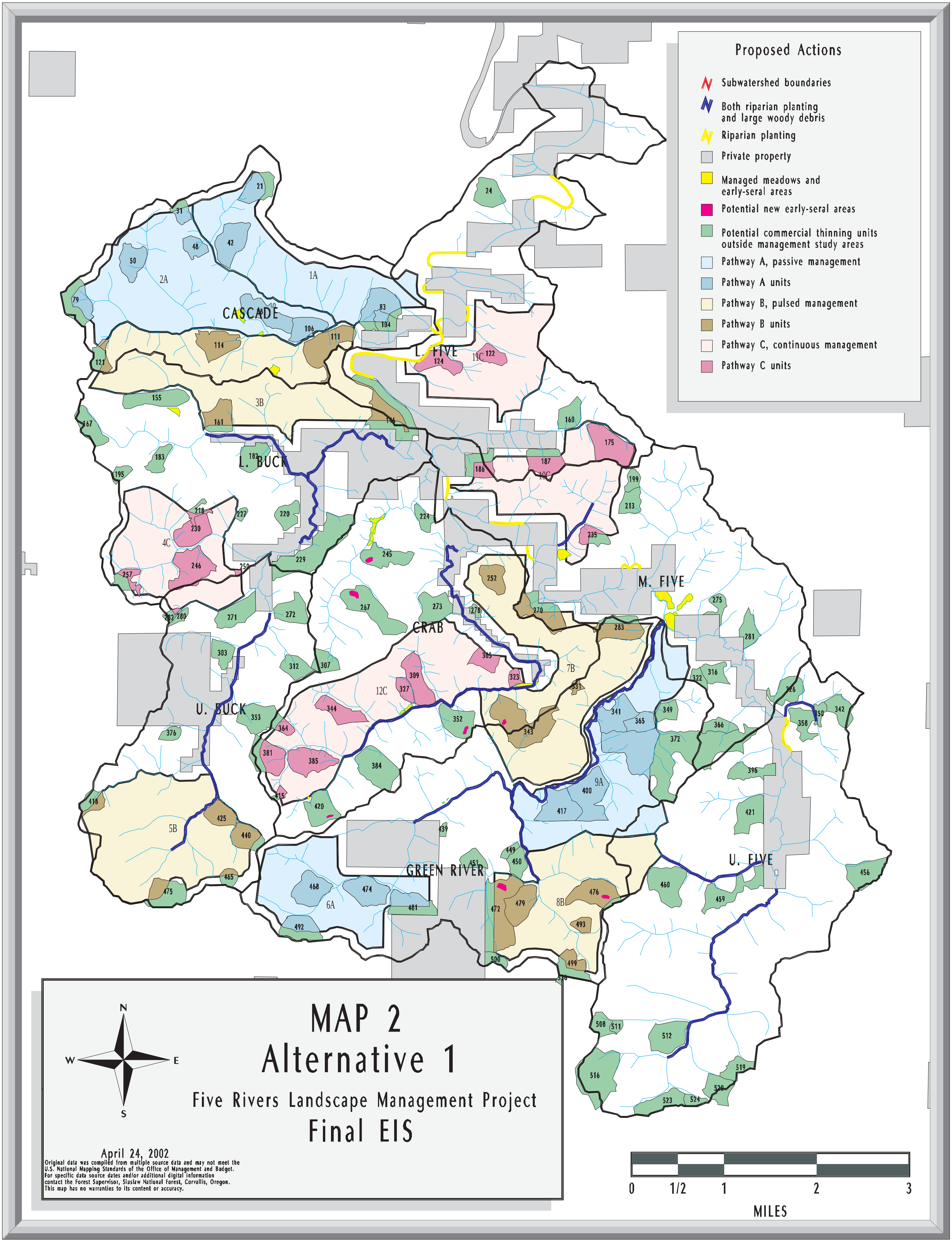
Waldport Ranger District

Map 1

April 11, 2002



Original data was compiled from multiple source data and may not meet the U.S. National Mapping Standards of the Office of Management and Budget. For specific data source dates and/or additional digital information contact the Forest Supervisor, Siuslaw National Forest, Corvallis, Oregon. This map has no warranties to its content or accuracy.



Proposed Actions
Subwatershed boundaries
Both riparian planting and large woody debris
Riparian planting
Private property
Managed meadows and early-seral areas
Potential new early-seral areas
Potential commercial thinning units outside management study areas
Pathway A, passive management
Pathway A units
Pathway B, pulsed management
Pathway B units
Pathway C, continuous management
Pathway C units
CASCADE
L. FIVE
L. BUCK
M. FIVE
CRAB
U. BUCK
GREEN RIVER
U. FIVE
1A
2A
3B
4C
5B
6A
7B
8B
9A
10C
11C
12C
N
S
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MAP 2
Alternative 1
Five Rivers Landscape Management Project
Final EIS
April 24, 2002
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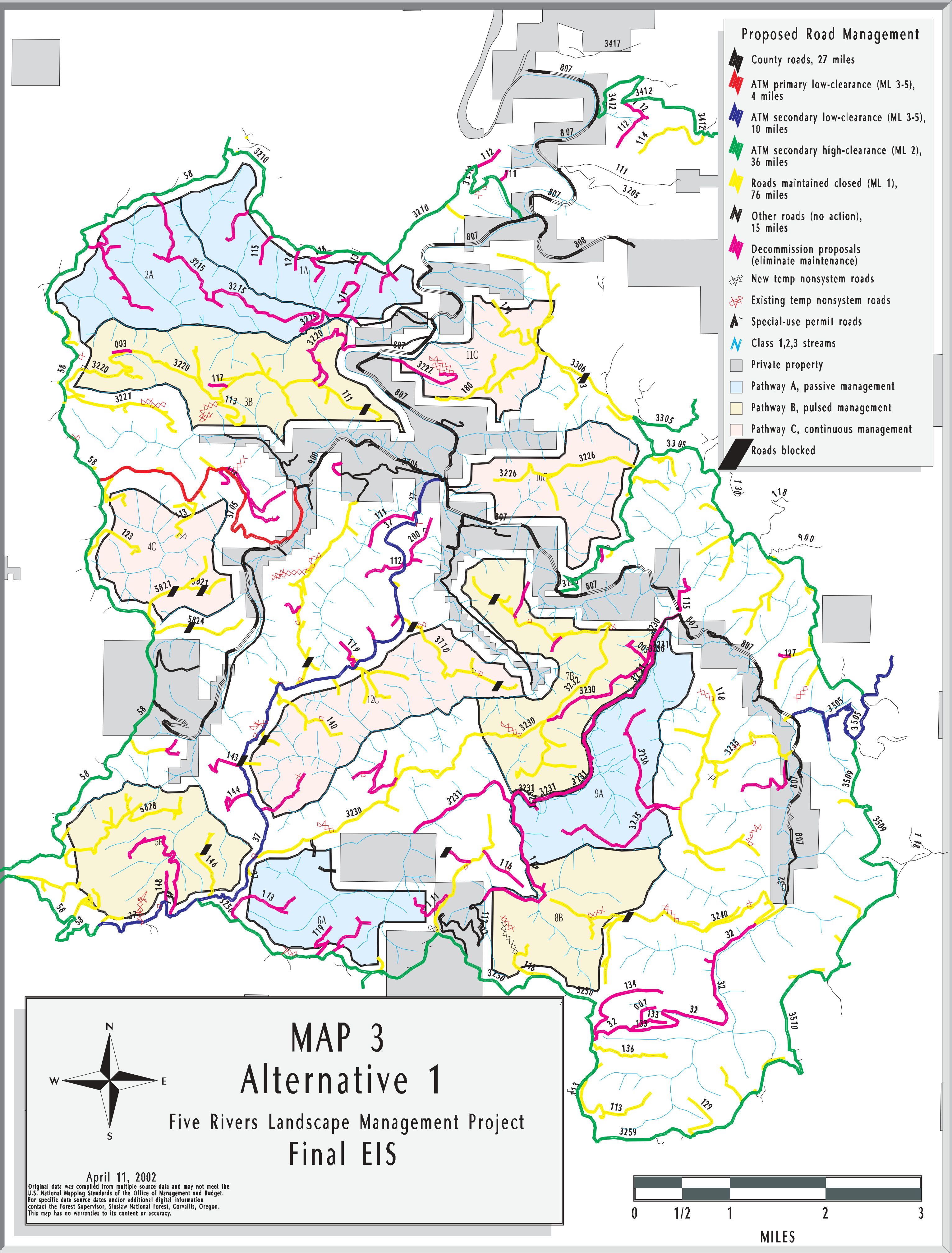
MILES



Proposed Road Management
County roads, 27 miles
ATM primary low-clearance (ML 3-5), 4 miles
ATM secondary low-clearance (ML 3-5), 10 miles
ATM secondary high-clearance (ML 2), 36 miles
Roads maintained closed (ML 1), 76 miles
Other roads (no action), 15 miles
Decommission proposals (eliminate maintenance)
New temp nonsystem roads
Existing temp nonsystem roads
Special-use permit roads
Class 1,2,3 streams
Private property
Pathway A, passive management
Pathway B, pulsed management
Pathway C, continuous management
Roads blocked
N
W
E
S
MAP 3
Alternative 1
Five Rivers Landscape Management Project
Final EIS
April 11, 2002
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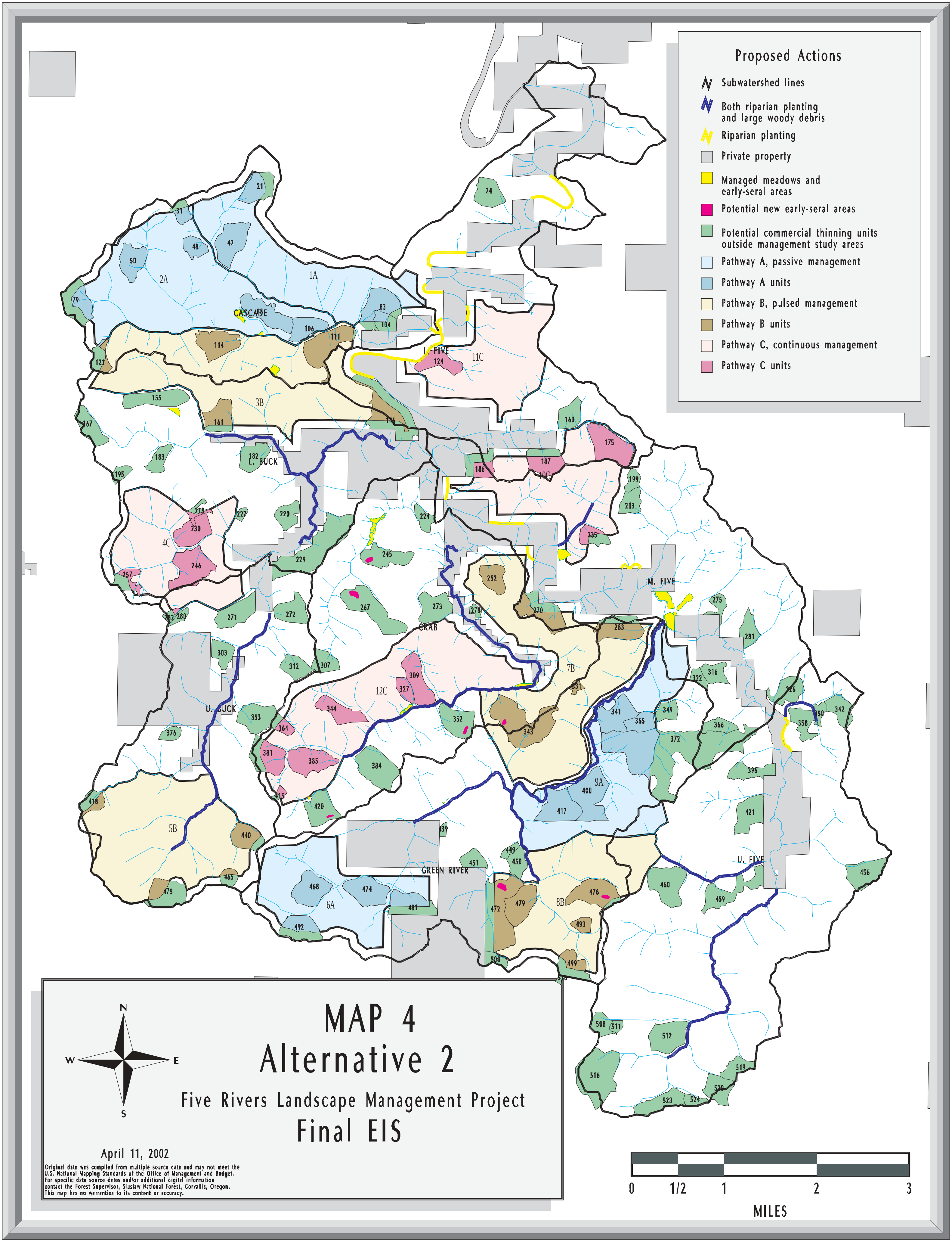

Proposed Actions
Subwatershed lines
Both riparian planting and large woody debris
Riparian planting
Private property
Managed meadows and early-seral areas
Potential new early-seral areas
Potential commercial thinning units outside management study areas
Pathway A, passive management
Pathway A units
Pathway B, pulsed management
Pathway B units
Pathway C, continuous management
Pathway C units
1A
2A
3B
4C
5B
6A
7B
8B
9A
10C
11C
12C
CASCADE
L. FIVE
L. BUCK
M. FIVE
CRAB
U. BUCK
GREEN RIVER
U. FIVE
MAP 4
Alternative 2
Five Rivers Landscape Management Project
Final EIS
April 11, 2002
Original data was compiled from multiple source data and may not meet the U.S. National Mapping Standards of the Office of Management and Budget. For specific data source dates and/or additional digital information contact the Forest Supervisor, Siuslaw National Forest, Corvallis, Oregon. This map has no warranties to its content or accuracy.
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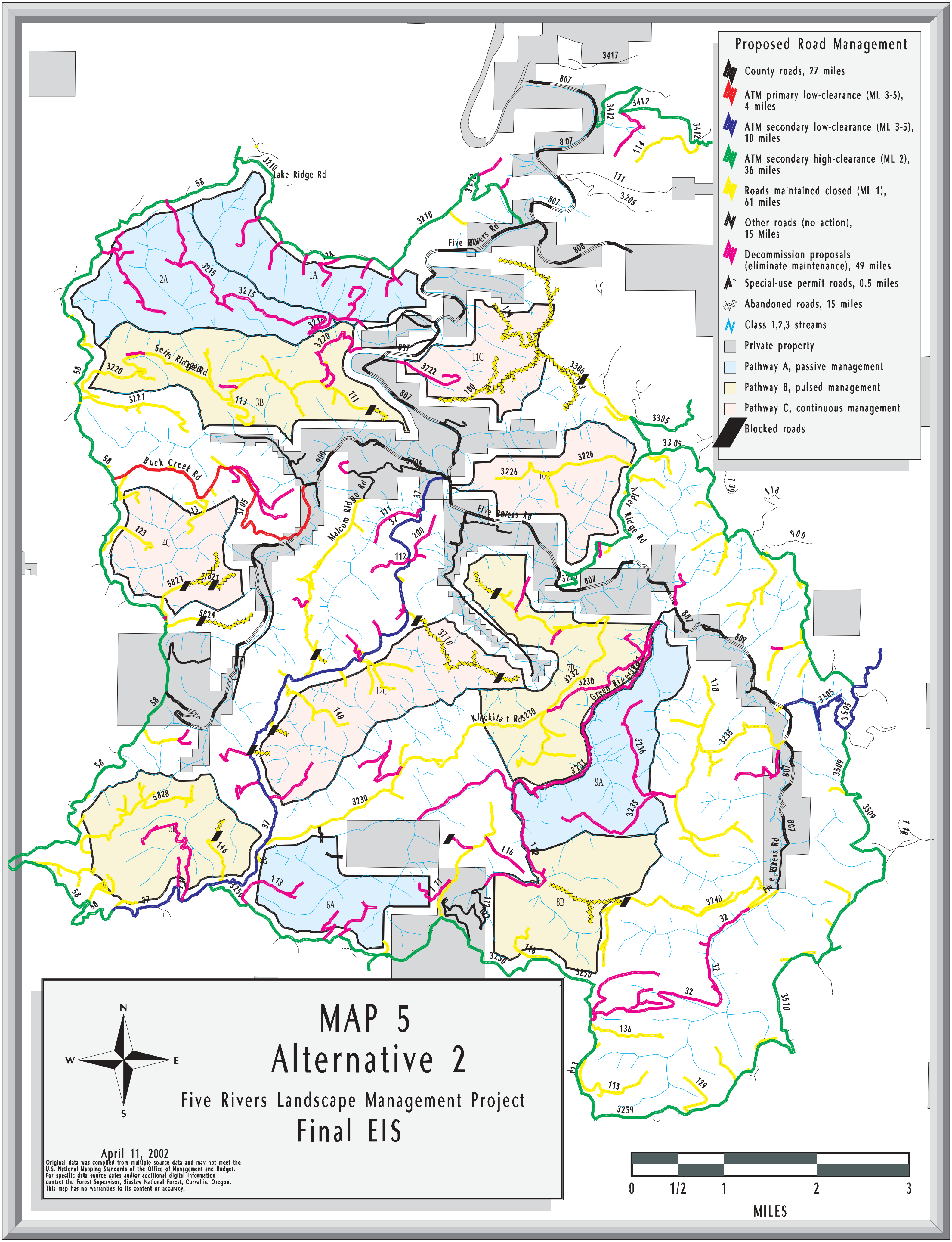
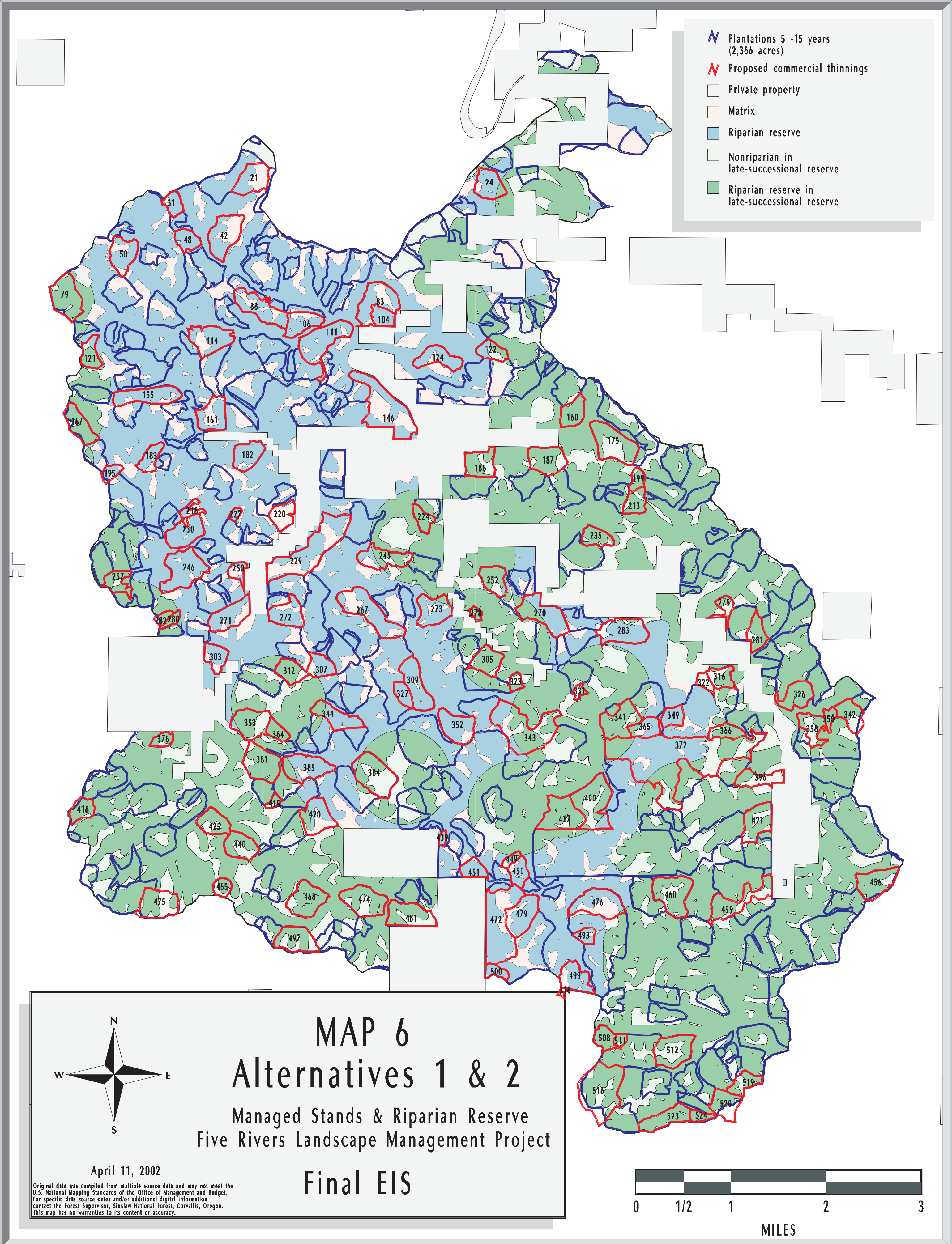
MILES



Proposed Road Management
County roads, 27 miles
ATM primary low-clearance (ML 3-5), 4 miles
ATM secondary low-clearance (ML 3-5), 10 miles
ATM secondary high-clearance (ML 2), 36 miles
Roads maintained closed (ML 1), 61 miles
Other roads (no action), 15 Miles
Decommission proposals (eliminate maintenance), 49 miles
Special-use permit roads, 0.5 miles
Abandoned roads, 15 miles
Class 1,2,3 streams
Private property
Pathway A, passive management
Pathway B, pulsed management
Pathway C, continuous management
Blocked roads
Lake Ridge Rd
Seits Ridge Rd
Buck Creek Rd
Malcom Ridge Rd
Five Rivers Rd
Alder Ridge Rd
Green River
Klickitat Rd
2A
1A
3B
11C
4C
12C
7B
9A
5B
6A
8B
N
W
E
S
MAP 5
Alternative 2
Five Rivers Landscape Management Project
Final EIS
April 11, 2002
Original data was compiled from multiple source data and may not meet the U.S. National Mapping Standards of the Office of Management and Budget. For specific data source dates and/or additional digital information contact the Forest Supervisor, Siuslaw National Forest, Corvallis, Oregon. This map has no warranties to its content or accuracy.
0
1/2
1
2
3
MILES


Plantations 5 -15 years
(2,366 acres)
Proposed commercial thinnings
Private property
Matrix
Riparian reserve
Nonriparian in
late-successional reserve
Riparian reserve in
late-successional reserve
N
S
E
W
MAP 6
Alternatives 1 & 2
Managed Stands & Riparian Reserve
Five Rivers Landscape Management Project
Final EIS
April 11, 2002
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0
1/2
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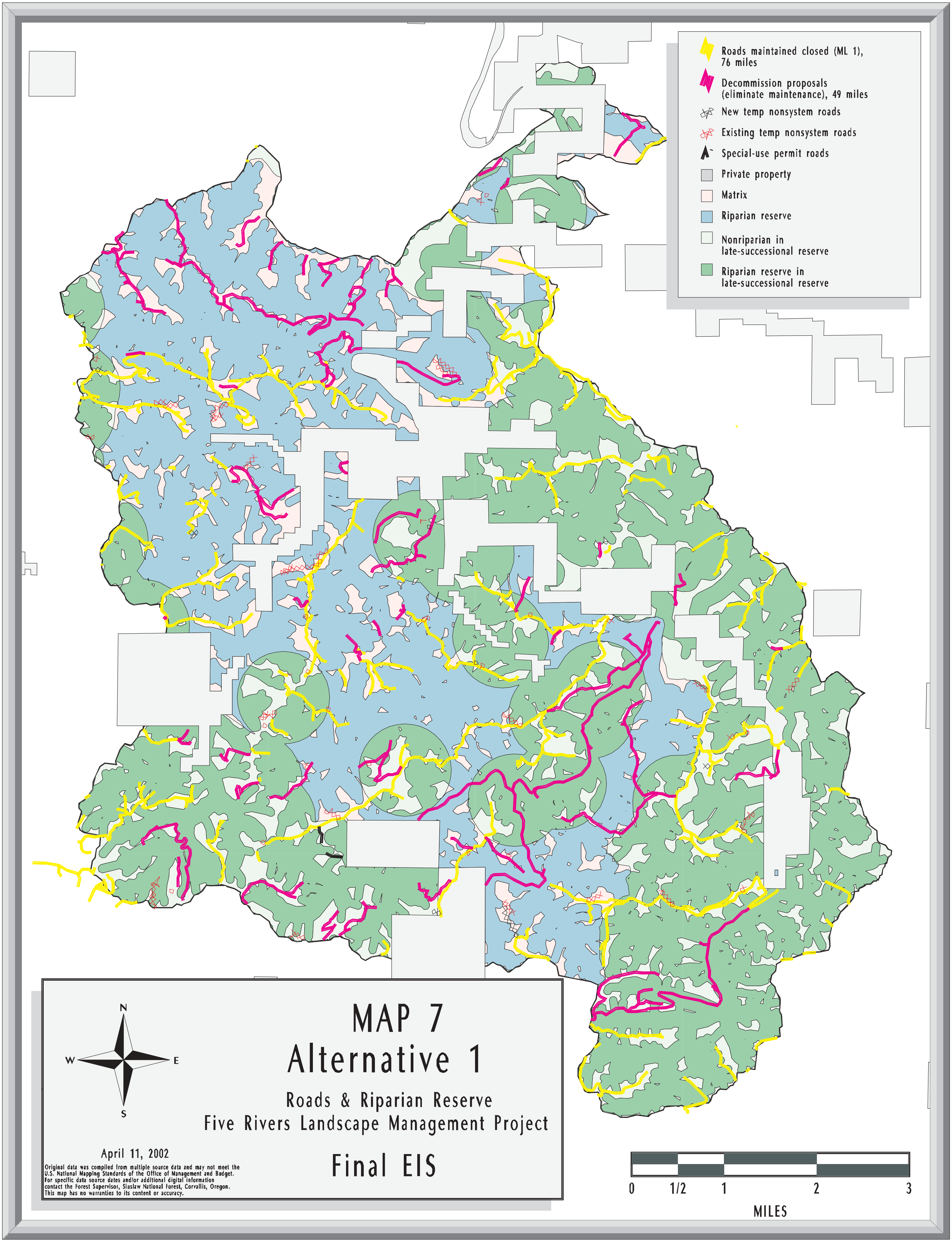
MILES


Roads maintained closed (ML 1), 76 miles
Decommission proposals (eliminate maintenance), 49 miles
New temp nonsystem roads
Existing temp nonsystem roads
Special-use permit roads
Private property
Matrix
Riparian reserve
Nonriparian in late-successional reserve
Riparian reserve in late-successional reserve
N
W
E
S
MAP 7
Alternative 1
Roads & Riparian Reserve
Five Rivers Landscape Management Project
Final EIS
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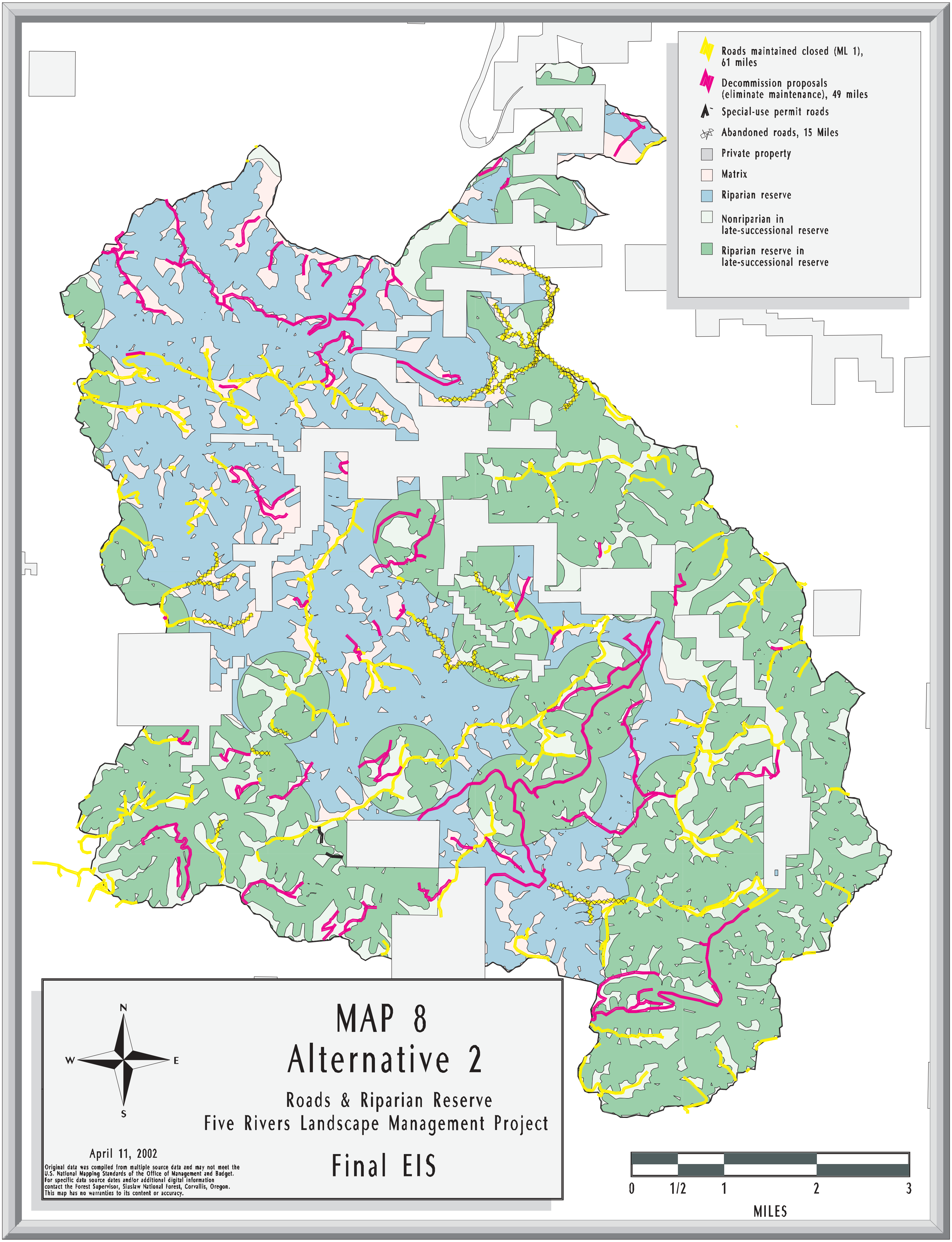
0
1/2
1
2
3
MILES



Roads maintained closed (ML 1), 61 miles
Decommission proposals (eliminate maintenance), 49 miles
Special-use permit roads
Abandoned roads, 15 Miles
Private property
Matrix
Riparian reserve
Nonriparian in late-successional reserve
Riparian reserve in late-successional reserve
N
W
E
S
MAP 8
Alternative 2
Roads & Riparian Reserve
Five Rivers Landscape Management Project
Final EIS
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0
1/2
1
2
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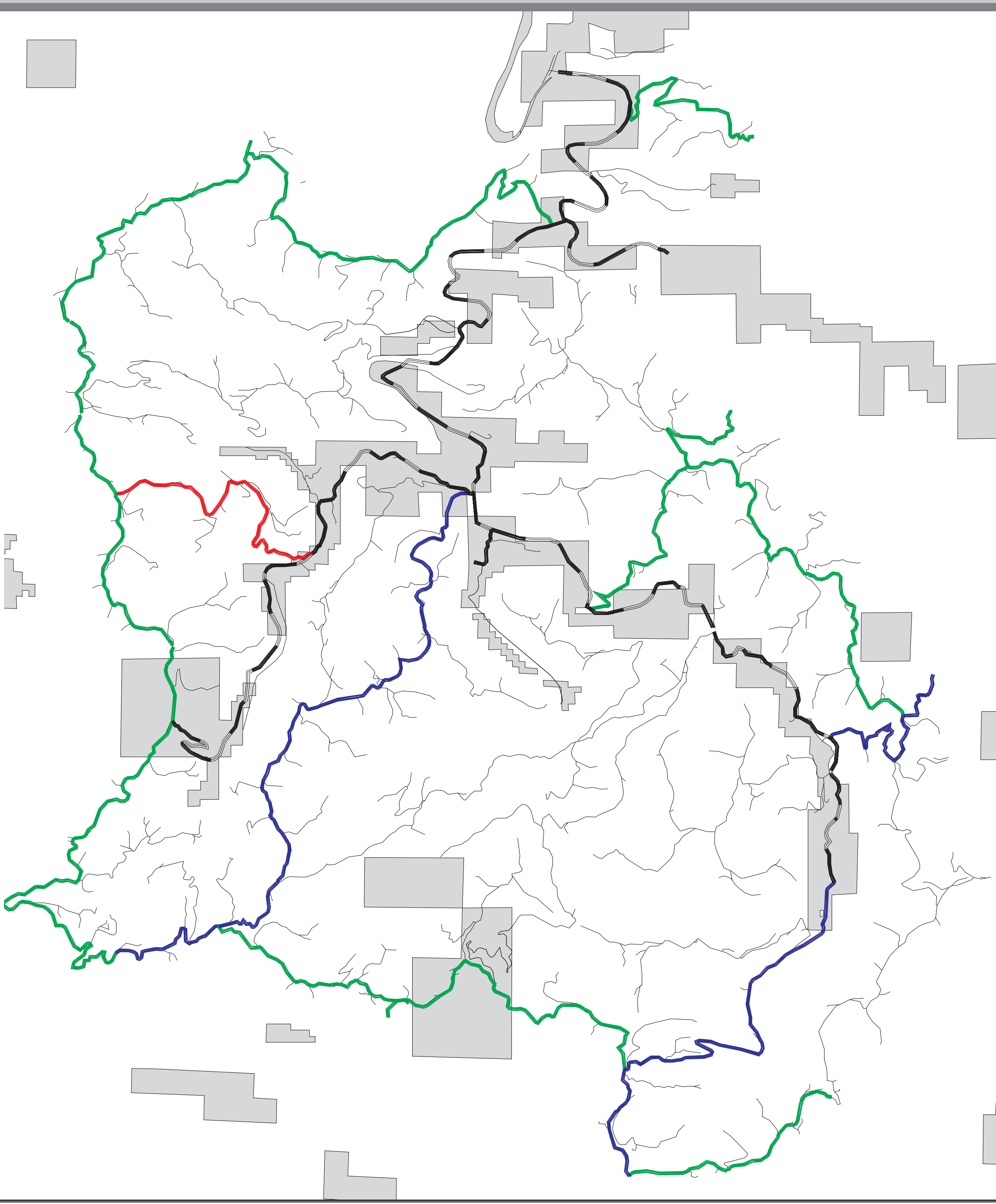
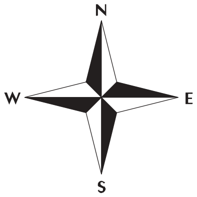
MILES



Five Rivers Project

Final EIS
Current Road Management Objectives



April 11, 2002

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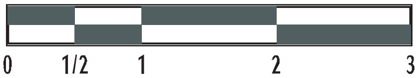
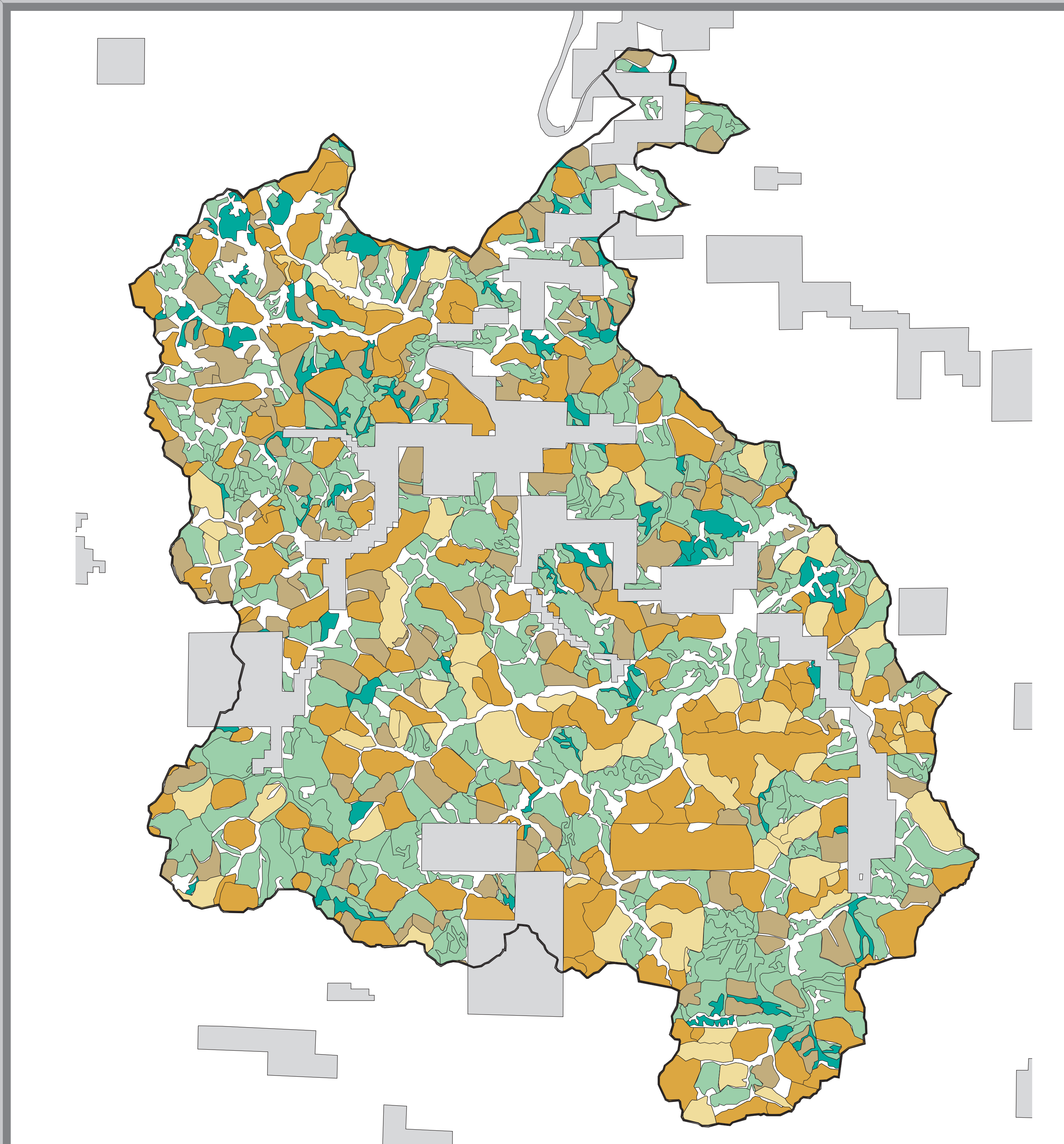
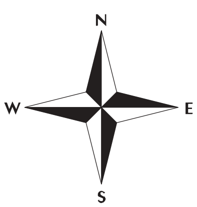


Map 9



Five Rivers Project

Final EIS
Existing Plantations and Mature Stands



April 11, 2002

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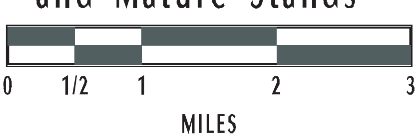

- Private property
- Plantations, 5 -15 years
- Plantations, 16-24 years
- Plantations, 25 years plus
- Mature stands, conifer mix
- Mature stands, conifer
- Old growth
- Nonconifer

Map 10