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January 1997

Northern Coast Range Adaptive Management Area Guide

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Northern Coast Range
Adaptive Management Area

February 10, 1997

Dear AMA Partner,

The Northern Coast Range Adaptive Management Area (AMA) came into being in the summer of 1994 with the signing of the President's Northwest Forest Plan. This document, the AMA Guide, was prepared to help citizens, scientists, and BLM and Forest Service managers to work together in planning and implementation of AMA activities.

To provide more detailed information about the AMA, we are in the process of preparing several documents: A bio-physical assessment, a social-economic assessment, a cultural-historical assessment, and a research and learning assessment. Copies will be available on request.

We hope the AMA Guide will encourage all those interested in forest land management to look for new ways of doing business. We also hope the Guide will encourage us to continue to learn from one another and to take full advantage of the opportunities inherent in an adaptive management area. We welcome your participation.

For further information, or to find out how you can participate in AMA activities, please contact Warren Tausch, Northern Coast Range AMA Coordinator, at 503-815-1124, or any any of the AMA staff listed in Appendix H at the back of the Guide.

Sincerely,

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NORTHERN COAST RANGE

ADAPTIVE MANAGEMENT AREA

GUIDE

January 3, 1997

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Introduction

Who should read this Guide?

If you have an interest in the public lands within the Northern Coast Range Adaptive Management Area (AMA), then this Guide is written for you.

You can be a partner in the AMA management process, whether your interest is:

- as a private citizen,
- as a user of public forest lands,
- as a member of the scientific community,
- as a member of a particular interest group,
- as a representative of local or tribal government,
- as one whose livelihood is related to forests or forest products, or
- as an employee of one of the managing or regulatory agencies.

What is the purpose of the guide?

The purpose of this AMA Guide is, first, to help everyone understand what this Adaptive Management Area is all about.

Second, the Guide outlines how we will conduct business in the AMA--by outlining a process to follow in planning and designing activities.

Third, the Guide points the way to opportunities for you, as a partner or stakeholder, to take part:

- in proposing new ideas,
- in suggesting new ways of working together,
- in planning activities,
- in getting things done, and
- in monitoring what we've done to see how well it worked.

We'll begin by explaining where the idea of AMAs came from, and then we'll describe a possible future vision for the AMA.

Where did the AMA idea come from?

The Northwest Forest Plan

On April 13, 1994, the Northwest Forest Plan (Plan) was signed by the Secretaries of Agriculture and Interior. It resulted from the President's Forest Conference of April 1993 and was designed to help settle the prolonged and heated controversy about how we should manage federal forests in the Pacific Northwest.

The Plan's strategy is based on protecting a wide range of animal and plant species and their habitats--the building blocks of biological diversity. The strategy provides a network of reserves on federal lands to protect older forests (Late-Successional Reserves), and also provides reserves along all streams, lakes, and wetlands (Riparian Reserves). The Plan establishes certain standards and guides for land management practices within the two kinds of reserves, and other, less-restrictive standards for the federal land outside the reserves (Matrix). Recognizing that we have much to learn about ecosystem management, the Plan also created ten Adaptive Management Areas--one in each physiographic province--where new approaches to public forest land management are to be developed and tested.

Adaptive management

Adaptation is the process of responding positively to change. As defined in Bormann et al. (1996), the term *adaptive management* is used to describe an approach to managing complex systems that builds on common sense and learning from experience. Adaptive management--which has sometimes been described as "learning to manage and managing to learn"--consists of three basic steps:

- conscious experimentation in the design of activities,
- careful monitoring to see how things turn out, and
- regular adjustment of practices based on what was learned

Monitoring is perhaps the most critical step in the process: people and funds must be provided to monitor results, analyze what happened, and feed the results back into the design of new projects. Monitoring, based on a sound sampling design, provides regular feedback about how well things are working--or not working--so that practices can be frequently modified in response to new information and changing values. The concept of adaptive management is discussed more fully in Appendix A.

Adaptive Management Areas

The team that prepared the Northwest Forest Plan applied a prescriptive approach to forest land management to meet legal requirements for protecting threatened and endangered species. They also recognized, however, that we have much to learn about how to manage forest lands for a variety of values. How could some creativity and flexibility in management be provided and some opportunities for exploring and experimenting be created and sustained? The ten Adaptive Management Areas, or AMAs, were created to help answer this question (Shannon et al. 1996). The Plan prescribes a different management emphasis for each AMA. While the agencies are directed to apply adaptive management to all federal lands in the Pacific Northwest, the AMAs were conceived particularly as places to encourage the development and testing of new technical and social approaches to forest management. Thus, learning itself becomes an important objective--and outcome--of management. Table 1 displays the ten AMAs and the primary management emphasis for each.

Late-successional forest

Restoring and maintaining late-successional forest is a common theme for most of the AMAs--but what is a late-successional forest? "Succession," as used here, refers to the sequence of different kinds of plant communities that come to occupy an area after the previous vegetative cover has been removed in some way. An area may be cleared by fire, flood, landslide, windstorm, or by human activities such as timber harvest. "Early-successional" plant cover, the first species to reoccupy a vacant site, generally consists of vegetation such as grass, herbs, thistles, and small shrubs. In western Oregon, this stage is followed (or succeeded) by tree seedlings, which change the character of the vegetation cover as they age and grow. The later stages of this succession ("late-successional"), as used in

Table 1. Adaptive Management Areas

AMA	Location	Acres	Management emphasis
Applegate	Oregon	277,500	Development and testing of forest management practices to provide a broad range of forest values, including late-successional forest and riparian habitat
Central Cascades	Oregon	155,700	Intensive research on ecosystem & landscape processes, integration of forest & stream management
Cispus	Washington	143,900	Integration of timber production with maintenance of late-successional forest, riparian zones, and recreational values
Finney	Washington	98,400	Restoration of late-successional forest & riparian habitat
Goosenest	California	172,900	Management to promote forest health, late-successional forest, riparian habitat, and timber production
Hayfork	California	488,500	Commercial timber production, late-successional forest, and riparian habitat
Little River	Oregon	91,800	Intensive timber production and restoration and maintenance of riparian habitat
Northern Coast Range	Oregon	281,200	Restoration and maintenance of late-successional forest, conservation of fisheries habitat and biological diversity
Olympic	Washington	150,400	Integration of ecological and economic objectives, restore structural complexity to forests and streams
Snoqualmie Pass	Washington	212,700	Provision of late-successional forest on "checkerboard" lands to provide a north-south connective link

the Northwest Forest Plan, include mature forest (about age 80 to 190) and old growth (very roughly age 200 and older). The actual age at which late-successional and old-growth forest structure and characteristics develop varies widely from one area to another. Characteristics of late-successional forest are discussed in chapter 3. In this Guide, the term "older forest" will often be used to refer to what the Plan calls "late-successional forest."

AMA management is intended to focus not only on ecological goals, but also on economic and social concerns--especially those of local communities. The two are closely related:

- The search for creative solutions to resource management questions is futile if we do not know what the ecological system can support.
- Defining what is ecologically possible, however, does little good without also knowing what people want.

The central role of Adaptive Management Areas is, as the Plan states, "learn to manage, and manage to learn." Although management goals have been set at the national level, the source of new ideas for meeting these goals must be primarily local people: local citizens, managers, and scientists. Collaboration is the key to bringing these "stakeholders" together. Their contributions might be summarized as follows:

People in the community know the land, know what is important to them, and have ideas on how to achieve it.

Managers have the tools, resource information, and work force needed to get things done.

Scientists can help design activities to answer specific questions, and know how to collect the right kinds of information so that the questions are answered.

Northern Coast Range Adaptive Management Area

Our AMA is in the Oregon Coast Range, from Tillamook south almost to Newport. About 1.4 million acres are within the exterior boundary of the AMA. This boundary was drawn along watershed lines to include all Federal AMA lands, amounting to more than 281,000 acres, about 20 percent of the total area. Some 151,000 acres are Siuslaw National Forest lands administered by the USDA Forest Service, Hebo Ranger District. The remaining 133,000 acres are administered by the USDI Bureau of Land Management, Salem District, Tillamook and Marys Peak Resource Areas. Table 2 displays Federal land by county, and map 1 displays locations of Federal, State, and Tribal lands in the AMA.

That leaves just over a million acres of other ownership in the AMA, including state forest land, tribal forests, forest industry lands, state and county parks, private woodlots, farms, and communities. Fig. 1 shows the approximate distribution of AMA lands by type of ownership.

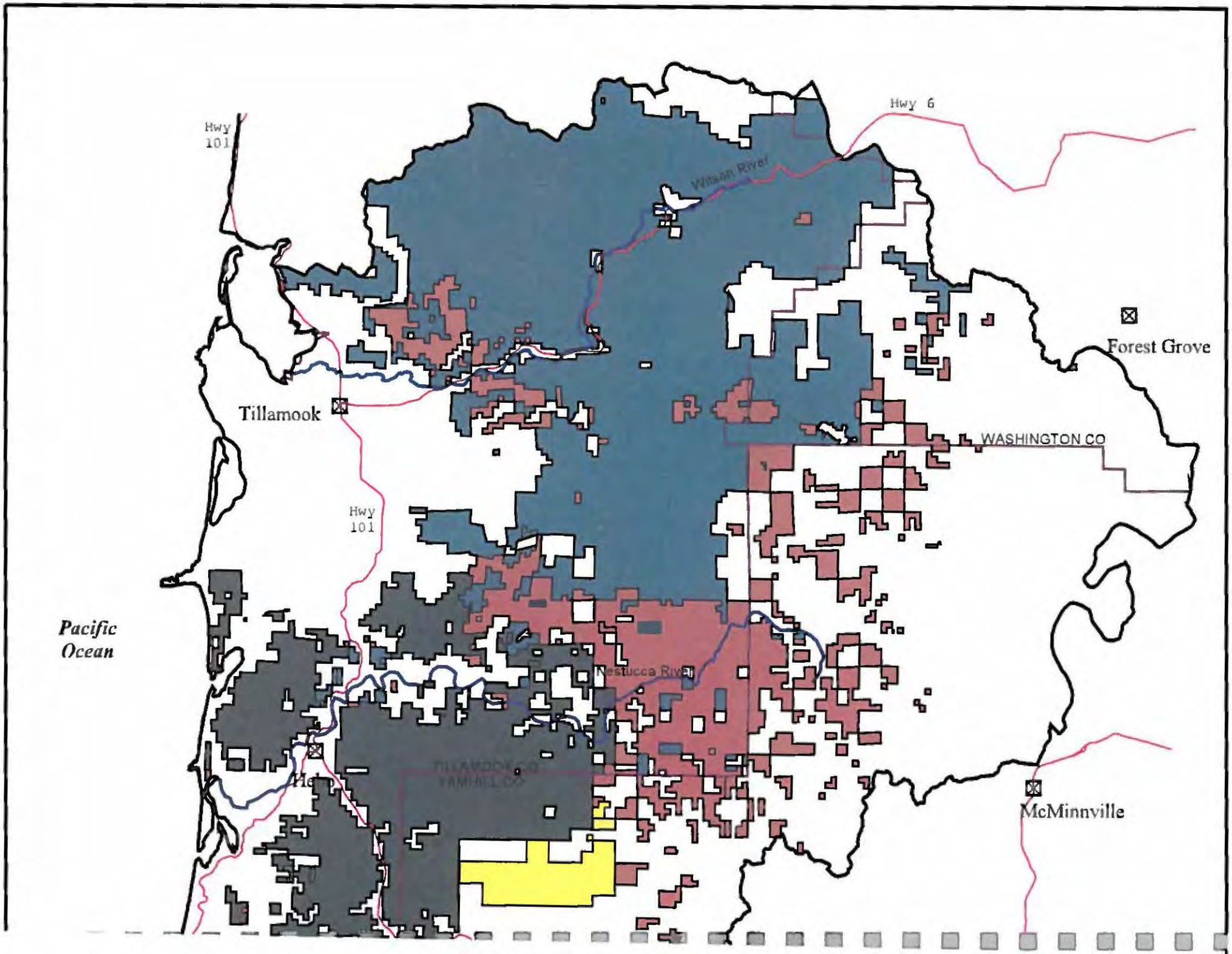
Note that the Northwest Forest Plan gives Federal agencies no management authority regarding nonfederal lands within the AMA boundary. Cooperative management of adjacent ownerships, however, is encouraged. Map 2, Major Land Owners, illustrates the ownership of the eight largest forest industry companies in this area, along with the public and tribal lands.

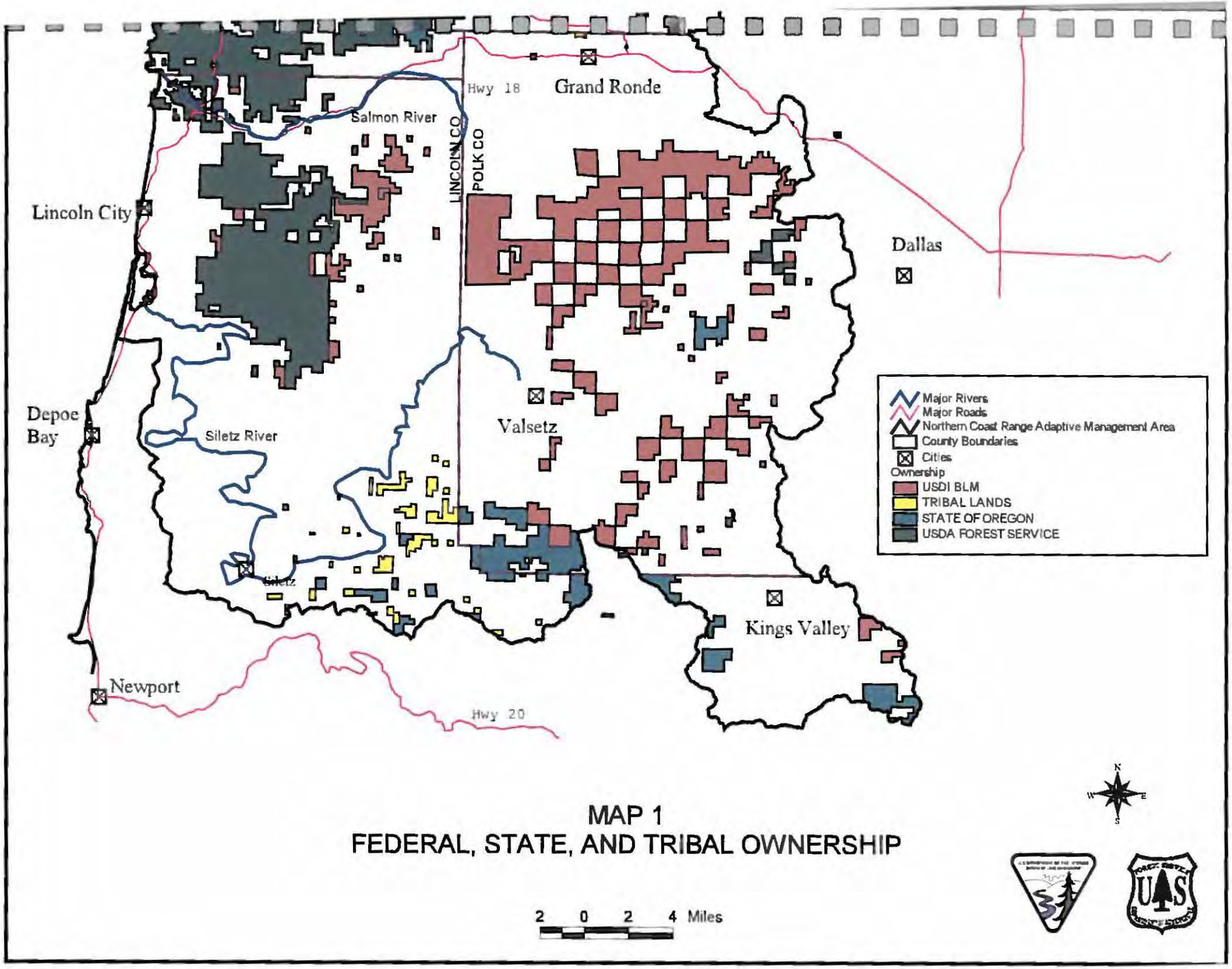
The objectives for managing federal lands in the Northern Coast Range AMA are presented in the Northwest Forest Plan as follows:

- Restore and maintain late-successional forest habitat. This is basically the same goal assigned to Late-

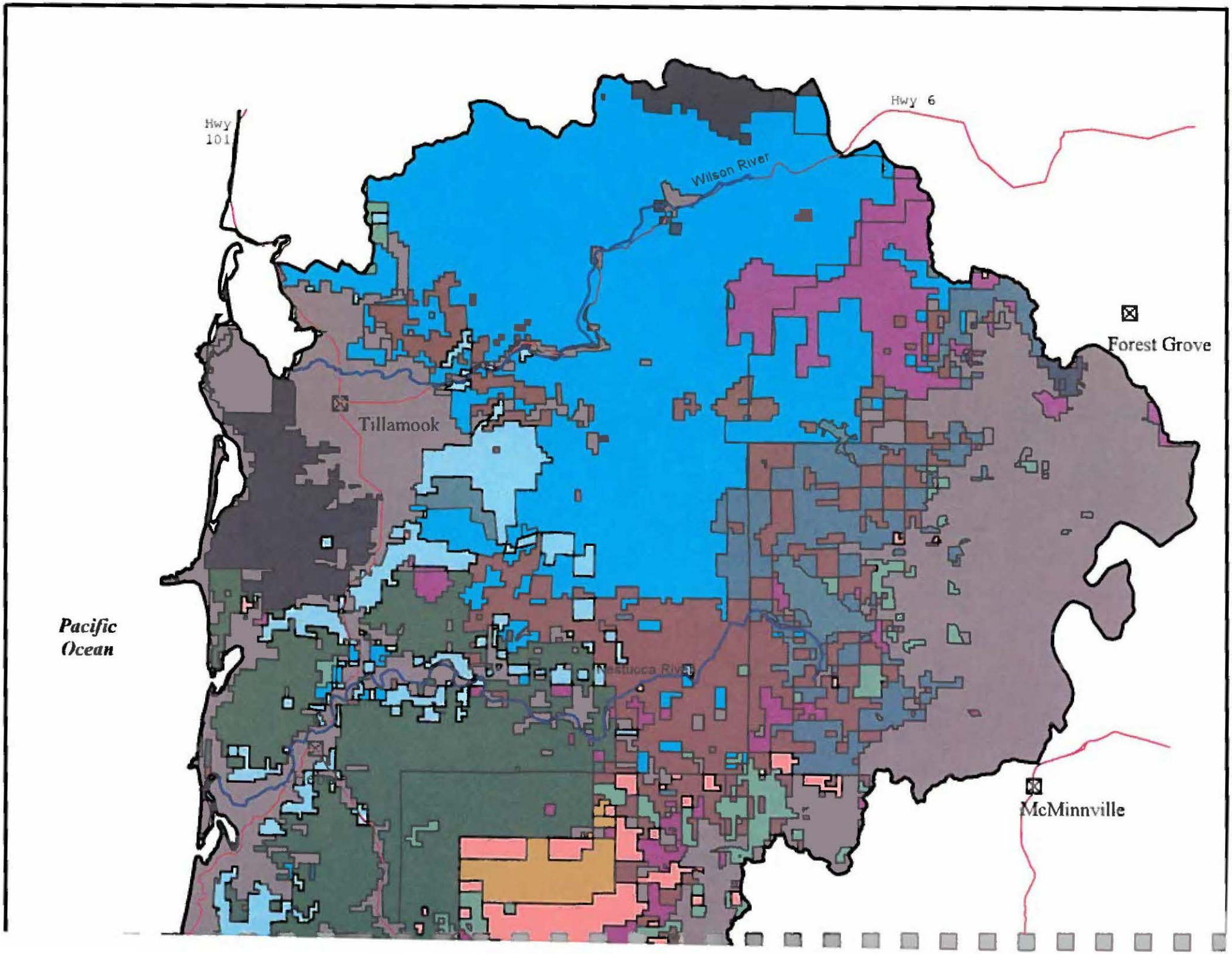
Table 2. Northern Coast Range AMA: Acres of Federal Land by County

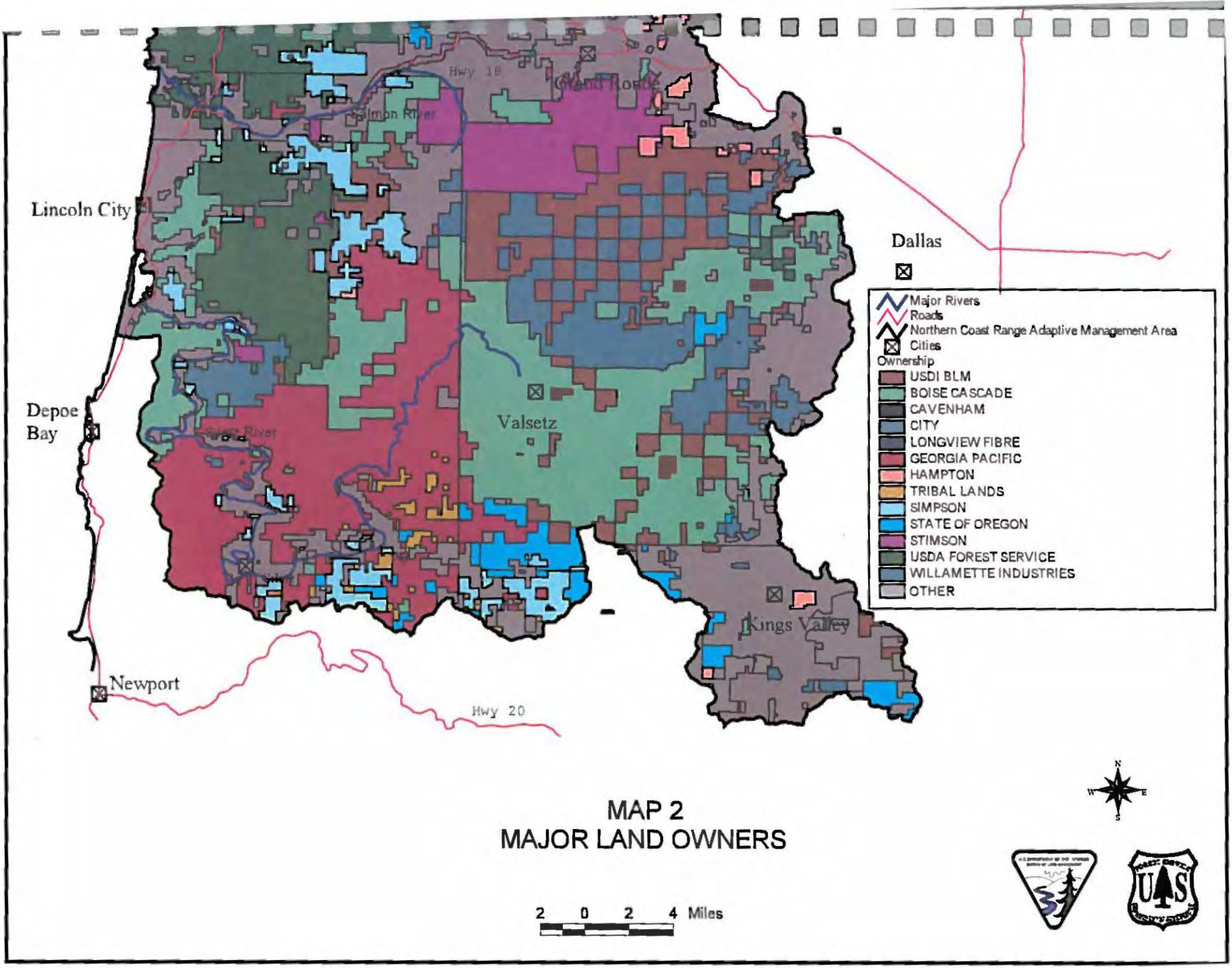
County	BLM Public Domain	BLM O&C	National Forest	Totals
Benton	156	778	0	934
Lincoln	6,057	0	33,128	39,185
Polk	230	39,889	1,169	41,288
Tillamook	11,033	37,035	88,849	136,917
Washington	317	4,762	0	5,079
Yamhill	60	32,961	24,837	57,858
Totals	17,853	115,425	147,983	281,261


Hwy 101
Hwy 6
Wilson River
Forest Grove
Tillamook
WASHINGTON CO
Hwy 101
Pacific Ocean
Nestucca River
McMinnville



MAP 1
FEDERAL, STATE, AND TRIBAL OWNERSHIP


Hwy 101
Hwy 6
Wilson River
Tillamook
Forest Grove
McMinnville
Pacific Ocean



MAP 2
MAJOR LAND OWNERS

Successional Reserves, except in the AMA more flexibility is provided to explore innovative methods of reaching the goal.

- Develop a strategy to conserve fisheries and other elements of biological diversity, and invite the Oregon Department of Forestry to collaborate in this effort. In the AMA, we are encouraged to take active steps to improve and restore habitat conditions.

- Provide social and economic benefits to local communities. This objective is common to all AMAs. The intention of the Northwest Forest Plan, in fact, is to tie ecological and social objectives together.

The first two habitat-oriented objectives are not meant to prevent AMA lands from producing economic commodities. The AMAs were intentionally located near communities that have been affected by reduced timber harvest from federal land. Production of timber (though less than the amounts harvested in the past), special forest products, and other commodities is expected as part of the AMA program of activities.

Adaptive Management Area Plans

The Northwest Forest Plan requires each AMA to have a plan, and this Guide has been prepared to fulfill that requirement for the Northern Coast Range AMA. Why, then, are we calling it a Guide, rather than a plan? A plan usually contains decisions on allocation of lands or resources to specific uses. Existing plans include the Siuslaw Forest Plan, which was amended by the Northwest Forest Plan, and the Salem District BLM Resource Management Plan, which was tiered to the Northwest Forest Plan.

This Guide, on the other hand, is not intended to be a vehicle for documenting in-place management decisions. Instead, it is to be a working document (which means that, with your help, we'll keep revising and improving it) that will outline how we expect to do business and to help everyone interested in the AMA understand how their concerns can be reflected in management decisions. The expected effects of individual projects will be analyzed--and their results predicted--as projects are developed.

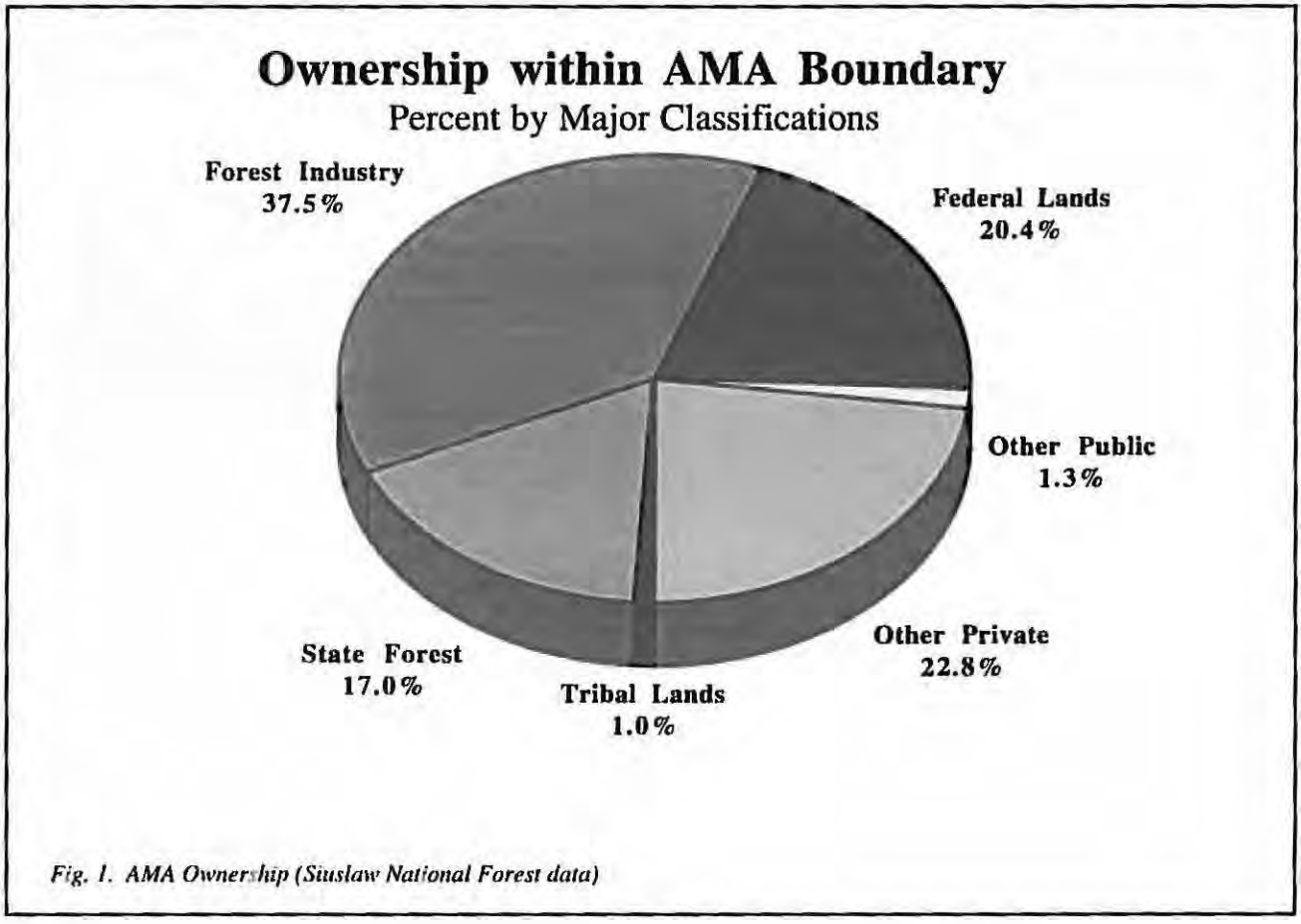


Fig. 1. AMA Ownership (Siuslaw National Forest data)

CHAPTER 1: SHARED VISION

Douglas-fir stands - Mt. Hebo.

What is our vision for the Northern Coast Range AMA?

We invite you to join us on an imaginary future tour, on which we will see how a part of the AMA might look 60 years from the signing of the Northwest Forest Plan. The vision presented here represents a managed, integrated approach to meeting the goals established for the AMA by the Northwest Forest Plan. It's a projected outcome of more than 50 years of applying creative ideas from local citizens, scientists, and agency staff, ideas tested, evaluated, and adjusted through the mechanism of adaptive management. No one knows, of course, exactly how things will really turn out. Our hope is that this scenario will serve as a springboard for discussion--it's one view of how an active management approach might be used to work toward the goals set for the AMA in the Northwest Forest Plan.

It is April 16, 2054. You have boarded a solar-powered bus for today's 60th-anniversary tour of the Northern Coast Range Adaptive Management Area, hosted by the Northwest Ecosystem Agency, which manages all publicly-owned lands in this region. The tour leader tells us that today's trip through the Coast Range west of the town of Carlton will show us a typical cross section of the AMA forest. The focus will be to observe how well we have met the objective of developing late-successional forest and maintaining biological diversity, while also meeting human needs.

As the bus winds its way along Meadow Lake Road, we're treated to some grand views of Willamette Valley farms, woodlots, and small towns extending below us to the east. As we continue up the ridge, pastures and hillside homes gradually give way to plantations of Douglas-fir, hemlock, and western redcedar on industrial forest lands.

Large, old trees

As we enter publicly-owned forest lands, the texture of the forest begins to change. We notice more large conifers dispersed among the smaller trees. Some of the largest Douglas-fir and cedar have dead or flattened tops, forks, rot cavities, and large limbs in the upper

canopy. Our tour leader asks if we'd like to guess the age of these patriarchs of the forest, many of which are three to four feet in diameter. Some say 250 years, some 300. The tour leader responds that most of them are not more than about 160 to 170 years old, having seeded in after the last major wildfire in this area near 1890. Management treatments applied to the stand and to individual trees have enabled them to take on some of the appearance and function of much older trees in a relatively short period of time.

Snags and logs

We soon begin to notice that dead trees ("snags") are everywhere a part of the forest. Many small, dark-colored snags form as the result of natural competition among younger trees. Very large trees that have died in the last few years are now tall snags that still have their bark and many limbs; those that died more than 10 years ago are hard and smooth. Short, thick, soft brown snags are reminders of the forest that burned near 1890. Some of the snags have visible cavities, and our tour leader informs us that woodpeckers and flying squirrels are frequent residents. The forest floor is littered with logs of all sizes and in various stages of decay. On top of the older logs are thick mats of moss, red huckleberry, ferns, and hemlock seedlings.

Multiple canopy layers, multiple species

We turn left and travel south along the crest of the Coast Range on the winding Bald Mountain Access Road. Trees of all sizes line the road, some widely spaced and fast growing, with live crowns beginning almost at the ground, and others in dense clumps with tall, thin trunks and no live limbs for 60 feet or more. Where layers of live limbs are found at several heights in a forest stand, ecologists say the stand has multiple canopy layers, a condition important to some species--such as northern spotted owls--adapted to older forests. Most of the smaller trees appear to be Douglas-fir or hemlock, but we also see cedars, occasionally a bigleaf maple, spruce, white pine, dogwood, or golden chinquapin. Groups of fast-growing red alder take advantage of openings in the tall conifer canopy.

A half-mile down the road, the forest takes on a different appearance. The stand here is a mixture of Douglas-fir and hemlock, almost all three feet or more in diameter. In this part of the forest, there are few gaps between the tall crowns; in fact, the branches seem almost to meet above the road. The result is a forest floor with little cover of shrubs, herbaceous vegetation, or understory trees. Our tour guide explains that this variation is an example of the horizontal diversity typical of late-successional forests. Density, structure, and species composition vary considerably from place to place.

Diversity of shrubs and herbaceous plants

Occasional breaks in the forest give us glimpses of the Willamette Valley floor to the east, and beyond, the snow-capped Cascade Range summits of Mount St. Helens, Mount Adams, and Mount Hood. We take a break from road travel and walk through the forest on a narrow trail. Beneath areas with a dense canopy, few understory plants are growing, but in gaps and where the trees are more widely spaced, many kinds of shrubs crowd the slopes: vine maple, salal, Oregongrape, rhododendron, sword fern, and huckleberry. Among and between the shrubs are trailing stems of twinflower and dewberry, thick dark leaves of princes-pine and pyrola, small white blooms of starflower, showy white trillium petals, and carpets of queens-cup lily.

Stand Management

When we look closely beneath the shrub layer and in small openings, we find low stumps of various sizes. Our tour leader explains that the diversity of this forest is a direct result of a series of carefully planned "disturbances", in the form of periodic thinnings. Removing some of the trees in the stand at intervals allowed many of the remaining trees to grow much faster in diameter. The small openings created in the forest also made room for patches of shrubs and wildflowers and clumps of small trees. The small trail on which we're walking has served at least four times in the last 50 years as an avenue for removing merchantable logs, using lightweight, low-impact harvesters. Each time the stand was thinned, a portion of the trees selected for removal were converted to snags by being girdled or topped; other trees were felled and left in place to contribute to the supply of large woody debris. At times, certain trees in the stand were selected for *habitat culturing*, using a variety of techniques to stimulate development of large limbs, flat or dead tops, forks, rot cavities, and other deformities that help provide a greater diversity of habitats in the forest.

Every year, thinning operations are carried out at sites throughout the AMA. Between 1,000 and 2,000 acres are treated annually, helping to maintain a healthy, diverse forest and at the same time providing many jobs, substantial income to local communities, and raw materials for wood products manufacturers. Our leader says we'll visit an active thinning operation later in our trip.

Prescribed use of fire

Returning to the bus, we travel past the rounded summit of Bald Mountain. According to our tour leader, the peak was so named because it sported a large, grassy meadow with a wooden, fire-lookout tower 120 years ago. The meadow was originally created and sustained by repeated wildfires, but gradually filled in with tree seedlings during the 100-year period of wildfire exclusion. Today, it is again a grassy meadow, a result of prescribed burning about every 10 years since 2020. Such planned burns are used to maintain a small amount of early-successional meadow habitat in the area.

Our tour leader relates how populations of deer and elk in the Bald Mountain area, a large block of public forest land, declined substantially from about 2005 to 2015. The elimination of clearcut timber harvesting, combined with continued extinguishing of all wildfires, resulted eventually in a forest with little foraging habitat for large grazing animals. Even the industrial forest lands to the east were occupied at that time primarily by dense, young plantations. During the past 30 years, however, prescribed burns on small areas within the AMA have created and maintained a number of small gaps and openings. Some of the openings are only a fraction of an acre, but others range up to 2 or 3 acres. Deer and elk populations are now stabilized at much higher levels than before the planned fire use--and big game hunting continues to be one of the most popular forms of recreation in the AMA.

Landscape patterns

In occasional views to the west, we see little obvious evidence of management activity. We are reminded that half a century ago, the forest in this part of the AMA was extensively fragmented. Well over half the timber in the area had been cut and converted to young plantations of seedlings and saplings. Between the harvested areas and in strips along the larger streams were remnant blocks of mature forest. Today, an almost continuous forest blankets the ridges and valleys of the AMA. There are small openings here and there, resulting from small-patch harvest of trees, or caused by fire, windstorms, insect damage, or root disease.

The trees in today's forest vary considerably in size, but because of the periodic thinnings and establishment of new canopy layers in the understory layers, it is difficult to pick out just where the edges of the old clearcuts were located. Why? Large and small trees, stumps, and understory vegetation are present in similar quantities whether the overstory is aged 60 or 160 years. On closer inspection, of course, the largest trees, four feet and more in diameter, are found only in the older portions of the forest. The AMA forest now contains, across the landscape, much of the structure and features of unmanaged forests over 200 years of age, though some of the area was clearcut only 60 to 70 years ago. Has "old-growth" forest been created? We would say no--we can influence the direction and rate of stand development through management interventions--but only old age produces true old growth. Nevertheless, many of the habitat elements needed by wildlife species dependent on late-successional forests seem to be in good supply in the AMA today. Recent surveys confirm steady increases in nesting use by northern spotted owls, a bird that does best in older forests, and once federally listed as a threatened species. By any measure, we appear to have met the objective of restoring late-successional forest habitat, as required by the Northwest Forest Plan of 1994.

Trail systems

On the south side of Bald Mountain, we get off the bus at the upper end of the Bald Mountain-Nestucca River Trail, which was originally built by enterprising fishermen more than 100 years ago to access prime fishing holes on a part of the Nestucca River that was remote from any roads. The trail has been improved, rebuilt, and linked with newer trail systems, and is maintained by the Tillamook Hoofers outings club, under the terms of a voluntary agreement with the Northwest Ecosystem Agency. Most AMA trails, according to our tour leader, are maintained through voluntary agreements.

As we talk about trail development, a group of six or seven hikers with backpacks arrive at the roadside. They have spent the last three days exploring AMA trails. A very fit looking elderly woman remarks that the AMA is her favorite hiking destination in the Coast Range because of the beauty of the forest, the abundant berries and wildlife, and the excellent trail system. From this point, the more physically ambitious tour participants will hike the Bald Mountain trail down to the river, walking through a relatively large, unroaded block of forest--one of several in the AMA. The rest of us will travel in the bus around to the bottom via forest roads.

Roads

Our bus turns west on Hoag Pass Road and begins the descent to the Nestucca River. A senior citizens club from the Yamhill area has "adopted" this road, and patrols it regularly to check for blocked culverts, trees fallen on the road, bank failures, or other maintenance

needs. They keep the road clear of small trees and brush and regularly report conditions back to the agency. A local Carlton company takes care of required major maintenance on this road and several others under a long-term maintenance contract with the Ecosystem Agency. Several old spurs branching off Hoag Pass Road have been blocked to four-wheeled vehicle traffic. Some of these are now designated as horse or bicycle trails, and others are part of a network of motorcycle trails. Many years ago, these roads were "decommissioned" to eliminate the need for regular maintenance, yet allow passage by foot traffic and two-wheeled vehicles. User groups now provide most brush control and other maintenance on the trails. As a result of these road closures and conversions to trails, the road system in the AMA today has less than half the total mileage it had when the AMA was established. The roads that were retained are those in the most stable and useful locations.

Harvest practices

Part way down the Hoag Pass Road, we stop to watch an active harvest operation. A local logging contractor is thinning a 66-year-old plantation, established in the late 1980's following a clearcut harvest. This is the stand's fourth thinning, our tour leader tells us. Logs that are surplus to habitat needs are being brought out of the woods with one end suspended by a continuous-loop moving cable system. The cable is supported by pulleys suspended from standing trees, using specially designed anchors which do not damage the bark of the tree. By using the intermediate supports, the "yarding" trail does not need to follow a single straight line, but turns several angles on its way to the landing.

Someone asks about the impacts to long-term soil productivity from this type of management. Our leader says that techniques to protect and maintain the soil resource are integral parts of the operation. The contractor selects which trees to cut and which to leave, based on detailed prescriptions provided by the Agency. He also leaves a prescribed number of the cut trees on the ground to ensure that an adequate supply of large woody debris is provided. To help prevent loss of nutrients from the site, the limbs and bark are removed from each log before it is yarded to the roadside.

The work is being done by a crew of five: three are in the woods, felling trees, cutting them into sections ("bucking"), limbing the logs, removing the bark with a portable barker, and attaching the logs to the cable system. Two are at the landing, operating the yarding machine, unhooking the arriving logs, and stacking them in sorted piles for later transport to mills.

Recreation sites

Leaving the harvest site, we soon arrive at the parking area for Jane Creek Recreation Site, at the lower end of the Bald Mountain Trail. Our tour leader estimates that the hikers will begin to arrive in about half an hour. This site looks much like well-developed public campgrounds have looked for over a century, except that the camping and picnic sites are not next to the water. The facility is on a flat bench above the river, out of the sensitive riparian zone. This position results in dryer campsites on more stable ground, and reduces the effects of recreation on the stream and riparian zone. Our tour leader says that the Jane Creek site has over 200 camp and picnic units, but the way it's designed, no more than 3 or 4 can be seen at one time. As we break out the box lunches, the hikers begin to arrive.

Stewardship agreements

While we eat our lunches, we meet with several people who have had an active role in shaping management of portions of the AMA. They represent a variety of volunteer groups, groups that hold different ideas about what a healthy, sustainable forest is and how to achieve it. Over the last 50 years, each group has accepted "stewardship" of a small subwatershed area (1,000 acres or less) and is working in collaboration with the Northwest Ecosystem Agency to implement their vision.

One of the subwatersheds was adopted by a wilderness advocacy group. They have stabilized and closed most roads within the subwatershed, and have suspended all timber harvest and salvage. They have developed several popular trails through part of the watershed, and have maintained most of the area as virtual wilderness. Under the guidance of several scientists, they are monitoring long-term changes in a variety of habitat characteristics.

In another of the subwatersheds, generations of high-school biology classes have been involved in stream restoration, tree thinning and planting, and monitoring of past projects. As they work, they also learn about the plants, animals, and ecological systems found in the area. Each year's class of students has its own set of ideas about what to do--who knows what this year's group will cook up!

A coalition of fishermen and woods workers has been actively managing their adopted subwatershed to enhance productivity and diversity. Under their approach, individual stands are entered every 20 to 50 years to selectively harvest trees in a range of sizes. At the same time, they convert some trees to snags and fell

others to increase the supply of large woody debris. Some trees are dropped into creeks to help create improved fish habitat.

In yet another drainage, representatives of local Native American tribes are intervening in stand development to increase the supply of a variety of commodities traditionally gathered from the forest. Some ridgetops have been lightly burned to maintain huckleberry fields and to create more open stands with better opportunities for hunting. Some wet meadows are being cultured and maintained to produce native camas, and cedar trees have been planted in moist areas throughout the valley to provide materials for future ceremonial log houses, canoes, and totem poles.

The groups retain much of the income generated by commercial activities for use in planning, carrying out, and evaluating future activities. Each stewardship group believes their approach leads to a healthy and sustainable forest, providing for the needs of late-successional species as well as people. They take a strong interest in the tables and graphs depicting monitoring results to prove their point. The Forest Ecosystem Agency monitors all stewardship plans to ensure reasonable consistency year-to-year, and to guard against actions that might have serious negative impacts.

Education and learning

After lunch, we cross the Nestucca on a suspension footbridge and take a short walk west along the Nestucca River Trail. We pass a shady hollow where a group of 15 teenagers is working with measuring equipment and clipboards. Our tour leader explains that they are an environmental studies class from McMinnville High School. Today they are surveying the rate of regrowth of mosses after controlled harvesting at this site. Many such groups are active in the AMA: Volunteers from the local watershed council come to monitor streamflow, water temperatures, and sediment loads; wildlife advocacy groups survey population trends of bird species; and Scout troops with digital infrared binoculars collect data on use of snags by rodents, woodpeckers, bats, and birds of prey.

Stream structure

Our trail leads us up and over a four-foot-wide log--with hand rails--spanning a small stream tributary to the Nestucca River. The water flows through a series of deep pools, small cascades, and riffles separated by log jams and woody debris. The water is cold and clear on this mild spring day, and in the stream are assorted gravels, large downed trees, and side channels that provide refuge and rearing areas for young fish. Most of the stream is shaded by a canopy of alder, cedar, fir, and hemlock; occasional sunny pools are bordered with monkey flower, bedstraw, and coolwort.

Anadromous fish

We see several large fish in the pools, which our tour leader says are spring chinook. Populations of coho and chinook salmon and steelhead trout fluctuate from year to year, but this year's runs in the Nestucca River are the largest seen since the AMA was established in 1994. Improvement in fish habitat and increase in fish populations has been and continues to be an important objective of AMA management.

Riparian zone habitat

On the seasonally flooded flats adjoining the river, we see an even greater variety of trees, shrubs, and herbaceous plants than we saw on the uplands. Cedar and hemlock dominate the stand, but Douglas-fir finds a foothold on small, less saturated knolls. Alder, maple, and black cottonwood fill the space between the larger conifer trees. In some places, salmonberry, thimbleberry, and devils-club form almost impenetrable thickets. Where the shrubs are more scattered, the soil is blanketed with mosses, oxalis, and miners lettuce. Snags and logs are abundant, but here in this zone of high water tables, we find only occasional stumps.

Social and economic contributions

On the drive back to the valley, several guests begin discussing social values. What does this forest mean to the people of nearby communities such as Carlton and Yamhill, or the more distant cities of Salem and Portland? Our leader says that the interactions between local communities and the AMA are continually evolving. For example:

- A company from McMinnville holds the contract to operate the Nestucca River recreation sites.
- Many residents of the Gaston, Yamhill, and Carlton areas come to the AMA to gather forest products such as moss, ferns, and mushrooms, which they sell to a local distributor in Carlton. Certain locations are designated for exclusive use of individual collectors, who have entered into stewardship agreements with the agency. They follow particular procedures to gather the products and monitor the effects of collection on regrowth

of the product and on other identified environmental conditions.

- People from many nearby communities cut firewood under permit from the agency.
- Nurseries and landscape contractors dig native plants which they purchase by permit.
- An organization known as the North Coast Forest Rendezvous meets four times each year to brainstorm directions and approaches for the AMA, and invites anyone who's interested. Ideas and proposals, as well as feedback on current actions, are forwarded to watershed councils and agency managers for further development, evaluation, and possible implementation.
- Many residents of adjacent communities have told us that the nearby scenic beauty and opportunities for solitude found in the AMA forest are very important reasons for living where they do.

End of tour

As we step off the bus back in McMinnville, we thank our tour guide for an enjoyable and informative trip. It has whetted our appetite to find out how we can take part in the unfolding story of this amazing place known as the Northern Coast Range Adaptive Management Area.

Typical forest road.

CHAPTER 2: PAST AND CURRENT CONDITIONS IN THE AMA

Mount Hebo Plantation (1910-1920).

An understanding of lands and resources in the AMA, how they got to their present condition, and how they are presently being used will help to identify realistic opportunities and limitations for future management of the area. This information is described in greater detail in the various assessments being prepared for the AMA.

Physical and Biological Environment

Topography and climate

The Coast Range within the AMA parallels the coast in a band about 35 miles wide. The ridges rise from sea level to a little over 3,000 feet in elevation. Some areas are very steep and unstable, but most of the AMA is characterized by moderate slopes and gentle, rolling uplands, with deep, fertile soils, mild temperatures, and abundant rainfall (from less than 40 to more than 200 inches per year). These are ideal conditions for growth of forest trees; in fact, forests on the north coast are considered by many investigators to be the most productive in the world (Fujimora, 1971; Agee, 1993). This exceptionally high productivity is coupled with high resiliency compared to forests in colder climates located farther north, at higher elevations, or inland, where growing seasons are shorter and soils generally shallower and less fertile. Most upland forest areas have the capacity to recover their site productivity (i.e., biomass production) quickly following disturbances such as repeated stand-replacing wildfires or timber harvest. The high productivity may also mean that the system has the potential to provide, over time, both abundant wildlife habitat (in terms of forest cover, snags and large woody debris), recreational opportunities, and a sustainable output of commodities.

Vegetation, disturbances, and age-class patterns

Species Conifer forest is the dominant vegetation type in the AMA. Near the beaches, shore pine, Sitka spruce, and western hemlock are tolerant of the frequent high winds and salt spray of exposed locations. Where tree cover is scattered, thickets of salal make cross-country travel almost impossible for humans. A short distance inland, shore pine disappears, and occasional Douglas-fir trees make their appearance among stands of spruce, hemlock, and cedar. Where the overstory is not closed, understories of dense brush, including sword fern, salmonberry, and elderberry are common. Further inland, in what is called the Western Hemlock Zone,

Douglas-fir forms almost pure stands in the northern portion of the AMA, but is more mixed with western hemlock and western redcedar to the south. Beneath the canopy and in openings, vine maple, salal, and Oregongrape are common shrubs.

Throughout the AMA, stands of red alder occupy areas of moist or unstable ground, low-lying ground adjacent to streams and bogs, and disturbed areas where mineral soil was exposed by human activity or natural events. Red alder with a salmonberry understory is now the dominant vegetation type in many areas that were cleared by early-day logging, homesteading, repeated fire, landslides, or floods. Other hardwoods include bigleaf maple, common on many streamside terraces and on the lower eastern slopes, black cottonwood in the river valleys, and Oregon white oak on dry foothills on the Willamette Valley margins.

Disturbances and age classes The dominance of Douglas-fir in the western hemlock zone is largely due to disturbance, primarily by fire, over a period of many centuries (Agee, 1993). In the moist western hemlock forests of the Coast Range, most forests consist of first-generation postfire forests less than 750 years old. This would suggest a fire-return interval less than 750 years. A regional average fire-return interval for the Douglas-fir zone has been estimated at 230 years, based on an analysis of 1930's forest survey records (Fahnestock and Agee 1983). However, the notion of a fire cycle, or a return interval of regular frequency, is not as meaningful on the north coast as in drier forest types, where there seems to be a roughly cyclic occurrence of fire. *Periodic* is a better descriptor of fire-return intervals in these forests (Agee 1993). Fires don't occur often in north coast forests, but when they do they tend to be severe, stand-replacing events.

How much did Native American burning contribute to past wildfires? Sauter and Johnson (1974) noted that large areas of brush and small trees were burned away each year by local tribes to clear the land for easier hunting and travel. This cleared land also provided new browse each spring to attract deer and elk. Morris (1934) first documented accounts of large historical fires in the Pacific Northwest. Coastal Oregon tribes were the victims of some of these fires, having been driven to the Pacific Ocean to survive. Oregon tribes of the northern coast were reported to burn Neahkahnie Mountain and the hills near the present site of Bay City every spring to stimulate browse and attract deer and elk (Sauter and Johnson 1974). Agee (1991), however, points out that although Native Americans have been implicated in anecdotal accounts as the source for some fires, the evidence is not convincing for widespread aboriginal burning in Oregon forests.

Morris (1934) stated that in western Oregon approximately seven times as much land was burned from 1845 to 1855 as in any of the three previous decades. He attributed this increase in deforestation to fires caused by European settlers. Lightning-caused fires in the north coast are rare, because lightning storms occur only occasionally in this area, and they are usually accompanied by enough rainfall to extinguish any fires. There is no record of large wildfires in the Oregon Coast Range resulting from lightning between 1770 and 1993. (Zybach 1993). Whatever the cause, large fires are clearly part of the historic record for the North Coast, often spreading over several hundred thousand acres. Prominent examples are the 1840 and 1880 Nestucca fires, the 1910 Mt. Hebo fire, and the Tillamook fires of 1933, 1939, 1945, and 1951.

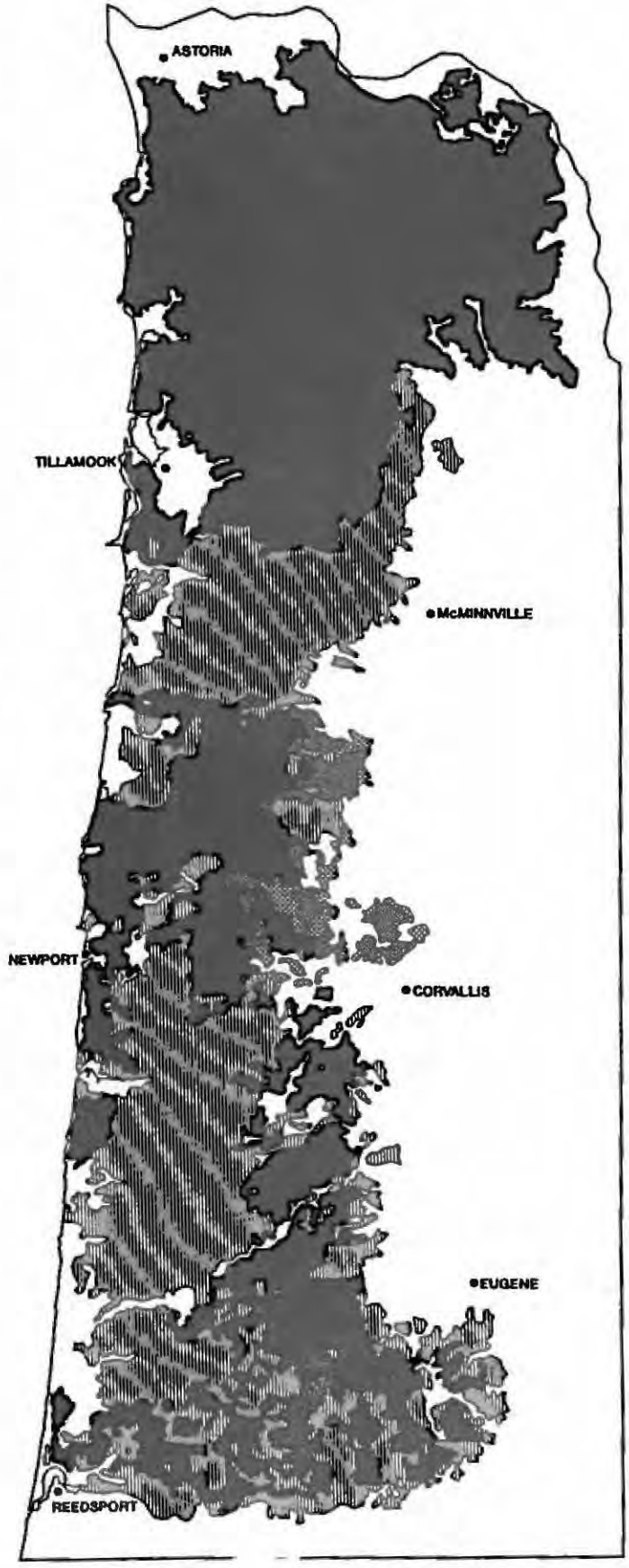
How much of the north coast supported old-growth forest prior to European settlement?

We don't know for sure, but Booth (1991) estimated that 61% of western Oregon's forests were old-growth before European settlers began logging. Most estimates of old growth for the Coast Range closely agree with the Teensma et al. (1991) estimate that 40% of the Coast Range forests were over 200 years old in 1850. Teensma also estimated that 34.5% of the Coast Range forests burned in the late 1840's. Using the Teensma data, it can be concluded that approximately 61% of Coast Range forests were over 200 years old before the 1840's fires, which would equate to a 406-year fire cycle (Agee 1993). Ripple (1994) states that the amount of old growth in the Coast Range was approximately 43% based on the 1933 forest survey, and 61% before the great fires of the late 1840s. Fig. 2 shows the estimated distribution of old-growth forest in the Coast Province in 1850, from Teensma (1991). Note the recent Nestucca Burn area, west of McMinnville, and the large block of old forest northeast of Tillamook.

How much old-growth forest is left? Because of the history of large fires and timber harvest, old-growth forests are rare in the AMA today. Conifer plantations from 1 to 30 years old are distributed over much of the AMA's federal lands. Between the plantations are remnant blocks of mature conifer forest or stands of red alder, ranging mostly from 60 to 110 years old in the north, and up to 150 years old in the south. Occasional residual old-growth trees are scattered throughout these younger stands. The Nestucca Watershed Analysis contains an estimate that less than 2% of the land in that drainage now supports old-growth forest.

A small patch of old-growth forest (less than 10 acres) is located between Bear Creek and Elk Creek in the

FOREST STAND AGE CLASSES OREGON COAST RANGE, 1850



LEGEND

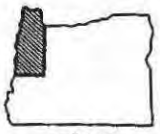
- 200 + Years
- 100 – 199 Years
- 50 – 99 Years
- 0 – 49 Years
- Recently Burned

20.0 0 MILE 20.0

20.0 0 20.0 KILOMETER

SCALE 1:850,000

N



OREGON

Note:
This map was compiled from reconnaissance field notes. It was digitized from hand interpolated source materials and may differ spatially from digital mapping compiled from other source data. Prepared by Salem District and Oregon State Office, Bureau of Land Management, Sept., 1991.

Nestucca River watershed. This stand is visited often during ecosystem management tours conducted by agency staff. Scattered residual old-growth trees are mixed with stands 100 to 150 years old in the High Peak-Moon Creek Research Natural Area, between the Nestucca River and East Beaver Creek. Farther south, several blocks of old-growth Douglas-fir and hemlock, intermixed with young plantations, remain on AMA lands in the headwaters of the North Fork of the Siletz River and Warnick Creek, including the area designated by BLM as "Valley of the Giants." A largely unroaded area with mature forest stands and remnant old growth is on National Forest lands near Drift Creek and several tributaries to the lower Siletz River.

Several areas of federal land in the AMA are still largely unroaded and unharvested. One of these areas is the north and east slope of Mount Hebo, in the upper drainages of Tony and Powder Creeks. These areas support 60- to 70-year-old stands of Douglas-fir and red alder.

Disease and insects

Forest stands in the north coast area are remarkably free of damage from disease pathogens and damaging insects, particularly when compared to current conditions in central, eastern, and southern Oregon forests. However, several root-disease fungi are active in the AMA. The most significant is *Phellinus weirii*, which causes laminated root rot. The disease infects the roots and lower bole of conifers such as Douglas-fir, western hemlock, and grand fir. Spreading from root to root, it results in blowdown of large trees and mortality of small ones. Some scientists estimate that 15 to 30 percent of north coast forest stands are infected.

Most insect damage in the north coast forest results from activity of the Douglas-fir bark beetle, *Dendroctonus pseudotsugae*, which tends to attack individual trees that have been weakened by other factors. The damage occasionally spreads over larger areas when beetle populations build up in windthrown timber.

Terrestrial animals and birds

A variety of animal species are present in the AMA and are discussed briefly here: large animals such as blacktailed deer, Roosevelt elk, black bear, cougar, and bobcat; and small animals such as the northern flying squirrel, red tree vole, raccoon, porcupine, and several species of bats. Four of these bats are listed in the Northwest Forest Plan as "survey and manage" species: the silver-haired bat, the long-eared myotis, the fringed myotis, and the long-legged myotis.

Among birds, those with the most recent publicity in this area are the northern spotted owl and the marbled murrelet, both Federally listed as threatened species. Northern spotted owls have been observed in young and old forests, conifers and hardwoods, plantations and natural stands. However, most successful long-term residency and reproductive success has occurred in old-growth forests, or in younger forests with scattered large, old conifers. It is believed that most owls found in younger stands are passing through for hunting or dispersal. The spotted owl population within the Oregon Coast Range Province is extremely low and in a significant decline, according to the Recovery Plan for the Northern Spotted Owl (USDI 1992). Suitable habitat--especially nesting habitat--is very limited, poorly distributed, and highly fragmented. Owls are present at very low densities, with many pairs isolated from others by more than 10 miles (Nestucca Watershed Analysis 1994). Within the AMA, all critical habitat identified in the Recovery Plan is also designated as Late-Successional Reserve. Surveys for northern spotted owl have been conducted in the AMA since 1975.

The marbled murrelet is a seagoing bird which, in coastal Washington, Oregon, and Northern California, nests in the tops of large, old trees in coastal forests. Birds have been sighted more than 35 miles inland exhibiting nesting behavior. However, it is difficult to locate actual nests, since they are usually near the top of very large trees in dense stands, and the murrelets enter and leave the nest area at high speeds, usually early in the morning. Potential habitat for the murrelet is defined as (1) mature conifer forests, with or without an old-growth component, and old-growth forests; and (2) younger coniferous forests that contain remnant older trees with deformations or structure suitable for murrelet nesting. Suitable nesting structures are thought to be large, flat-topped, moss-covered limbs, or platforms resulting from forks or breaks in the main stem of the tree. Stands with these features are scarce in much of the AMA. Nests are usually located high in the canopy, but concealed by overhead branches so that the risk of predation on eggs or young (by crows, hawks, or other birds) is reduced.

Surveys for marbled murrelets have been conducted in the AMA area since 1989. Ocean conditions may have contributed to recent declines in the murrelet population. However, timber harvest in the Coast Range has caused a steady decrease in the amount of suitable nesting habitat available. The Late-Successional Reserves in the AMA have been designated as critical habitat for the marbled murrelet.

Bald eagles, Federally listed as a threatened species, are known to nest and forage within the AMA. One pair or

two pairs have nested in the Elk Creek drainage, north of the Nestucca River, since the early 1950's (Nestucca Watershed Analysis, 1994). Nesting activities have produced at least 15 fledglings from three known nest sites since 1970. The last successful nesting occurred in 1982, though eagles are still observed in the area. An Area of Critical Environmental Concern (ACEC) encompassing 2,058 acres has been designated in the nest area. Eagles forage in the vicinity of several of the bays and estuaries in the AMA during all seasons of the year.

Fisheries Resources

The rivers and streams in the AMA historically sustained robust runs of salmon and trout, composed of coho, chinook, and chum salmon, and steelhead and both resident and sea-run cutthroat trout. Other resident fish species include several species of lamprey, sucker, dace, and sculpins (Nestucca Watershed Analysis 1994). Populations of most of these species have declined substantially in the last several decades.

Information is not available for all major coastal streams in the AMA, but historical data gathered for the Nestucca River Watershed Analysis, a major drainage in the northern part of the AMA, may be taken as representative of trends for the AMA as a whole.

During the late 1960's and early 1970's, the Nestucca River annual catch of steelhead averaged an estimated 13,400 fish. During the late 1980's and early 1990's that harvest dropped to an estimated 2,600 fish. In-river harvest of all species has remained at about 4,000 fish per year over the last 20 years, supported almost exclusively by healthy runs of fall chinook salmon. In the 1920's, coho spawners in the Nestucca averaged 75 fish per mile. By 1993, spawning coho salmon had declined to an estimated 5 fish per mile.

Changing habitat Salmon, steelhead, and cutthroat trout populations are naturally limited by changing habitat conditions, but are able to maintain viable populations by using a variety of life history strategies. For example, wild runs migrate at different times, thus lessening their vulnerability to severe habitat impacts. Natural causes of habitat change include stand-replacing fire, flood, mass movements (landslides, slumps, earthflows, etc.), drought, and adverse ocean conditions.

Human activities in the AMA that have impacted fish habitat in the lower watersheds include channelization, dams, dikes, destruction of riparian vegetation, and water pollution. Some upper watershed problems are linked to channel simplification through stream cleaning, elimination of riparian conifers that formerly supplied large down wood, timber harvest, and road construction.

A particularly destructive and widespread practice early in this century was "splash damming," a method of moving harvested logs downstream to waiting mills. A dam composed of logs and debris was created, backing up large amounts of water and logs that had been cut and dragged into the stream. When the dam was broken free (probably using dynamite), the whole mass of logs and water moved rapidly down the channel to a larger river or lake or the ocean, obliterating downstream fish habitat and scouring stream banks of vegetation.

Unique populations Some parts of the AMA support unique and important fish populations:

- The Siletz River hosts one of the few coastal summer runs of wild steelhead. The Siletz also contains all seven Pacific salmon and trout species.
- Tillamook Bay and its tributaries support the largest remaining chum salmon population in Oregon. Chum salmon are a federal assessment species.
- Coastal coho salmon inhabit many of the streams in the AMA and are a candidate for listing as a threatened species under the Endangered Species Act.
- Coastal steelhead inhabit nearly all the larger streams and are a candidate for listing under the Endangered Species Act.

Stocks at risk Nehlsen et al (1991) determined which stocks of wild salmon and steelhead appeared to be at risk of extinction for major coastal streams. Table 3 summarizes her conclusions.

Riparian conditions

Evidence suggests that most riparian (streamside-influenced) areas in the AMA were forested in the past with a mix of hardwoods and conifers. Both groups are important to diversity of aquatic habitat. Hardwoods, in this area mostly red alder and bigleaf maple, provide shade, which lowers stream temperatures, and leaves and stems, which provide nutrients for aquatic organisms. Conifer species, including western red cedar, western hemlock, Sitka spruce, and Douglas-fir, also provide shade and some nutrients, but provide greater contributions to stream channel structure than do hardwoods. This results from the typically larger size of conifers, and their longer shelf life, i.e., resistance to rot.

Large conifers growing along streams or in unstable headwall areas may eventually fall into the stream channel or be transported there by landslides or debris torrents. Once in the channel, the logs provide hiding

Table 3. Salmon and steelhead stocks at risk in major AMA streams (Nehlsen et al. 1991)

Status	Siletz River	Salmon River	Nestucca River	Tillamook Bay Tributaries
Special Concern	Spring/Summer Chinook	Winter Steelhead Trout	Winter Steelhead Trout	Winter Steelhead Trout
	Winter Steelhead Trout	Sea-Run Cutthroat Trout	Sea-Run Cutthroat Trout	Sea-Run Cutthroat Trout
	Sea-Run Cutthroat Trout			
Moderate Risk	Coho Salmon	Coho Salmon	Coho Salmon	Coho Salmon
	Summer Steelhead Trout			Chum Salmon

cover for adult fish and create quiet water areas where juvenile fish can find refuge from high flows. Conifer logs also act as scour agents for the creation of deep pools important to juvenile and adult fish. Furthermore, they help streams to retain and sort gravel from finer particles, making gravel more suitable for spawning.

Many upland riparian areas in the AMA are now dominated by red alder, bigleaf maple, and various brush species. The lack of conifers along streams in the uplands, and the resulting scarcity of large logs in streams, contribute to simplified habitat, limiting many fish populations. In the lower portions of watersheds, native riparian vegetation is often missing or severely lacking alongside streams. This leads to increased bank erosion, reduces floodplain function, and lowers water quality, all of which contribute to poorer fish habitat and lower populations.

Social and Economic Environment

Native peoples

Human use evidenced in archaeological sites dates back at least 8,000 years along Oregon's coastal margin and to about 10,000 years on the Willamette Valley side of the Coast Range. Most of the coastal sites are very close to the ocean or at the edge of an estuary. The evidence suggests that human use was concentrated on the margins of today's AMA--along the ocean and Willamette Valley edge, where there were ample and readily available food and material resources for Indian inhabitants. The majority of the AMA, consisting of inland and upland Coast Range forests, apparently had little prehistoric use other than travel routes across the mountains and some dispersed hunting.

At the time of settlement by European immigrants (1820-1850), the AMA was within homelands of coastal tribes identified as the Tillamook, Nestucca, Siletz, and Yaquina Indians on the west, and Willamette Valley Kalapuya bands identified as the Tualatin, Yamhill, Luckiamute, and Marys River Indians on the east. While it is thought that the coastal people did not typically practice deliberate burning to manipulate vegetation or wildlife resources, the Willamette Valley people regularly set fire to the dry prairies. The fires were set to control brush, to maintain open land for camas production, and to promote the growth of seed plants important for human use and other browse species favored by deer.

Contact with European people resulted in exposure of the Indians to pandemic diseases, causing an estimated 70 to 80 percent population loss within little more than a decade (1829 to 1845). Indians were also greatly affected by the land uses of the settlers, including farming and grazing, restricted access to traditional use areas, and declines in native resources. In 1855, the Siletz Indian Reservation was established, encompassing a large area extending from Cape Lookout on the north to the Siltcoos River (near present-day Florence) on the south, and east as far as the line between Range 8 West

and Range 9 West, about 15 to 20 miles from the coastline. Then in 1857, the Grand Ronde Reservation was established, a 60,000-acre area including most of the headwaters of the South Yamhill River. Indians from all over western Oregon, plus some from northern California, were moved to these reservations.

During the next 40 to 50 years, many areas were removed from the reservations and opened to homesteading or sale. An executive order in 1865 cut the Siletz reservation by 220,000 acres, and in 1875, an act of Congress reduced the reservation by another 700,000 acres. In 1887, the Dawes Severalty Act served to break up the reservations further by granting land allotments of 80 acres to each adult Indian and opening the remaining unallotted land to settlers. On the remaining Siletz reservation, only 551 natives received the 80-acre allotment, and in 1892, unallotted lands totalling 192,000 acres were purchased by the government for $0.74 per acre. Tribal status and the reservation were terminated in 1956, and the 7,900 acres remaining of the reservation were sold, except for 38 acres turned over to the city of Siletz..

On the Grand Ronde reservation, over 26,000 acres were not allotted because there were not enough Indians to lay claim to them. These lands were ceded to the government in 1904 and subsequently opened to white settlement. The Grand Ronde reservation was terminated by act of Congress in 1956 and the remaining tribal trust lands of 440 acres were sold.

Both tribal groups later successfully petitioned the government for reinstatement of tribal status. In 1977, the Siletz tribes were granted a reservation consisting of 3,630 acres in scattered parcels in the hills near the lower Siletz River, and in 1988, the Grand Ronde tribes received a reservation of 9,811 acres, mostly in a single block of land formerly administered by the BLM, in the north part of the South Yamhill watershed. These lands are now actively managed for production of timber and other forest products.

Historic human use

Lands in the AMA area were first visited by Europeans, and later Americans, from the sea. Spanish, English, Russian, and American ships on voyages of exploration and trading visited the northern Oregon coast, but only occasionally made landfall. Fur traders entered the area in the 1820's, but little record exists of their activity along the coast. The earliest settlements were established in the prairie areas of the Willamette Valley during the 1840s. The timbered areas of the Coast Range were seen as too remote and difficult to cultivate to be desirable homesteads.

Early settlement The Tillamook Bay area was settled in the 1850's, but early development was slow. Because of the difficulty of travel across the Coast Range and the lack of safe, usable harbors, it was difficult to get supplies and products in and out of the coastal area.

As roads were constructed and the Indian reservations reduced in size, additional land was made available for settlement. The Homestead Act of 1862 stimulated greater in-migration, and after 1878, individuals began to make claims on higher elevation lands (above 1,000 feet) under the Timber and Stone Act. These claims were mostly taken up by people interested in logging, since the Coast Range, except for flat river terraces in some areas, proved to be largely unsuitable for farming. Much of the region had been declared "unsurveyed and unfit for cultivation" by early General Land Office (GLO) surveyors. Dense brush and trees made even flat lands difficult to clear for farming. When a large forest fire denuded the Nestucca area of brush and trees, it became more popular with settlers because the burned-over land was easily converted to cropland or pasture.

The Tillamook area early became a center of dairy farming. Because of the isolation of the coastal communities and the difficulty in transporting products to the population centers in the Willamette Valley, the farmers focused their attention on producing something which could be shipped without risk of spoilage. Thus, cheese factories began to open in many of the northern parts of the AMA area during the 1890s. The fishing industry also has an early beginning on the Oregon coast. Homesteading continued to play a role in development of land in the AMA until the 1930s. Many of the original homesteads were later acquired by logging companies, as the settlers found farming on the mountainous slopes too difficult to continue.

The depression of the 1930's brought more people into the woods. With the loss of jobs, homes, farms, and finances, many people ended up squatting on abandoned homesteads or unclaimed land, repairing existing structures or building new ones and practicing subsistance living. Most of these residents remained only a short time.

Transportation routes From 1850 until the mid-1870s, settler trail systems ran along major drainages and ridgelines, often following Indian travel routes. A stage road was built in 1872 connecting Carlton on the valley side with Tillamook, via the Trask River drainage, and another stagecoach line ran from Salem to Tillamook via Grand Ronde and Hebo, following the current route of Highway 22. In 1911 a railroad line was put into service between Hillsboro and Tillamook, and in 1918 another line was extended from Independence to Valsetz, in the center of the Coast Range. Additional highways to the

coast were constructed in subsequent decades, following the canyons of the Wilson, Salmon, and Yaquina Rivers.

Today, Highway 101, the Coast Highway, serves as the primary north-south travel route; the majority of the population centers in the AMA are in or near this corridor. State Highway 47 and US 99W form a north-south route on the east side of the AMA. The major east-west travel routes include Highway 6 at the northern tip of the AMA, serving as the primary link to Portland; Highways 18 and 22, which link the central Willamette Valley to the coast, and Highway 20, which connects Newport and the southern Willamette Valley. [insert map 1]

Demographics and employment

Approximately 60,000 people live in the AMA area, according to the 1990 census. Most (77%) of the population lives in rural areas and small communities. Coastal counties are growing significantly, primarily due to people moving in, and the average age of the population is increasing, as many retirees and second-home buyers acquire homes on the coast. Nearly 60% of the population in the AMA over 16 years of age was in the work force in 1990. As shown in Fig. 3, employment is spread over a variety of industries and services.

Values

Interviews with a sample of AMA residents reveal that they most value such things as having a clean and safe environment, rural appearance, community pride, opportunities for outdoor recreation, and a friendly environment where one can count on neighbors to help in times of need. Following is a sample of the views of AMA residents:

- Human and natural systems are connected;
- Well-being of both forest and human communities depends upon healthy natural resources;
- The multiple-use philosophy of public land management is the right approach;
- The value of the land is related more to personal and community history than to economic outputs or real estate appraisals;
- The land-management agencies are well-intentioned, but unfortunately tied to decision-making processes at higher levels in the government;
- Forest Service and BLM employees have little daily contact with AMA residents, and any relationships with staff result from residents taking the initiative;
- In order to reduce conflict and polarization, the agencies need to make an effort to listen to the public and to bring together the people connected to the various watersheds;
- Crime and drugs are the most serious problems facing many AMA communities;

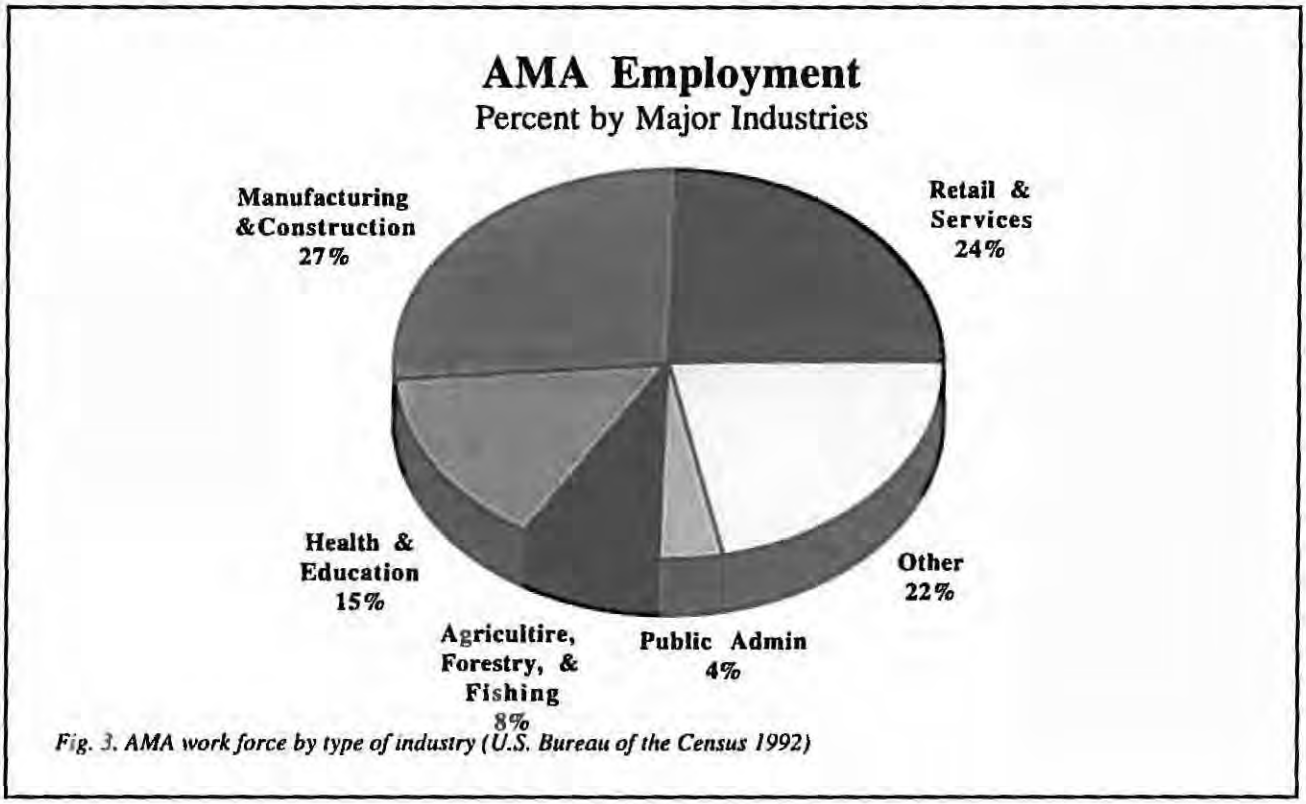


Fig. 3. AMA work force by type of industry (U.S. Bureau of the Census 1992)

Hardwoods in riparian zone.

- Many (but not all) AMA communities would like to have more economic opportunities and development in their areas.

Communities

AMA communities represent a wide range of viewpoints and concerns, but are linked by common issues relating to forest management and dependence on natural resources: forestry and wood products, dairies, commercial fishing, and tourism.

A community may be an organized or unorganized collection of residences or places of business--known as a community of place--or an identifiable group of people with common concerns--a community of interest.

A community of place represents a defined geographic area and population base that functions as a cohesive social and economic center, usually under some sort of unified governmental or leadership system. A community of place could be a county, city, town, or rural community. Examples are Lincoln County, the City of Newport, or an unincorporated rural community such as Blaine or Hebo. A community of place could also be represented by a Tribal Government such as the Confederated Tribes of the Grand Ronde Community.

A community of interest may represent a wide variety of geographic areas or no geographic area at all. Such communities simply represent a shared interests or goals, and are generally coalitions of citizens who have agreed to share resources in the interest of advocating for a common goal or set of objectives. Examples are environmental organizations such as the Oregon Chapter of Sierra Club, trade organizations such as the Associated Oregon Loggers, and local intergovernmental organizations such as the Tillamook County Economic Development Council. Communities of interest also include organizations such as civic clubs, fraternal organizations, and local watershed councils.

A detailed list of communities of place and communities of interest within or associated with the AMA is presented in Appendix B.

Although Oregon's metropolitan areas have been able to transition from resource-dependent to high-tech manufacturing economies, rural Oregon communities continue to have a strong economic and social linkage to ecosystem management and resource production. However, rural Oregon derives more than economic

stability from marketing of its natural resources. The social and cultural health of these communities is also directly related to long-term ecosystem management. Social well-being seems to be closely related to quality of employment, degree of social cohesion, and to the level of local empowerment (Beckly 1995).

- *Quality of employment*: Employees need more than just having a job and earning an adequate income. Loggers, for example, are very committed to their jobs even though the work is often difficult and dangerous. Their sense of social well-being is closely tied to their occupational identity as loggers.
- *Social cohesion*: Although the unity or cohesiveness of local communities has declined considerably since the 1930s and 1940s, a sense of community identity is still present in many parts of the AMA, and is closely identified with the social well-being of rural communities.
- *Local empowerment*: Social well-being depends also on feelings people have that they can control their lives. In communities closely connected to nearby federal forest lands, people want opportunities to provide input to federal management decisions, and they need to know that we're listening. People also want opportunities for meaningful employment in resource management activities, and they may need additional education and training to make the transition from traditional jobs.

Recreational uses and esthetic values

The north coast area attracts over 2 million visitors each year, and a substantial portion of them pursue recreational activities in AMA forests. Hunting, fishing, recreational driving, on and off the road--and perhaps firewood cutting--are the most popular recreational uses in the AMA. Highway 101 is one of the best known and most traveled bicycle corridors in Oregon.

- Dispersed uses depend on public access and to a large extent on availability of roads and trail systems. The federal and state-owned forests have generally well-developed road networks that are open to the public, so most dispersed use (hunting, fishing, driving) takes place on public lands. The Parks and Recreation Department (OPRD 1994) found that, for most users, the physical setting is very important for dispersed recreation, and most prefer more semi-primitive settings.

- Large numbers of hunters come to the AMA for a variety of large and small game such as deer, elk, bear, upland game birds, and waterfowl. Data from the Oregon Department of Fish and Wildlife, the Confederated Tribes of Siletz Indians, and the Confederated Tribes of the Grand Ronde Community indicate that more than 20,000 deer hunters and 10,000 elk hunters visit AMA forests every year. More than 28,000 upland game bird stamps were purchased in 1994-1995 for ODFW Hunt Area 1, which includes the AMA (ODFW 1994-95).

- Anglers are spending more time and effort trying to catch salmon and steelhead in coastal streams, but both sport and commercial catch of these fisheries have decreased over the last decade. ODFW reports show that anglers spent an average of 20 to 30 hours per fish caught on the Alsea River, just south of the AMA, in recent years.

- The Coast Range is a popular destination for use of off-highway vehicles. Most private lands are not open to off-highway vehicles, so public lands provide most opportunities for this sport. Networks of motorcycle trails are in use in the Tillamook State Forest and on BLM lands in the forested hills west of McMinnville and Carlton.

- Developed recreation sites are important in the AMA. Federal, state, and county agencies manage 27 campgrounds and 27 day-use areas. More than 130,000 people visited campgrounds managed by the Siuslaw National Forest in 1992, and over 7,000 visits were recorded at campgrounds managed by the Tillamook Resource Area, BLM. For the north coast area, the Oregon Departments of Forestry (ODF) and Parks and Recreation (OPRD) recorded more than 150,000 camper nights in 1995, and over 3 million people visited day-use facilities on the north coast managed by OPRD in 1994-1995.

- Hiking and horseback riding are increasingly popular activities in the Coast Range. Many trails are located on National Forest and BLM lands, in Oregon State Parks, and within the Tillamook State Forest.

Federal Lands

O&C Lands

The Oregon and California Railroad Act of 1866 provided for 3,700,000 acres in Oregon in alternate sections to go to the builder of a railroad line down the Willamette Valley to California (12,800 acres for each

mile of track laid). The purposes of the grant were to provide financial resources for construction of the railroad and to encourage settlement of the area. The land grant was made on condition that the company sell the land in small tracts (no more than 160 acres each) to bonafide settlers, at a price of no more than $2.50 per acre. The Oregon and California Railroad Company began construction in 1869, and reached Roseburg in 1872. Because of the availability of free homesteads on public land and because much of the grant land was heavily forested and not suited to agriculture, the company had little success in selling land to settlers. The company eventually was forced into bankruptcy, and control of the railroad passed to the Southern Pacific, which completed the connection to California in 1887.

In the meantime, the railroad had deferred the taking of title to unsold grant lands until there was a market for the property, thus avoiding taxes. This kept those lands unavailable for acquisition by anyone else. On the request of the Oregon legislature, the federal government investigated and discovered that the terms of the O&C land grant had been violated. Litigated before the Supreme Court in 1915, the remaining unsold O&C grant lands, over 2,800,000 acres, were revested by Congress to the United States in 1916. Initially, these lands were managed by the General Land Office, and after 1946 by its successor, the Bureau of Land Management (BLM). The BLM still manages the O&C lands today, along with remaining unallocated federal lands, or "public domain." There are over 115,000 acres of O&C lands in the AMA, and nearly 18,000 acres of public domain.

The 1916 Revestment Act required that timber on the O&C lands be sold at current market prices. In 1937, passage of the O&C Act established the government's intention to retain the lands in federal ownership, and specified that they be managed under principles of sustained yield, to provide a permanent supply of timber, protect watersheds, regulate stream flow, contribute to economic stability of local communities, and provide recreational facilities. Under the terms of the act, fifty percent of timber sale receipts are distributed to the eighteen Oregon counties having O&C lands.

National Forest lands

In 1906, a large portion of the remaining federal lands in the AMA area were designated as a forest reserve. Because of the 19th-century fires, most of this land then supported only brushfields or small trees. The O&C lands were tied up in the railroad grant at that time, so they were not included in the reserve. The Coast Range forest reserve became, in 1908, the Siuslaw National Forest. Early Forest Service activities focused on developing a network of ranger stations, trails, and lookout towers, to help protect the forest against wildfire and unauthorized use. As road systems were developed, many of the original ranger stations were closed, and with the advent of aerial fire reconnaissance, most lookout towers also became an unnecessary expense and were removed.

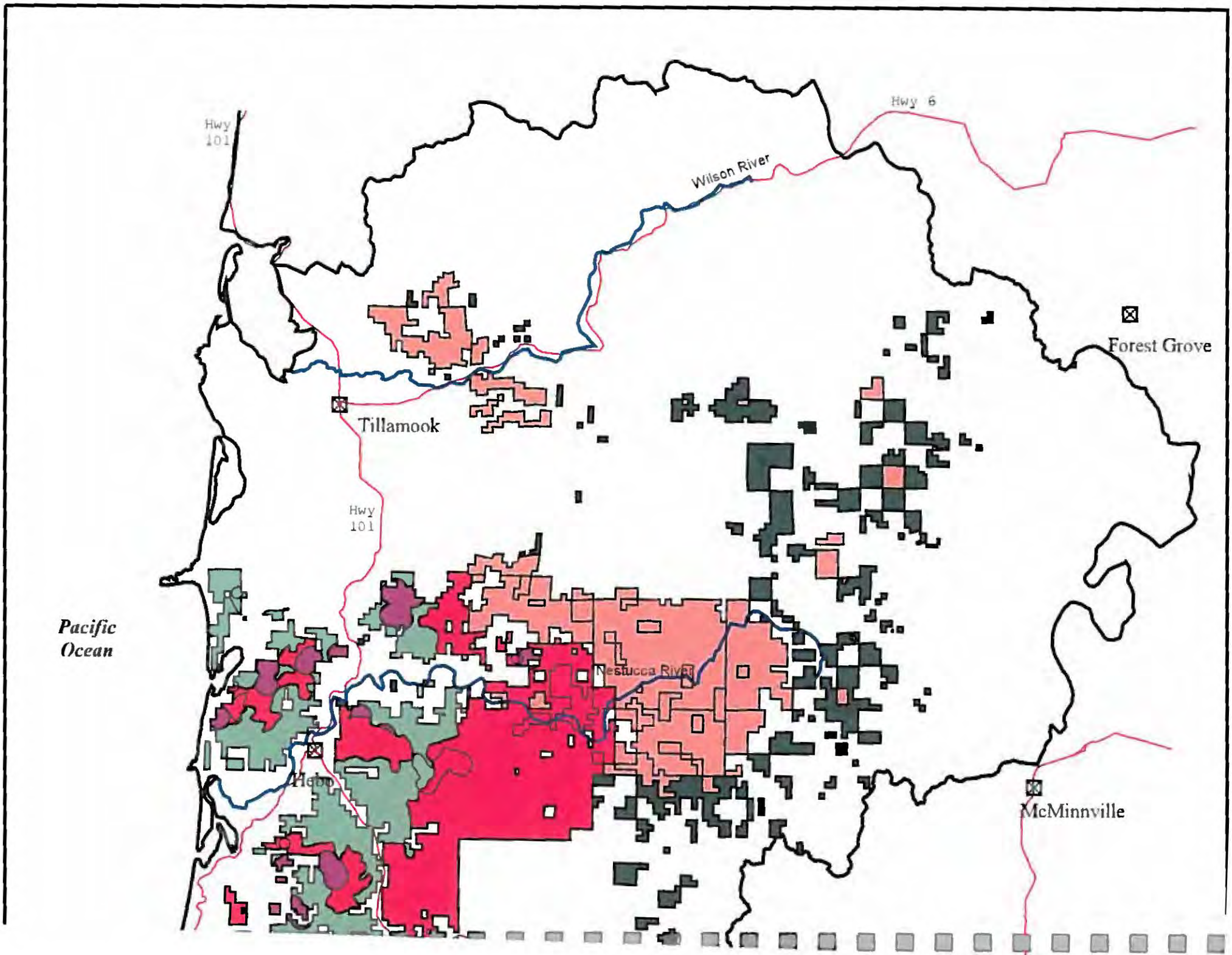
Following the large Mt. Hebo fire of 1910, the Forest Service embarked on an ambitious reforestation program. Thousands of acres were planted and seeded, and much of the seed was derived from sources in the state of Washington. This non-local, or "off-site" seed has produced a stand with different characteristics and growth rates than stands regenerated from local seed sources.

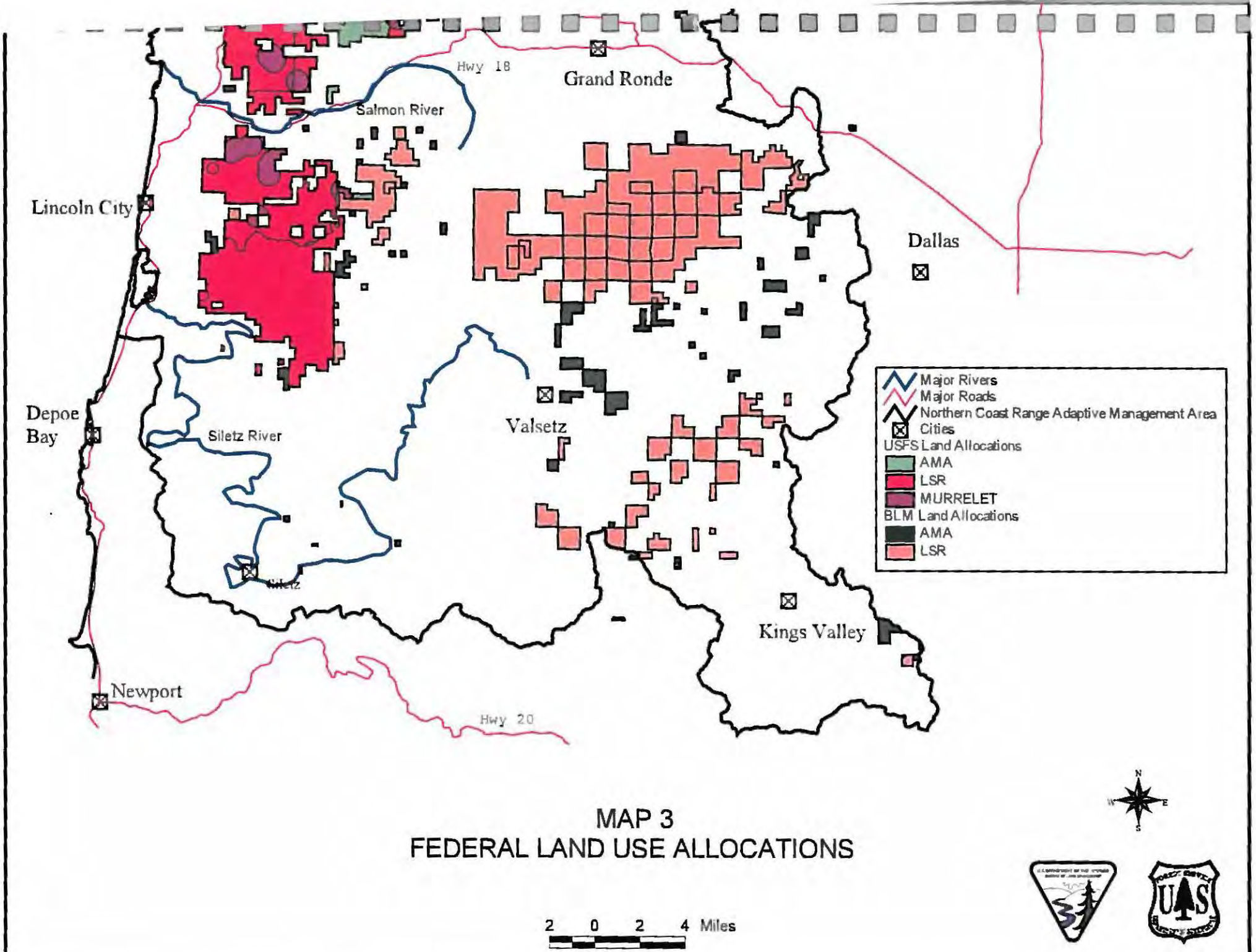
Federal land-use allocations

Although we've drawn an exterior boundary for the AMA--on watershed lines--several other land designations fall within that boundary, including Late-Successional Reserves, Riparian Reserves, Special Areas, and other administrative withdrawals. Major federal allocations are described as follows:

- Late-Successional Reserve (LSR): Almost 193,000 acres, or about two-thirds of the federal land in the AMA, carries the LSR designation. The goal of managing LSRs, according to the Northwest Forest Plan, is to "protect and enhance old-growth forest conditions." This does not mean the area is set aside as wilderness; some management activities can take place in LSRs, but the standards and guides described in the Northwest Forest Plan are more restrictive for management of LSR than for other AMA lands. Within most of the LSR in this AMA, thinning (precommercial and commercial) may occur in stands up to 110 years old, but only where the purpose of the treatment is to benefit the creation and maintenance of late-successional forest conditions. The management of LSR in the AMA is discussed more fully in the last part of chapter 5.

- Riparian Reserve: Guidelines in the Northwest Forest Plan provide for Riparian Reserves to protect all streams and other bodies of water by limiting management activity on federal lands within a distance of one or two "site-potential" tree heights on each side of the stream. For streams or bodies of water with fish, two tree heights apply; for all other streams, including intermittent ones, the reserve width equals one tree height on each side


Hwy 101
Hwy 6
Wilson River
Tillamook
Forest Grove
Hwy 101
Pacific Ocean
Nestucca River
Hebo
McMinnville



MAP 3
FEDERAL LAND USE ALLOCATIONS

of the stream. In this AMA, the average potential height of Douglas-fir may range from 180 to 280 feet, depending on the productivity of the site. If the potential tree height on lands adjoining a given fish-bearing stream is 220 feet, for example, then the reserve width would be 220 X 2, or 440 feet on each side of the stream.

Under the provisions of the standards and guidelines, management actions within Riparian Reserves should be only those activities that improve aquatic and riparian habitat, or do not adversely affect it. These reserves overlay all other land designations on federal land. Though the exact acreage involved is not yet known, Riparian Reserves may amount to 60 to 90 percent of the total forest acres in the AMA, depending on density of the stream network.

- Administrative withdrawals: The types of sites administratively withdrawn (that is, withdrawn from most other uses) include developed recreation sites, communication sites, management facilities such as road maintenance compounds, and areas unavailable for timber harvest because of fragile conditions or reforestation problems.

Special area designations on federal lands in the AMA include eight Research Natural Areas (RNAs), twelve Areas of Critical Environmental Concern (ACECs) (five of which are also ACECs), and the Cascade Head Experimental Forest and Scenic-Research Area. These areas are listed and described in Appendix C.

Commodity Uses

Commodities, as used in this discussion, are products physically extracted from forest lands in the AMA, producing economic returns and jobs from marketing of the resource. Commodities include commercial timber and pulpwood; posts and poles; firewood; transplants of native trees and shrubs; Christmas trees and boughs; floral greens including ferns, salal, and mosses; mushrooms; cascara bark; and other special forest products. Fish production is not discussed under commodities because commercial fish harvest takes place primarily outside AMA forest lands, in the bays and estuaries or offshore. Sport fishing in AMA streams certainly generates jobs and income for local communities, but the income derives from providing for the needs of those coming to fish--which relates to recreation and tourism--rather than from sale of the fish.

Timber harvest

Commercial timber cutting began before 1900 in the AMA, at first in the more accessible lower elevations. Because of extensive fires during the late 1800s and early 1900s, the trees in some areas of the AMA were generally too small to be considered for harvest until about 1960. Harvest practices on the various types of ownership within the AMA are generally as follows:

Federal lands (20% of the AMA, much of it in large blocks, but also scattered tracts).

From about 1960 to 1990, the federal agencies pursued a program of intensive road construction and timber management. Some large forest areas were commercially thinned, but most harvest took the form of clearcuts, which ranged from as little as 3 to 5 acres each up to more than 80 acres in some locations. Most commonly, the quantity of logging debris--limbs, tops, and cut brush--was reduced by burning the harvested units, creating room to plant from 400 to 800 conifer seedlings per acre. In the AMA, such clearcuts have been applied to nearly half the forest acres administered by the Bureau of Land Management and about one-fourth of the National Forest acres. Timber sales were for the most part suspended in 1990 following court actions, but have now resumed in the AMA, following the guidelines of the Northwest Forest Plan. Most harvest now takes the form of partial cuts or salvage of trees damaged by wind, fire, insects, or disease. Federal lands are shown on Map 1.

State forest lands (17% of the AMA, most of it in a large block).

The Tillamook State Forest is located at the northern end of the AMA. Most of the Tillamook forest was burned one or more times between 1933 and 1951. As a result, trees on those areas have only recently become large enough for commercial thinning. State forest managers are developing a long-range plan for the forest using "structure-based management", which is designed to provide a range of habitat types and forest structures needed by native wildlife, while continuing to produce substantial timber and revenue. State forest lands are shown on Map 1.

Tribal forest lands (1% of the AMA).

The Confederated Tribes of the Grand Ronde Community hold a reservation of almost 10,000 acres, nearly all in a single block located north of Grand Ronde and Valley Junction, near the center of the AMA. The Tribes completed a new management plan for natural resources on tribal lands in May of 1996. The plan prescribes an annual timber harvest of 5.7 million board feet, derived from commercial thinnings of stands

between the ages of 25 and 60 years, and regeneration harvests at a minimum stand age of 70 years.

The Confederated Tribes of the Siletz Indians of Oregon have a reservation in the southern portion of the AMA amounting to almost 4,000 acres in scattered tracts of land near the lower Siletz River in Lincoln County. The Siletz Tribes also have an active timber management and land acquisition program. Tribal lands are shown on Map 1.

Industrial forest lands **(38% of the AMA, a combination of large blocks and scattered tracts).**
Forest land owned by the large timber companies has mostly been cut over one to three times, generally on rotations of 40 to 60 years. These companies carry out intensive reforestation and young stand-management programs, including site preparation, hand planting, brush control, fertilization, precommercial thinning, and, more recently, pruning. Approximate holdings of the 8 largest industrial forest landowners are shown on Map 2.

Other public lands **(1% of the AMA in scattered parcels).**
Includes state and county parks, and other county and city-owned forest lands.

Other private lands **(23% of the AMA, consisting of scattered tracts of forest, pasture, and developed communities).**
Management of nonindustrial forest land varies widely. Some ownerships are intensively managed to maximize timber yield or economic returns, and others are managed lightly or not at all. Most such forest land has been harvested one or more times in the past, and many tracts are today well stocked with young timber. In some cases, reforestation success was limited, and those lands currently support mixtures of hardwoods, conifers, and brush, with a relatively low volume and dollar value per acre of standing timber. There are substantial opportunities to increase timber yield on these lands, where desired, through application of active forest management practices. Very little mature or old-growth forest exists on nonindustrial private holdings in the AMA.

Special forest products

Forest land of almost all ownership classes is used for harvest of special forest products, including firewood, moss, mushrooms, floral greens (such as ferns, salal, and beargrass), native plants, cascara bark, conifer boughs, nuts and seeds, and other non-timber resources. These products from federal forest lands are sold to the public on small sale permits. Though they were considered of minor importance in the past, demand for these products has increased dramatically in recent years, stimulated by increases in product value, more people interested in harvesting them, and expanding markets.

All of these special forest products are believed to be renewable, but we need to learn more about how much harvest would be sustainable over the long term, what methods of harvest are preferable, and what the effects of their harvest would be on other resources. In addition to needing more information, the agencies have problems with enforcing existing standards for collection and preventing unauthorized harvest. New approaches and uniform standards are needed to help meet growing demand while protecting the health and productivity of the system.

The Siuslaw National Forest has developed a program for long-term leases or stewardships for commercial use of special forest products. The "steward" for the long-term lease would have exclusive harvest rights within specific guidelines for a designated land area, and could either collect the products or issue harvest permits to others. The first leases issued will probably include all types of special forest products available on the permit area except firewood. As part of the lease agreement, the steward would perform tasks such as collecting preharvest data and conducting specified monitoring.

Commercial collection of mosses is presently one of the most controversial special forest product programs in the AMA. The sustainability of the moss resource itself is one issue, but another, more important one is to find out what effects moss collection has on ecosystem functions and processes, especially those of late-successional forests. To identify ways of monitoring and evaluating the effects of moss collection, two studies have been initiated. One focuses on moss regeneration rates after collection, and the other on the amount of moss biomass growing on vine maple and shrubs of various ages.

Mineral extraction

Mineral products account for a small share of the economic activity on forest lands in the AMA. Many small rock quarries have been located on upland areas on both public and private lands, to provide a source of crushed rock for construction of forest roads. In several of the larger river valleys on private lands, plants have been set up to extract and process sand and gravel for use in making concrete and asphalt aggregate.

CHAPTER 3: RESEARCH AND LEARNING

Adaptive Management Areas...are specific areas dedicated primarily to the objective of development and testing of new approaches...
(Plan 1994, P. E-13, emphasis added)

Thinning and Underplanting - Mt. Hebo

What Are the Roles of Research and Learning in Adaptive Management?

Learning is what makes adaptive management adaptive; the formalized learning process in adaptive management is what distinguishes it from past forms of management. Any management approach with multiple objectives (for example, maintaining many different resources, species, and benefits to people) is of necessity an educated guess based on past experience, research, and theory. Land managers have tended to implement a few "best management practices" which were only adjusted when sufficient evidence of problems accumulated. In adaptive management, the goal is to try several different educated guesses in the beginning, monitor them systematically to see how they're doing, evaluate results and learn more about how the ecosystem works, and adapt our management plans to better meet our objectives. The AMAs in particular are also charged with testing the guidelines of the Northwest Forest Plan to see if better ways can be found to manage ecosystems and to avoid making new mistakes by following a narrow range of approaches.

Of course, forest management in the Oregon Coast Range isn't starting from scratch! We already know quite a bit about ecosystems in this area, and bringing that knowledge with us is important as we set out on a new course with different, broader objectives. Several assessments will help us do that:

- The Assessment Report on Federal Lands in and Adjacent to the Oregon Coast Province (Siuslaw National Forest 1995b) was completed in July 1995.
- Watershed analyses are being developed for each major basin in the AMA and have been completed for the Nestucca, Drift (Siletz), Upper Siletz, and North Yamhill watersheds.
- Five area assessments will be completed: research and learning, biophysical, social and economic, cultural-historical, and late-successional reserve.

Many terms and definitions have been used to describe mature and old-growth forest in the Pacific Northwest. One definition of late-successional forest is given in the introduction to this Guide. As used in the Northwest Forest Plan, the term refers to a range of forest conditions, beginning with stands in which tree crown expansion slows, openings between trees become larger and more stable, and large dead and fallen trees begin to accumulate. The definition includes older stands in which the oldest trees reach their maximum sizes, understory trees form multiple canopy layers, and large

amounts of dead wood accumulate (ROD 1994, B-3). Late-successional characteristics typically begin to form in Douglas-fir forests between ages 80 and 140. The Forest Service definition of old growth applies to old late-successional stands that meet some minimum standards for numbers of large trees, range of tree sizes, multiple canopy layers, and abundance of snags and logs (Old Growth Definition Task Group 1986). The Bureau of Land Management classifies stands greater than 200 years of age as old growth, as a rule of thumb for analysis purposes. The Oregon Department of Forestry is developing an "older forest" definition with structural categories similar to, but minimum standards different from, the Forest Service old growth definition.

What Do We Know?

Late-successional forest

As we pointed out in Chapter 2, there is much less late-successional forest in the Oregon Coast Range now than there was 150 years ago. In 1850, about 40% of the Coast Range between Astoria and Reedsport consisted of forests more than 200 years old, and 35% of the area had recently burned; thus 200-year-old forest may have covered about 60% of the area before the large fires that burned in the 1840s (Teensma et al. 1991, Ripple 1994). At least some, and maybe most, of the fires during the mid- and late-1800s were caused by people. This and other information suggests that coastal forests experienced catastrophic fire every 300 to 400 years, on average (Agee 1993, Ripple 1994, Siuslaw National Forest 1995). Estimates of currently existing older forest differ by method and geographic area: 0.8% of the Nestucca Watershed (200 acres) has forest older than 200 years (Nestucca Watershed Analysis 1994); 5.4% of the Siuslaw National Forest (33,800 acres) is old-growth forest (Bolsinger and Waddell 1993); and 10.0% of the federal lands in the Coast Range (140,500 acres) is multi-canopied forest with trees greater than 21 inches in diameter (FEMAT 1993). Note that federal lands occupy about one-third of the entire Oregon Coast Province (Siuslaw National Forest 1995). General classes of forest types in the AMA are shown in Map 3.

Late-successional forest is important habitat for many different species, including two species listed as threatened under the Endangered Species Act: the northern spotted owl and the marbled murrelet. The abundance of many other forest species seems to be associated more with the features that are found in natural and late-successional forests (for example, large snags and logs, multiple tree canopy layers, trees in a range of sizes), rather than with the age of the forest itself (Ruggiero et al. 1991, FEMAT 1993). We know that we can harvest some of the trees in mature Douglas-fir forests to accelerate the growth of the trees we leave and provide room for new trees to grow underneath to develop multiple canopy layers. We also know that we can increase the number of logs and snags in a forest by selectively killing trees and leaving them in place.

Fisheries and Watersheds

Anadromous fish populations in the Oregon Coast Range are a fraction of what they were 150 years ago. For example, the numbers of commercially caught salmon on the Siuslaw River (just to the south of the AMA) went from 87,500 to 7,000 for coho, and 11,000 to none for chinook between 1890 and 1960 (Sedell and Luchessa 1982). Accounts of rivers in the 1800s "choked" with salmon are common. Currently, 32 salmonid stocks in the AMA are considered at risk of extinction or of concern (FEMAT 1993). The National Marine Fisheries Service (NMFS) has grouped salmon stocks into "evolutionarily significant units"; the numbers and locations of these units are not yet available. The NMFS has proposed that coho salmon and steelhead be listed as threatened throughout Oregon.

Fish need clean water, in-stream gravel beds, and channel complexity (for example pools, riffles, and side channels) to complete their life cycles. Watersheds are dynamic systems that over time experience large fires, floods, and landslides. Natural stream systems maintain complex fish habitat through the periodic addition of gravels, boulders, and large conifer logs to streams from landslides and bank erosion. In many managed watersheds, however, streams are getting continual input of fine sediment, often from roads, but little coarse sediment and almost no wood. We know that we can install in-stream structures (mainly large logs) that increase channel complexity, but these approaches are inherently short term. Long-term solutions must consider the availability of large conifers that can fall or slide into streams, reduction of road density, and improved road design and location. Comprehensive solutions will also need to consider the entire upland, riparian, estuary, and ocean ecosystem on which fish populations depend, including the effects of commercial and sport fishing, agricultural activities along streams, and climate-driven changes in ocean currents.

People and communities

The communities in and around the north coast area are diverse, with a great variety of lifestyles and interests among residents. Communities tend to be somewhat isolated from each other because getting around in this mountainous landscape is not easy. Historically, the northern Coast Range has produced substantial natural

resources, but these resources have mostly been exported to other areas for manufacturing and use in value-added products. Many people also value unmanaged forest landscapes (wilderness and roadless areas), which have become relatively rare in the northern Coast Range. The primary natural resources have been commercial fisheries on the coast, timber in the mountains, and agriculture in the river valleys. Tourism continues to be important, particularly near the ocean, and collecting special forest products like moss and mushrooms is a growing industry. Employment in commercial fisheries and canneries declined several decades ago, and jobs in forestry have dwindled more recently. There is a trend toward fewer, larger businesses in many economic sectors (for example, lumber mills and dairy farms). The total number of jobs in the area has increased, but most are in primarily non-manufacturing sectors, so average take-home wages are lower.

What Do We Need to Learn?

The primary objectives of this AMA represent an experiment to determine if we can provide for healthy populations of late-successional and aquatic species and provide value to local communities at the same time. Historical management in this area has not done this; current ideas of how to do it range from leaving the lands alone to intensively managing different parts of the ecosystem. Information is also needed on the basic habitat needs of a variety of rare species, concern for which is driving current management policies in the region. We know relatively little about how species, management, and natural disturbance interact at the watershed and landscape scales that are important for the long-term viability of many species and ecosystem functions.

No one knows whether people, through management actions, can develop stands that function as old-growth. Current old-growth forests originated and developed during the last several centuries. Some people believe that we don't know much about how those ecosystems developed, and even if we figure it out, we may not be able to reproduce those conditions under current climate, land-ownership patterns, competition from exotic plants and animals, and disturbance regimes--particularly if it's the large fires, floods, and wind-storms that were the critical factors. Some people believe that every young forest will develop naturally into old-growth without our intervention. Other people believe that, through management, we can imitate some kinds of natural disturbance and create stands that function as old growth.

Much of our effort in the AMA will be concentrated in and near existing late-successional forest, with the hope that the plants and animals living in them will move into the surrounding younger stands as they develop. How many of these species are necessary for a functioning old-growth ecosystem, and how readily or rapidly they move between stands, are unknown. We do know, for example, that several species of mycorrhizal fungi associated with tree roots are essential to tree nutrient transfer and tree development. What if a forest can't develop into old growth without some of them? We don't know what the roles of different fungal species are, nor of countless microorganisms, snails, insects, spiders, lichens, and so on--many of which have never been identified. Nevertheless, we believe that applying what we do know about old-growth ecosystems by testing changes in structure and composition of maturing stands is the likeliest approach to reaching the goal of sustainable old-growth forests in the Northwest.

Some research needs--for example, studies of spotted owl feeding habits and monitoring approaches for "survey and manage" species--will be addressed through regional efforts (although sampling may be done within our AMA). Other learning needs can be met best through management experiments within the AMA itself, research directly linked to management questions, and independent research. The following list of general questions is meant to introduce some major issues; more specific items are contained later in this document, in watershed analyses, and in the forthcoming research and learning assessment.

Late-successional forest

In the long-term, what is the most effective way to maintain late-successional forest ecosystems and provide economic value to local communities at the same time? Although forests have been grown on long (150-300 year) rotations in a few countries, we have little experience with such practices, and no one has tried to manage a functioning late-successional ecosystem. Whether appropriate tree species and animal habitats can be maintained under different rates of selective harvest of trees or other uses of the forest over time is not known, nor do we know whether some kind of long rotation may be most appropriate.

What are the characteristics of late-successional forests in the different ecological zones within the AMA? We do not have a good idea of the composition and structure of old-growth forests in the AMA because of their rarity and a lack of studies. Current ecological descriptions of old growth were primarily developed from Douglas-fir forests in the Cascade Range. Even those descriptions focus on a small part of the ecosystem; we are still

ignorant about the role of most insects, fungi, plants, and soil organisms in old-growth forests. Studies of existing late-successional stands, stand reconstruction from stump measurements in clearcuts, and examination of historical records would help clarify what the "desired future condition" of late-successional forests in the AMA should be.

Can desired late-successional forest characteristics be promoted, and what prescriptions would be most effective in the different ecological zones? Although general responses of coastal forests to silvicultural manipulation are known, the specific responses in terms of habitats and ecosystem function are not. For example, we would like to know the most effective stand age at which to begin density treatments, the intensity of the efforts, the number of entries, and the specific stand attributes to provide. Repeating a set of different prescriptions across the AMA would help answer these questions.

Fisheries and watersheds

Can riparian reserve boundaries and management guidelines be modified to allow more management options while meeting conservation objectives? The interim riparian reserves under the Northwest Forest Plan cover at least 75% of the federal land area in the Oregon Coast Range. Many activities, including most timber harvest, are not allowed in the reserves unless they can be clearly shown to benefit aquatic habitat conditions. Guidelines allow for modification of reserve boundaries after watershed analysis, but the effects of many different management activities on stream habitats are not well known.

What is the most effective method for increasing structure in streams for fish habitat? Large conifer logs are the longest lasting and best providers of structure in streams, but most streams in the AMA are dominated by hardwoods. Several projects to reintroduce a component of conifers in riparian zones have been initiated, but we don't know how successful they will be in the long term, whether focusing our efforts on tributary headwalls or stream-sides would be more effective, or whether hardwood-dependent wildlife (for example, neotropical migratory songbirds) will be negatively affected by the introduction of conifers.

What is the role of coastal estuaries and large rivers in maintaining salmon populations? Although most federal lands in the AMA are in upper portions of watersheds, fish travel through and live in large rivers and estuaries during part of their life cycle. The importance of different parts of the river network to fish survival is not well understood. Studies examining the abundance and timing of fish use of different parts of a watershed, particularly where wetlands have been restored (for example, the Salmon River estuary) would aid in determining the importance of estuaries. Such studies may also identify methods and opportunities for collaboration among landowners.

People and communities

Can the AMA provide significant economic support for local communities? Timber harvest in the AMA is likely to produce a relatively low volume and will consist primarily of thinning treatments, at least for the next decade. Other opportunities to provide income include tourism, special forest products harvest, recreation, and possibly an eventual resurgence in sport and commercial fishing. How these products could be sustainably provided to meet the needs and interests of different local communities is not clear. Involving local residents in evaluating opportunities will be critical to answering these questions.

What are the best operational techniques for achieving AMA objectives, and what skills are needed for the personnel who will carry them out? Potential activities in the AMA include surveying, marking, cutting, removing trees, planting trees and shrubs, measuring plants, sampling water-quality, and keeping records. There is much to learn about relative ecological and economic costs and benefits of different methods (for example, roads and skyline logging, fewer roads and helicopter logging, wider or narrower rights-of-way, trails and horse logging) and the availability of expertise to carry out these actions. We may wish to try different techniques for getting work done, for example, contracting the management of stands or subwatersheds.

How can the management agencies fund the landscape treatments needed? Current funding and contracting regulations limit the ability of AMA managers to "reinvest" receipts from sale of commodities, such as harvest of timber or sale of special forest products, in land and resource improvements. Greater ability is needed to fund restoration projects; a number of potential ways have been discussed, but none are implementable under current law and policy.

How does management by different landowners (federal, private, state, and tribal) affect each other's management and the function of the ecosystem as a whole? Federal lands comprise only a part of the ecosystems within the AMA. For example, streams that provide fish habitat flow through, and are affected by, many different ownerships before they reach the ocean.

We need to explore how activities on different ownerships affect the behavior of the whole system and whether ways can be developed to ensure that activities on different ownerships complement, rather than work against, each other.

What can we do to promote more effective community involvement in the Northern Coast Range AMA, including both communities of interest and communities of place? The direction for management of the AMAs provides a clear mandate to increase agency interaction and collaboration with persons and organizations in local communities. Indeed, the social objectives of the AMA cannot be met without meaningful contacts with a variety of people and groups. The potential benefits of such involvement are significant:

- Increasing and maintaining public awareness and understanding of issues and opportunities relating to management of AMA forest lands;
- Gaining information and local knowledge;
- Creating better alternatives and solutions;
- Getting issues up front and addressing those issues clearly in project planning (rather than trying to address them after projects are planned);
- Avoiding conflict, gaining understanding, and often support;
- Creating opportunity for citizens to participate in many phases of projects (planning, implementation, and monitoring);
- Exploring potential for other sources of funding, such as cost-share agreements, to accomplish projects;
- Fostering relationships and, possibly, regaining trust.

What could be done to increase the educational opportunities relating to natural resources in the AMA? One of the principal goals of the Adaptive Management Area network is, not only to increase the rate of learning from management activities, but to explore new and more effective ways of sharing that information--not just with other agency offices, but with local schools, colleges, and communities. We need to identify and develop better-structured ways of initiating and maintaining connections with local educational institutions.

What can we do to creat more local employment opportunities? In order for the AMA to fully meet the goal of increasing economic support to local communities, ways must be found and developed to direct a greater share of employment to local companies and workers. A variety of tools to accomplish this will be needed, as well as possibly some changes in existing agency procurement regulations.

How Do We Go about Learning?

Different kinds and intensities of efforts can lead to learning opportunities to further adaptive management (Bormann et al. in preparation). At one end of the spectrum is traditional research, where the importance of a few factors is intensively studied and confounding variation is controlled. At the other end is the application of single management prescriptions that are well documented and monitored to detect future change. In between are research linked to management questions, and management experiments that have several attributes of experimental design (such as comparison, randomization, and replication). Most activities in our AMA will probably fall under these in-between categories, which--in practice--may be difficult to distinguish because most activities will involve collaboration of managers and scientists to some extent. Scientists will help managers to define learning objectives, review experimental designs, predict outcomes, and design systems for long-term record keeping, monitoring, and evaluation. The major distinction, however, is that scientists will have primary responsibility for the linked research and managers for the management experiments. Independent research projects will continue to provide valuable new information about Coast Range ecosystems.

Applying some *basic principles of experimental design* to management projects will maximize learning for a given amount of effort and minimize confounding factors that throw results into question. Study designs that ensure learning are based on comparisons, randomization, and replication. By applying solid learning designs, we will arrive at the truth more quickly than by trial and error, and be able to predict more accurately the benefits and outcomes of future activities.

Structured management experiments

Comparison: Let's say for example that we do some type of thinning (a "treatment") in a forest to create old-growth habitat; we come back in 10 or 20 years and find that some older-forest features are present, but others are missing. The problem is, we don't know if the change in the forest was caused by the cutting we did, or by the forest growing older on its own. And we never <u>will</u> know, unless we have something to compare it with. In a thinning example, the comparison might be a nearby similar patch of forest that we leave in its present

condition. It doesn't have to be a place where you do nothing--it could be a place where you do something the old way to compare with doing something the new way; it depends on what you want to learn. A solid design consists of different treatments (including controls) applied to similar pieces of ground (or stream, or road, or watershed). Moreover, not every test needs to achieve the intended result--our greatest learning often occurs from legitimate treatments that fail. If treatments don't differ much, we usually don't learn much from comparing them.

Randomization: Another important design element is random assignment of treatments on the ground, which protects a study from bias in selecting sites from among the unavoidable variability in nature. In a thinning project with two treatments, for example, we might find several nearby stands (or parts of one stand) that appear "similar". However, there will always be some differences in tree density or size, aspect and slope steepness, or shrub density (the fewer the better!). When we randomly assign treatments to different pieces of forest, we ensure that we won't consciously or unconsciously bias a particular treatment towards a particular kind of site.

Replication: The third element of experimental design is replication. That is, we ideally want to do several applications of each kind of activity. The more examples we have of each kind of treatment, the more confident we can be that the results we see from an activity aren't caused by something unusual about a particular site--for example, the wind exposure, soil composition, or growth history of a particular patch of forest. Replication and randomization are especially important if we know that our sites are not very similar to begin with.

The design concepts of controls, randomization, and replication can be applied at any scale, from trees to watersheds. For example, if we want to look at ways of developing large limbs on trees for marbled murrelet nest platforms, we could compare different ways of removing the top or pruning some limbs to encouraging the growth of other limbs on individual trees. Or, if we want to look at ways of partial cutting to increase forest diversity, we could compare different thinning rates on 40-acre patches of trees. If we want to look at ways of increasing fish populations, we could compare different management approaches relating to road densities, harvest rates, or stream-side plantings in nearby watersheds. The treatments don't need to be simple to provide valid comparisons, however: for example, some thinning treatments could have a range of densities or different sizes of patchy openings in them.

Keeping records

Probably the most important thing we can do, regardless of what kind of activities we pursue, is to keep good records. This may sound too obvious to bother mentioning, but it takes real dedication to keep activities well documented. Decisions or observations that were vivid in the woods easily turn into hazy memories in the office four months later. Even records that are well organized and carefully stored may not make sense to someone who looks them up ten years later. The best approach is to decide what we're going to record, how we're going to measure it, and how we're going to store that information even before we actually do anything. This process becomes a key part of our monitoring plan. As in all activities, we need to keep the process simple. When we undertake a project, we should ask ourselves: *"If I were someone else coming back to this project 20 or 30 years from now, what would I want to know to evaluate the effect of this action?"*

Following through

Once we decide to learn something, we will have to follow through with treatments and measurements long enough to answer our question. "Policies to learn must persist for times of biological significance, and they must affect human action on the scale of ecosystems" (Lee 1991, p. 161). Many of the changes we hope to see in late-successional habitats and healthy watersheds might not show up for several decades. A commitment to learning and to repeated monitoring will allow us to evaluate how we're doing. Even if we do not have a lot of resources (i.e., personnel and funds) to measure changes in the forest now, setting up valid comparisons--by using thoughtful design and carefully documenting what we did and why--will provide future managers with greater options to learn about future pressing issues.

Non-federal lands

Many of the answers we're looking for about management of forests and watersheds are needed by more than just managers of federal lands. Collaboration among federal, state, tribal, and private landowners could provide us with better answers sooner. Some treatments that are presently incompatible with federal land designations could be tested on private lands. Conversely, other landowners may wish to try something on federal lands that they do not have the resources or leeway to do on their own lands. Cooperation between landowners may also allow us to schedule activities so that we reduce needs for road maintenance and enhance conditions across watersheds.

We may also learn much about ecosystem response to management over large areas by comparing management of forests on state, private, tribal, and federal lands.

What Are We Doing to Learn So Far?

Research has been conducted in parts of the AMA for many decades. The Cascade Head Experimental Forest (managed by the Forest Service), north of Lincoln City, was designated in 1934. Early studies described the natural history, growth, and yield of native trees, and many of the original permanent plots are still being measured. Studies in the 1950s and 1960s included a variety of harvest techniques, including staggered-setting clearcuts, progressive strip clearcuts, shelterwood, and several types of thinning. Current activities include studies of forest development, ecology of wildlife and plant species, nutrient cycling, salt marsh restoration, and applied forestry studies of harvest techniques and various species mixtures (Greene and Blinn 1991). Two state-owned experimental forests also lie within the AMA watershed boundary. Some of the earliest research on forest thinning techniques was done at Black Rock Forest Management Research Area (managed by the Oregon Department of Forestry), just west of Falls City. Forestry research is also being done at McDonald-Dunn Forest (managed by the College of Forestry, Oregon State University), near Corvallis. Several Research Natural Areas (on both Forest Service and BLM-administered lands) also exist in the AMA (see appendix C); RNAs are mostly pristine, unmanaged areas, which provide opportunities for a variety of studies of natural ecosystems.

Many unplanned "experiments" are already in place; for example, adjacent forests that we know were the same once but have been managed differently, or places where managers have tried innovative plantings, thinnings, or road construction methods. These places can provide valuable information while we wait for more definitive results from newly installed studies. Some opportunities for retrospective studies have already been identified (Thomas et al. 1993); others no doubt could be found if we were to look carefully at current conditions. The sooner such areas are identified, the better the opportunities we will have to capture known information regarding how they came to develop the way they did.

Several research projects associated with the Coastal Oregon Productivity Enhancement Program (COPE) are being conducted on a variety of ownerships in the AMA, including studies on forest thinning and tree underplanting, changes in riparian forests, road-building techniques, and fish and wildlife abundance and habitat. The Coastal Landscape Analysis and Modeling Study (CLAMS) has an interdisciplinary team of scientists who are developing tools to understand changes over large landscapes and analyzing the economic and ecological consequences of different forest policies at the scale of the entire Coast Range. Scientists contributing to these studies work for many organizations, including the Biological Services Division of the USGS (formerly National Biological Service), the Forest Service's PNW Research Station, Oregon State University, and the University of Oregon.

Two sites in our AMA are being used for the Density Management Study conducted by the Biological Services Division of the USGS and the BLM. This study is evaluating several thinning methods in mid-aged and mature stands (40 to 70 years old) to achieve late-successional stand characteristics as quickly as possible, and the effects of those methods on wildlife (small mammals, amphibians, fish), understory plant species, and microclimate. Installations at two different sites (Callahan Creek and Sand Creek) will consist of four basic treatments:

- Unmanaged comparison;
- High density--thin 70-75% of the stand to 120 trees per acre (tpa);
- Moderate density--thin 60-65% of the stand to 80 tpa, cut 10% in dispersed openings of , , and 1 acre; and
- Variable density--thin 10% of stand to 40 tpa, 25-30% to 80 tpa, 25-30% to 120 tpa, and cut 10% in openings.

Different types of unthinned buffers along streams are also planned.

The goal of the Adaptive Management Pilot Project being conducted by the Siuslaw National Forest and the Pacific Northwest Research Station is to continue developing the theory of adaptive management by implementing the concepts in local projects such as the the Hebo Restoration Study and designing other large-scale management experiments. The Hebo Restoration Study is an attempt to accelerate development of late-successional stand characteristics in a 1910 plantation of nonlocal tree stock in which tree growth appears to be reduced compared to natural stands. We do not know to what extent these poorly adapted trees will ever develop effective late-successional structure, so the idea of "starting over" with locally adapted tree stocks is being compared with various ways of managing the existing trees and adding components of local stocks. Soil productivity on the Hebo plantation may also be degraded from past fires. The four treatments, replicated three times each, consist of:

- Unmanaged comparison;

- Heavy thinning (30 tpa) with planting of nitrogen-fixing alder;
- Heavy thinning (30 tpa) with planting of locally-adapted conifers; and
- Moderate thinning (60 tpa) with planting of shade-tolerant conifers.

Treatment effects on forest structure, woody debris, soil nutrients, microbial weathering of soil, and soil invertebrates will be evaluated.

Learning is also supported by managers in the AMA. A great deal of effort is going into watershed analysis, which provides valuable site-specific information that will help improve future decisions. Watershed analysis is used to quantify past and current ecosystem conditions, characterize the natural range of ecosystem conditions in the area, identify management opportunities and restoration strategies that will sustain long-term productivity and meet societal needs, and designate potential indicators for monitoring. Some watershed analyses have been completed, and several others are in various stages of completion (see Map 4 and the discussion in Chapter 5). Several implementation and monitoring projects are under way in the AMA, using various methods of placing logs in streams and planting conifers in streamside areas. Several timber sales that include alternative stand treatments are also planned (see chapter 5). These projects focus on different degrees of thinning, different types of variable thinning, and planting with different tree species on a variety of forest types around the AMA.

What Do We Need to Do next?

We are still conducting several assessments and will continue to consult with interested partners in the AMA effort. This information will help us set priorities for what we want to learn and how we're going to learn it. We expect that these priorities will continue to shift as we learn. In the short term, the following issues and approaches will guide much of the management in the AMA. Most of the implementation and basic monitoring will be carried out by land managers and their staffs, but participation by other interested persons and groups will be encouraged. Researchers will be able to assist with design of some projects and will help to provide detailed information on specific issues; other projects may be initiated to address specific research questions. Although forest, stream, social, and landscape issues are addressed separately below, actual prescriptions will probably address a combination of issues. Although many of the activities described in this Guide focus on the effects of tree harvest, current and future activities will likely examine the effects of exotic species, insect outbreaks, windthrow, fire, floods, landslides, and other influences on late-successional forests and streams.

Development of late-successional habitat

Some people believe that most forest stands will reach the old-growth stage on their own, without intervention or disturbance (Oliver 1981). There are many examples of old-growth forests that developed at low density or with repeated disturbance (for example, wind and fire), however, which suggest that we may be able to accelerate development of densely stocked stands by treating them in ways that mimic natural disturbances, through thinning, underplanting, and other management activities. Densely stocked plantations might not develop optimum old-growth characteristics on their own, however, and repeated thinning of older stands may provide both timber output and improved late-successional habitat.

When designing thinning projects, we should consider that commercial thinning differs from natural tree mortality caused by competition, windthrow, insects, or fungi because wood is removed from the forest, trees are taken all at once, and stumps are left in the ground (compared to the root wads and churned soil created by windthrow). These differences may be important to some animal and plant species. The density of trees remaining after thinning affects their growth as well as the density, growth, and composition of understory trees and other plants. The same total number of trees in a thinning unit can also be arranged uniformly or in variable density, which may also affect growth of overstory and understory vegetation. Although spatial variation is a characteristic of late-successional forest, uniform thinning in younger stands may create more large trees for future timber or woody debris; variation could be produced by later thinning or allowed to develop naturally. These issues could be addressed with the following types of management projects:

- Compare different thinning objectives in young plantations: develop many large overstory trees; establish a second tree layer under overstory trees; and leave some areas unthinned.
- Compare long-term management strategies: unthinned, no thinning after age 110, and regular thinning cycles with no age limit.
- Compare spatial treatments: uniform and variable thinning, comparing different opening sizes.

- Compare woody debris management in stands: unthinned, thinned with tree removal, thin with no removal (fell trees and girdle others).

Because forests vary substantially across the AMA (in climate, composition, slope position, and so on) the same thinning study should be repeated in a wide range of forest types across the AMA. Although general vegetation response would be monitored in all projects, selected projects should also monitor the response of a range of species, including understory plants, small mammals, birds, and fungi. Map 4 displays major vegetation classes in the AMA.

Restoration of aquatic habitats

The focus of most aquatic restoration strategies is to reduce or eliminate effects from timber harvest and roads (fine sediment erosion, channel constraints, landslides) and to place or promote input of large conifer logs into stream channels. Trees fall into streams naturally from stream banks and from landslides in unstable headwalls. Closure or modification of roads may have short-term impacts on streams as well as long-term benefits. Thinning to promote conifer growth, or conifer planting in hardwood areas (with or without thinning), may also affect stream temperature, erosion, and riparian habitat in the short term. How much buffering from different types of management, some of which may be beneficial, is needed in riparian zones? What is the relative importance of riparian habitat in smaller and larger streams within a watershed? These issues could be addressed with the following types of management projects:

- Compare different riparian buffer widths in thinning units: for example, control (no thinning), and 2 tree height, 1 tree height, variable width, and stream-side buffers.
- Compare different road closure techniques: for example, passive (waterbars, natural revegetation) and active (culvert removal, road ripping, and stabilization).
- Compare conifer growth, mortality, and input into streams on stream banks and headwalls from thinned and unthinned areas.
- Monitor existing and future landslides to assess impacts to fish habitat.

Similar to the forest topics above, the same project should be repeated in a wide range of streams across the AMA. Although the response of fish habitat (or stream structure) would be monitored in all projects, selected projects should also monitor fish abundance, physical factors (water temperature, sediment movement), the response of a range of species (stream invertebrates, riparian vegetation), and the use of riparian buffers as corridors for movement of terrestrial species.

People and communities

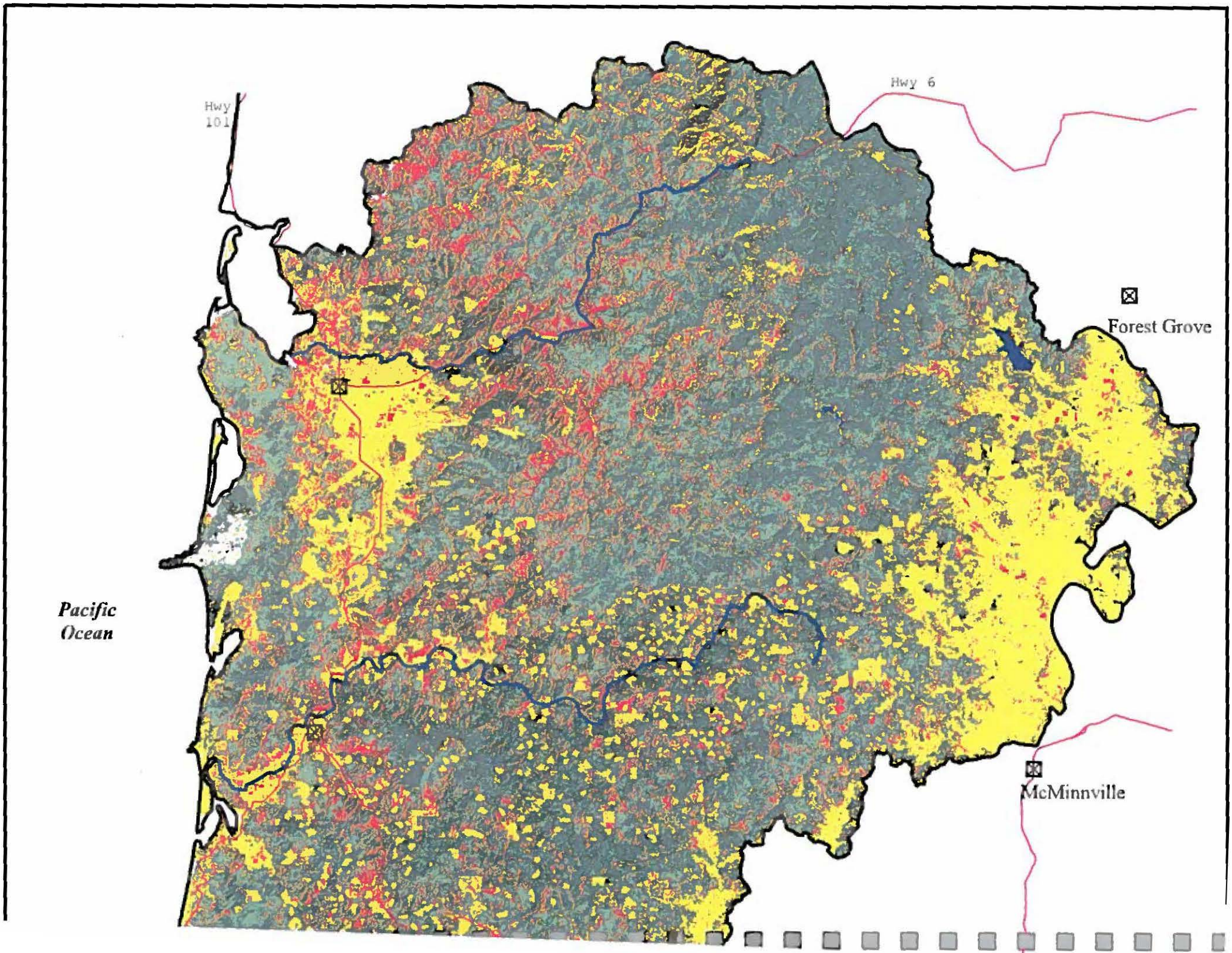
The range of values that could be provided to people while also providing late-successional habitat is not known. Many of the questions build on the issues raised above. For example, different thinning intensities not only provide different amounts of harvested wood, but may affect abundance and growth of plants that provide special forest products, condition of fish habitat, and suitability for recreation. Even activities like hiking or recreational driving, generally thought to be relatively benign, may lead to harmful effects on some species and habitats. The ways economic use is organized also have important implications to people, including the types of regulation, harvest, manufacture, and distribution. The techniques that are adopted will depend greatly on the interests, values, and abilities of the people participating. These issues could be addressed with the following types of management projects:

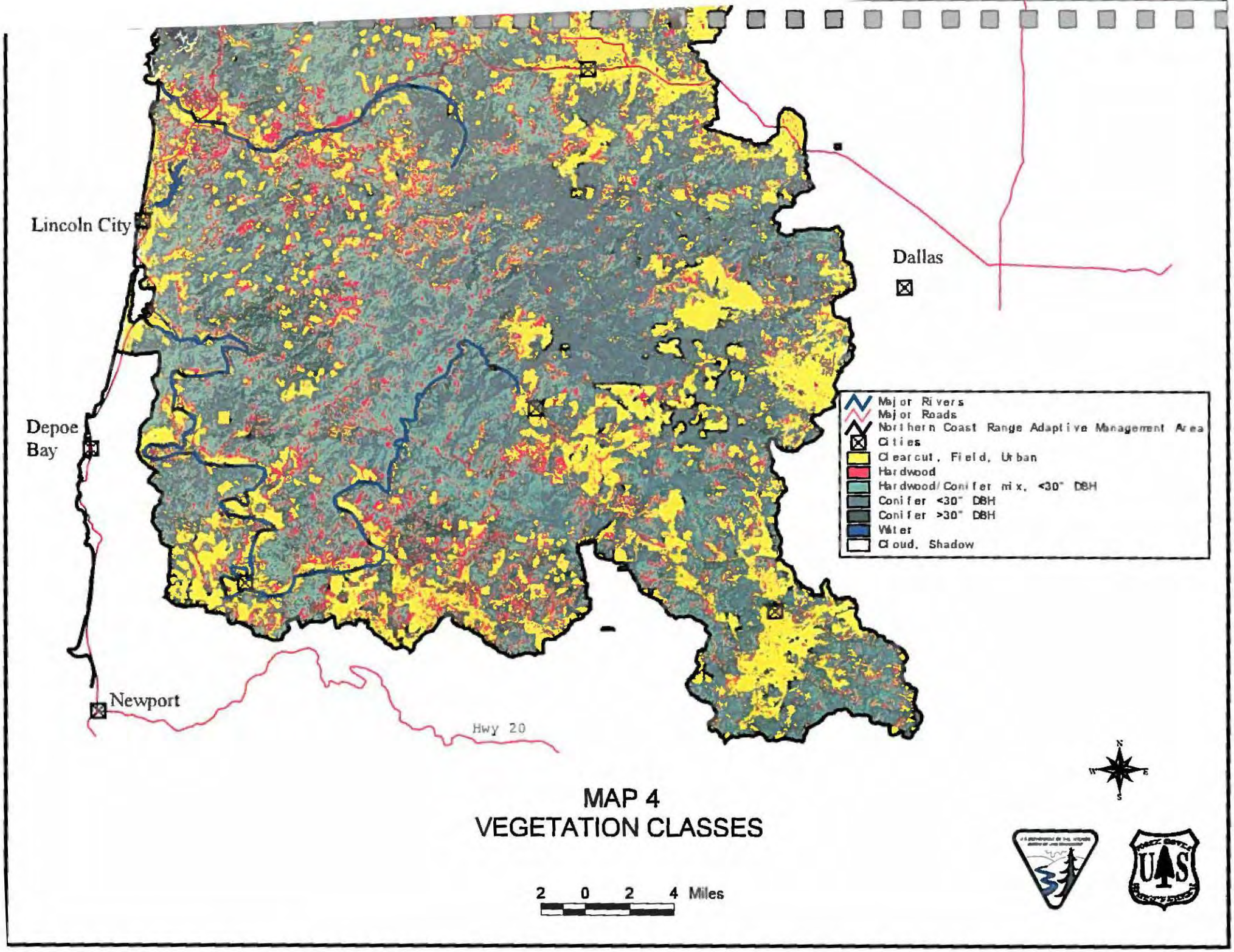
- Compare different timber sale methods: traditional (trees marked by agency and sold under detailed contracts), buyer discretion (buyer selects trees based on general guidelines and goals), log-deck sale (agency contracts logging and yarding, sells sorted logs at roadside).
- Compare management strategies: involve interested groups in designing and implementing management in specific areas in ways that both reflect groups' values (such as timber, special forest products, game, recreation, and wilderness) and meet AMA goals.
- Compare commodity and non-commodity economic values generated by different management strategies applied to various areas in the AMA (for example, active vs. passive restoration), and the change in those values over time.

Although landowner costs and the amount and value of harvested products will be monitored in all projects, selected projects or areas should also monitor people's movements, activities, and perceptions about the AMA.

Landscape design

Many of the issues surrounding late-successional forest habitat and fisheries must be addressed at a larger scale than we have focused on in the past. For example, the effect of the spatial distribution of different forest ages on wildlife, and the effect of road density and placement


Hwy 101
Hwy 6
Forest Grove
McMinnville
Pacific Ocean



MAP 4
VEGETATION CLASSES

on stream flows and fish habitat are issues that must be addressed at the watershed or river-basin scale. An adaptive management approach for these issues might attempt different types of management strategies on different watersheds (or groups of watersheds).

To assign different strategies to different geographic units--such as watersheds--a landscape plan will be needed. This plan will need to be based, not only on experimental design considerations, but also on existing resource conditions, including past impacts, current management allocations, and sensitivity of the resources present in each area.

An important step to developing a landscape plan will be to set priorities for what we would like to learn by treating the landscape in different ways. For example, most ideas about the role of people in conservation of natural resources fall along a spectrum between active landscape management, which proposes that most of the landscape should be managed (often with modified kinds of long rotations and intensive efforts for specific objectives), and reserve-based management, which maintains that large portions of the landscape should be allowed to develop without intervention, usually with most commodity-based activities excluded. We might want to choose two or more different approaches along the active-passive spectrum and try them out on different landscape blocks. Interested citizens would help design some of the different strategies. Instead of being separate efforts, projects to address stand-scale questions could be nested within particular landscape strategies.

Because changes over large landscape areas take place gradually, evaluating changes in watershed condition will require consistent strategies over periods of several decades or centuries. It would be useful to identify those areas in which future management might change to test newly identified strategies, and those areas in which strategies would be continued over a century or more.

Data management

The different landowners in the AMA, as well as state and local governments, already collect a great deal of information about resources and people's activities within the AMA. However, the objectives for collecting the information are often not clear, the standards used by different people are different, and the information often is not easily retrieved or analyzed. To set adaptive management on a sure footing, it will be important to:

- Catalog the status and types of current monitoring information: methods, timing, locations, data storage, and utility for objectives, and
- Set objectives and standards for future data collection, formatting, and storage.

Efforts to standardize data collection techniques among federal agencies are being pursued at regional and national scales, but we will also encourage our partners in the AMA to work with us on ways of translating existing information from different inventories or of adding measurements to existing inventories so that the comparable information can be examined across the AMA.

Research database and information map

Sometimes we aren't aware of things that have already been learned that could help us out. The AMA Research and Learning Assessment will assess past and current research studies in the AMA and similar portions of the Coast Range Province. Objectives, methodologies, and results of different studies will be summarized into a readily accessible and searchable data-base. Locations of study sites and raw data will be documented. The locations of research, monitoring, and retrospective sites could be compiled into GIS data layers readily available to all.

Research Coordination and Logistics

The lead scientist for the AMA is currently responsible for keeping track of existing learning projects in the AMA and helping coordinate the work of other scientists there. Information from research projects will be centrally stored for easy access and sharing among the partners in the AMA. The lead scientist also helps design management and monitoring activities to address key questions and aids in procuring funding for research activities in the AMA. An ad-hoc group of agency and university scientists provides advice and assistance in these efforts. Current funding for research is not sufficient to tackle all of the questions identified in a short period of time, but it is expected that researchers with external sources of funding will find opportunities to use proposed or existing projects within the AMA as settings in which to conduct their studies.

Approval of proposed studies is ultimately the land manager's responsibility. Many projects will be developed through the collaboration of managers, scientists, and the public. Other projects, especially those requiring coordination of resources and selection of specific sites in the forest, should be submitted to the AMA management team for evaluation and approval well in advance of proposed activities. Research studies planned specifically for Cascade Head Experimental Forest and Scenic-Research Area must be approved by the Pacific Northwest Research Station Director.

CHAPTER 4: OPPORTUNITIES

Overstocked Douglas-fir Planatation.

How do we define success for the AMA? Success might be increasing the quantity or quality of late-successional habitat. It might be the creation of new opportunities for natural resource-based employment, or expanding the choices for outdoor recreation in the north coast area. Success in the AMA will certainly require active and sustained citizen participation. Perhaps most important, success may be defined by how well AMA management helps us to learn better, more effective ways of managing our forest land.

All of us, as partners in the AMA, can help keep the learning process moving by sharing ideas--that is, ideas to try out on the AMA landscape--that might help us get to our shared vision. This chapter is intended to provide a bank of such ideas that we can draw from, and add to, as AMA management proceeds.

Commodity Production, Economic Outputs, and Jobs

The locations of the 10 AMAs were chosen partly with a view to economics. They are generally near communities that lost jobs and income because of the reductions in federal timber harvest. In fact, a basic assumption underlying the AMA concept is that ecological concerns and economic values can be,and should be, not only compatible, but complementary. This section explores ways of generating products and jobs while developing late-successional habitat.

Timber harvest

The federal lands now within the AMA have a history of producing a sizable annual harvest of timber, and the AMAs are expected to continue to produce timber--though harvest levels will be less than in past decades. The emphasis of management is to maintain and develop late-successional forest, while also providing social and economic benefits to local communities. Some of the ways in which commercial timber harvest might result from AMA management are as follows:

- Variable-density commercial thinning in young stands, 20 to 50 years old, to maintain good growth rates on retained trees, increase species and size diversityin the stand, and promote the development of older-forest structure;
- Partial cutting in mid-aged and mature stands, 60 to 110 years old, to improve stand vigor and

development of large trees, while providing room for establishment and development of understory trees and vegetation;
- Creation of small openings in stands to form islands of early-successional vegetation in the late-successional forest;
- Removal or topping of small groups of trees in selected locations to improve scenic views;
- Salvage of timber from large areas damaged by fire, wind, flood, disease, or insects, where the amount of damaged or killed timber exceeds current and projected habitat needs for snags and down logs;
- Salvage of disease-killed or windthrown trees adjacent to roads, to provide for public safety and preempt unauthorized taking; and
- Removal of hazardous trees from within and adjacent to developed recreation sites to increase safety for users.

Recreational Development and Tourism

There are many potential opportunities for recreational development in the AMA; but the federal agencies are receiving a much lower level of appropriated funding than in the past. People and money from other sources need to be recruited. Following are some ideas for projects that could be pursued in the AMA. Input from AMA stakeholders will have a major influence on which of these or other projects or activities might be implemented, where they would be located, and how they would be constructed or conducted.

Hunting and fishing

- Provide and maintain road and trail access
- Enter into cooperative agreements with private landowners
- Improve habitat in selected areas for game species
- Develop partnerships with Oregon Department of Fish and Wildlife to protect or improve habitat, help prevent violations of regulations, and monitor hunting or fishing success

Developed recreation sites

- Enlarge, improve, or relocate existing sites
- Create additional sites
- Develop scenic viewpoints
- Construct nature trails and interpretive facilities
- Provide group camp/picnic facilities
- Build trailhead facilities
- Develop horse campsites and corrals
- Lease some sites to local concessioners

Dispersed recreation

- Improve or maintain road access
- Maintain and improve existing trails
- Construct new trails
- Designate primitive (roadless) areas
- Develop and implement strategies to attract "eco-tourists"

Collaboration with Other Agencies and Organizations

A wide variety of agreements and funding arrangements are now in effect. Local and regional governments, tribes, public and private agencies, and other organizations of all types are currently cooperating with the Forest Service and Bureau of Land Management to accomplish projects of mutual benefit. These existing agreements are listed and described in Appendix E. Some opportunities for increasing our current level of collaboration are described below:

- *Identify new avenues of Collaboration with the Tribal Councils of the Confederated Tribes of Grand Ronde and Confederated Tribes of Siletz Indians.* The tribes are important both as managers of the adjacent reservation lands and as peoples with broad concerns about management of lands throughout the AMA.
- *Coordinate with Oregon Department of Forestry in assessing habitat needs on the north coast.* The Northwest Forest Plan specifically directs the federal agencies to invite the Oregon Department of Forestry to collaborate in developing a strategy for conserving fish and overall biological diversity in the northern Oregon Coast Range.
- *Coordinate with the Governor's Natural Resource Advisors on strategies for restoration of coastal salmon habitat.* The Governor's program is aimed primarily at forming partnerships with the various state agencies, communities, and local governments. It also could provide an excellent forum for coordination between state and federal land managers on issues relating to managing aquatic resources.
- *Seek additional ways to Coordinate with the scientific*