United States Department of the Interior
Bureau of Land Management

Oregon State Office
1300 N.E. 44th Avenue, P.O. Box 2965
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Preliminary Reconstruction and Analysis of Change in Forest Stand Age Classes of the Oregon Coast Range From 1850 to 1940

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October 8, 1991

Dear Reader:

In studying the Western Oregon Digital Data Base maps depicting age classes, I was very curious about why entire watersheds were even-aged stands of Douglas fir which pre-dated logging operations. I asked BLM's fire ecologist and foresters to help me understand what our forests in the Coast Range looked like in the past. Their research resulted in this report and a series of four maps, which together chart the changes in forest stand age classes from 1850 to 1940. The report leads me to some conclusions:

- The Douglas fir forests of the Pacific Northwest have gone through natural disruptive changes over several millennia, whether from fire, insects, disease, or wind throw.
- Some Native American tribes burned parts of the forest, knowing the green-up that followed would attract foraging game animals.
- Settlers in the mid to late 1800s burned forested areas to clear them for farming and building.
- Since the turn of the century, humans have intensively harvested timber from the forest, at the same time suppressing virtually all wildfires.
- The popular notion that all western Oregon was once a solid block of old growth forest, the misnamed "ancient forest," is wrong.
- Understanding the relationship between an animal and its habitat requires more than a "snapshot" of the current status. How the relationship varies over time must be considered.

Our managers are examining alternatives in our western Oregon planning to determine whether we can maintain biological diversity and a sustainable production of forest products. Intelligent intervention by forest managers is essential in mimicking natural processes.

The time has come to look at the whole picture, so that by understanding and considering the past, we will be better able to make informed decisions affecting the forests of the future.

D. Dean Bibles
State Director

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Introduction

Fire and other catastrophic disturbance events in the Douglas-fir forests of the Oregon Coast Range have been significant in determining the distribution of stand age classes and, hence, habitat. Except for the past half century, knowledge of fire in the region has largely been local and anecdotal. The Douglas-fir forests of the Coast Range are typical of those in the region (Waring and Franklin, 1979). This study presents broad-scaled, reconnaissance-level patterns of fire and other disturbance in the Coast Range between the Umpqua and Columbia Rivers. Several significant patterns appear at this scale, however, the need for detailed, localized investigations is also evident.

Methods

Forest stand ages classes were reconstructed for 1850, 1890, 1920, and 1940 (Maps 1-4). Actual or estimated dates of fire, extensive wind throw and harvest were used as available, although in many cases, the precise ages of the stands could not be determined. The methods used in this study are consistent with those used with some of the source references (e.g., the 1936 Vegetation Type Map of Oregon). These methods include the use of average stand diameter classes as a surrogate for age. In these cases, ages were estimated according to standard forest volume tables (Tables 3 and 4, McArdle, et al., 1961). The authors recognize that the relationship between size and age is not precise, but feel that it is adequate for stratifying forest ages into broad categories in a reconnaissance-level investigation of this type.

The total mapped area varies somewhat between the four maps, due to the increase or loss of records and cruise information, but the amount of change is relatively small. The maps were produced for four specific years, although the data may have been collected in years other than that precise year, or over a period of years. The 1920 map, for instance, uses data from timber cruises between 1913 and 1923.

The 1850 stand age class reconstruction was based primarily on the 1854 General Land Office survey notes, supplemented by stand volume data and age

class boundaries from the 1900 Land Classification Map of Oregon (Gannett, 1902). The term "Recently Burned" on both the 1850 and 1890 maps signifies areas burned within the previous 25 to 50 years, based on the classification used by this early survey. The 1890 map was largely reconstructed from the 1900 Land Classification Map of Oregon (Gannett, 1902).

County and agency timber cruise data were available for the 1910s and were incorporated into the 1920 stand age class map. Tillamook County Museum provided copies of county cruise notes from a 1908 survey. These notes documented the locations of old growth, burned over areas, and non-forest lands. Similar cruise notes were obtained from the Oregon Department of Forestry (Northwest District, Forest Grove) for the south township of Clatsop County (1913). Additional cruise data were obtained for Columbia County from the State of Oregon Archives, Salem. On the 1920 and 1940 maps, the term "Recently Burned" signifies areas that had burned and that had stocking levels below 10 percent.

The 1936 Vegetation Type Map of Oregon (U.S.D.A., Forest Service, Pacific Northwest Forest and Range Experiment Station) provided locations of recent fire events, recent (1920 to 1936) timber harvest, and older harvest units (pre-1920) not restocked. This source accounted for the majority of the data in the 1940 map, which was amended to reflect additional fires and timber harvest.

Fire History

The Tillamook Fire (1933) and the successive reburns (1939, 1945, and 1951) have received much attention in both the popular and scientific literature (Kemp, 1967; Pyne, 1982). Green trees, as individuals, in groups, and in unburned islands were numerous after the 1933 fire (Isaac and Meagher, 1938:6). These trees were natural seed sources prior to a beetle epidemic between 1935 and 1937. This epidemic killed a large number of green trees, thereby adding a significant amount of fine dead fuel from the crowns and branches, which probably contributed to the pattern of reburns. The Tillamook Fires are the only documented extensive recurrent fires in the Oregon Coast Range. Reburns in the northern Coast Range apparently did not occur prior to European settlement of the region (Agee, 1990). The Tillamook Fire of 1933 burned 311,000 acres, while the Wolf Creek and the Fisher fires burning concurrently added another 100,000 acres.

Other large fires in the Coast Range are not as well documented. A large fire or set of fires burned about 800,000 acres between the Siuslaw and Siletz rivers, probably in 1849 (Morris, 1934; Martin et al., 1974). The Nestucca Fire burned over 300,000 acres in the late 1840s. Most of the area burned had regenerated naturally and vigorously, except for an area near Mt. Hebo that was burned periodically by homesteaders to improve pasturage. That area remained unforested until replanted between 1912 and 1918 as the first artificial reforestation project in the Pacific Northwest (Munger, 1944:346). In 1868, a fire burned 125,000 acres between Coos Bay and the Umpqua River (Morris, 1934). Numerous smaller fires occurred in the Coast Range in 1902, largely a result of land clearing fires. The Cedar Butte Fire burned about 40,000 acres in 1918. The Salmonberry Fire burned some 25,000 acres in 1931.

Results

The distribution of older stands of forest in 1850 is dominated by a very large tract in the north, with scattered smaller tracts in the central and southern portions. This pattern is consistent with a general north-south trend of age class distribution and fragmentation along the Pacific Coast (Agee, 1990). The "recently burned" areas are approximate, and account for at least 35 percent of the mapped area, and probably more (Figures 1 and 2). By the 1890s, much of the area burned in the large fires of the 1840s had been naturally

restocked, and the fires that had occurred in the interim were much less extensive. The total area in 200 year or older stands increased somewhat. The previously burned areas were stocked with younger stands, and logging had begun to have an impact on the distribution of both the 100 to 199 and the 200 year and older age stands. By 1920, about 50 percent of the area is covered by 200 year and older age stands. Some additional area is burned, and some of the previously burned areas are still unstocked. The bulk of the area in 200 year and older stands is still on the north, although in the south previously burned areas have stands that are aging. The 1940 map illustrates considerable change from 1920. Timber harvest and the Tillamook Fires have removed the majority of 200 year and older stands from the north portion, leaving several scattered smaller areas. The largest tracts of older forest are now at the southern end of the area.

Discussion

The role of disturbance in Douglas fir forests of the Oregon Coast Range has not received much scientific study. The most comprehensive study of fire in the Coast Range to date is by Zybach (1988), an unpublished draft report. The Willamette Valley side of the Coast Range probably burned much more frequently than did the Coastal side. Climatologically, this is entirely expected. But the increase in frequency of burning is probably much more related to human factors. Encroachment of Willamette Valley prairie ecosystems by Douglas-fir dominated forest after European-settlement has been well-documented and is attributed to the ending of periodic grassland burning by aboriginals (Johannessen, 1970; Loy, 1976). David Douglas noted extensive burned areas encountered travelling from Fort Vancouver to the Umpqua river (Lavender, 1972). Prairie burning by the Kalapuya in the Willamette Valley is discussed in detail by Boyd (1986). The burning occurred in July and August in the prairies, and then shifted to the oak savanna on the margins of the valley by October. It is highly probably that some of these fires were initiated prior to east wind episodes similar to those that occurred during all of the major fires in the Coast Range from the 1840s to the present. The winds would increase the spread, intensity, and severity of the fires. Lightning has not been a major cause of forest fires in the North Coast Range since the advent of forest protection in 1908.

The frequency of fire in the Coast Range has not been determined. It probably does not have a regular cyclical frequency, occurring instead at irregular intervals. The frequency of fire in the Coast Range is higher than in the Olympic Mountains and Mount Rainier National Park, Washington, and less than in the Oregon Cascade Range (Agee, 1981; Hemstrom and Franklin, 1982; Teensma, 1987). Coast Range forest stands are more even aged than those of the central Western Cascades, where underburning and variable intensity fires were prevalent. The frequency and intensity of fire in the Coast Range appears most similar to the fire regime of true fir and spruce-fir forests as described in Kilgore (1981), characterized by high-intensity, stand-replacement fires, occurring at intervals from 150 to 350 years. Agee and Flewelling (1983) attempted to fit a climatic fire occurrence model to the Coast Range without success. The model predicted less frequent fire than has been observed historically. Agee (1991) believes that this may be explained by climatic aberrations. However, we hypothesize that this reinforces the belief that human-caused fires dominated the fire occurrence pattern of the Coast Range, both before and after European settlement.

Severe windstorms periodically create extensive blowdown, sometimes in concentrated areas, but usually in a wider and more scattered distribution (Orr, 1963). In 1880 and 1962 (the Columbus Day Storm), sustained winds in the Coast Range exceeded 90 miles per hour, with probable gusts over 135 mph over the

entire northern Oregon Coast Range, and up to 170 mph on Mount Hebo (Orr, 1963). The Columbus Day Storm caused blowdown in concentrations of over 80 acres per square mile, although considerably more area received blowdown of 10 to 39 acres per square mile. The total amount of blowdown west of the Cascades was roughly equivalent to the amount of forest killed by the 1933 Tillamook Fire (Orr, 1963; Kemp, 1967). The 1921 storm over the Olympic Peninsula produced peak gusts of 150 mph (Ludlum, 1971). Other storms of notable intensity occurred in 1951, 1953, 1957, 1958, 1963, and 1981 (Ruth and Yoder, 1953; Lynott and Cramer, 1966). Records of damaging windstorms in the Coast Range are generally absent prior to 1950.

The general pattern of land ownership in the Coast Range is closely related to the history of disturbance (Zybach, 1988). The Tillamook Burn became the Tillamook State Forest; the northern portion of the Nestucca Burn and the southern portion of the Yaquina Burn became the Siuslaw National Forest; the Coos Burn became the Elliott State Forest; and the eastern third of the Nestucca Burn and a portion of the northern end of the Siuslaw-Siletz Burns became the largest blocks of land holdings in the BLM's Salem District. A more detailed examination of land ownership and fire history would likely reveal further patterns in land acquisition and forfeiture.

Conclusion:

Further documentation and analysis of the role of disturbance in Oregon Coast Range ecosystems and of vegetation change since European settlement is warranted. We concur with Agee (1990:11) that "The historic role of fire in these Pacific Northwest forests is critical in understanding how these Douglas-fir forests developed, and to what extent they provide habitat for wildlife." The forests stands of the Coast Range have been changing both temporally and spatially, due to disturbance and succession. These forests were both born and destroyed by fire for millennia, however, this simple fact may have complex implications in forest management today and in the future.

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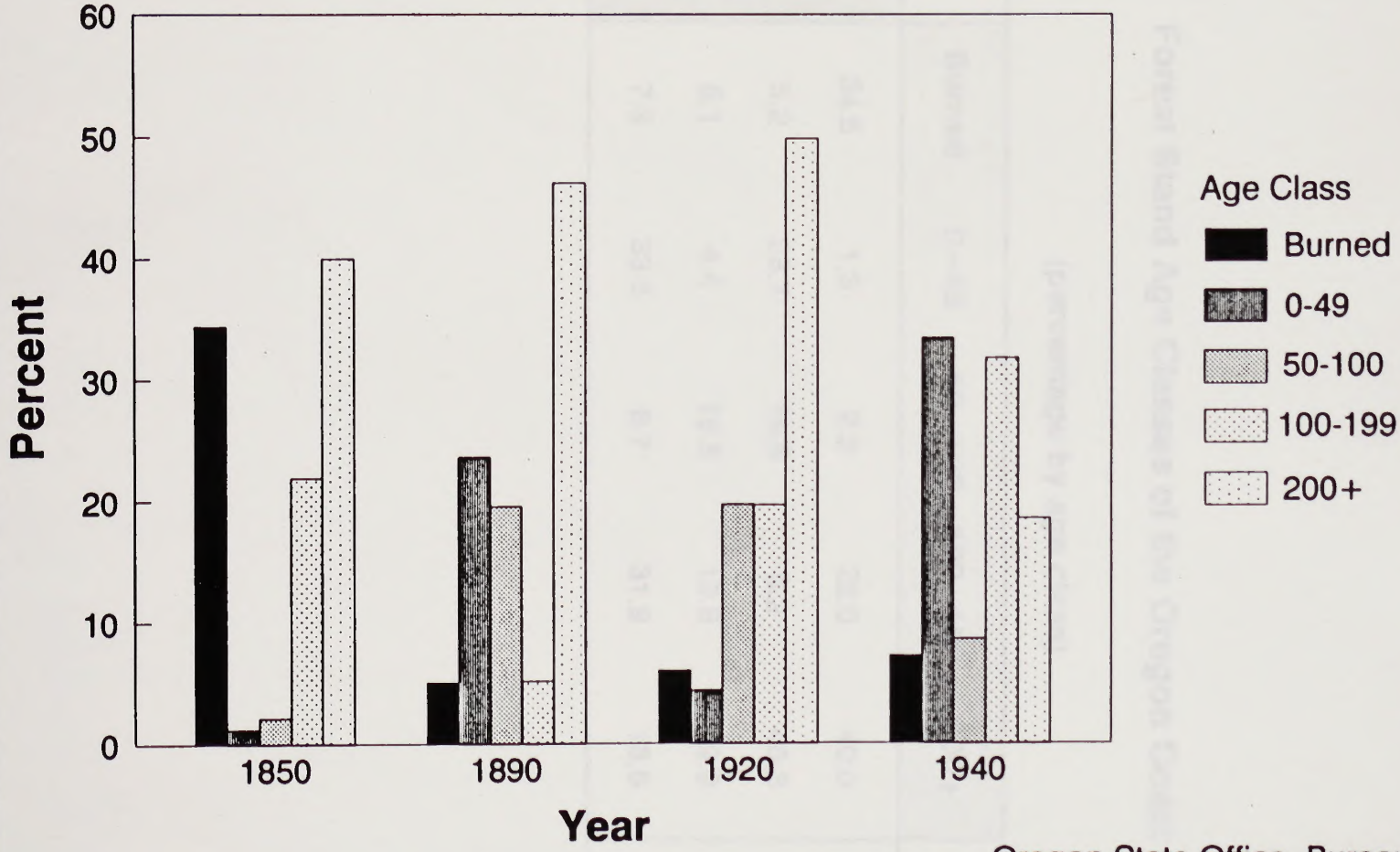
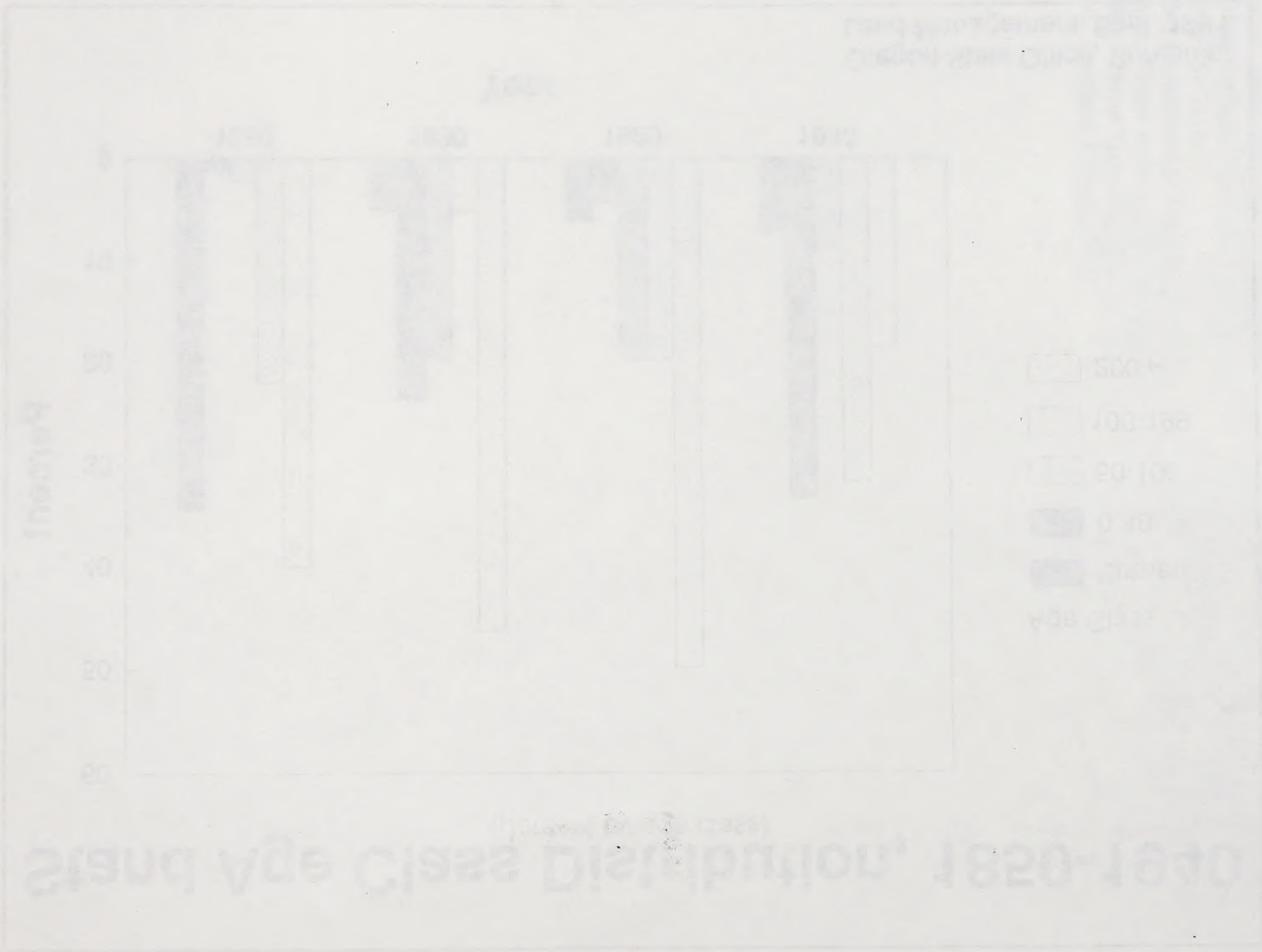
Stand Age Class Distribution, 1850-1940

(percent by age class)



Oregon State Office, Bureau of Land Management, Sept. 1991

Appendix A



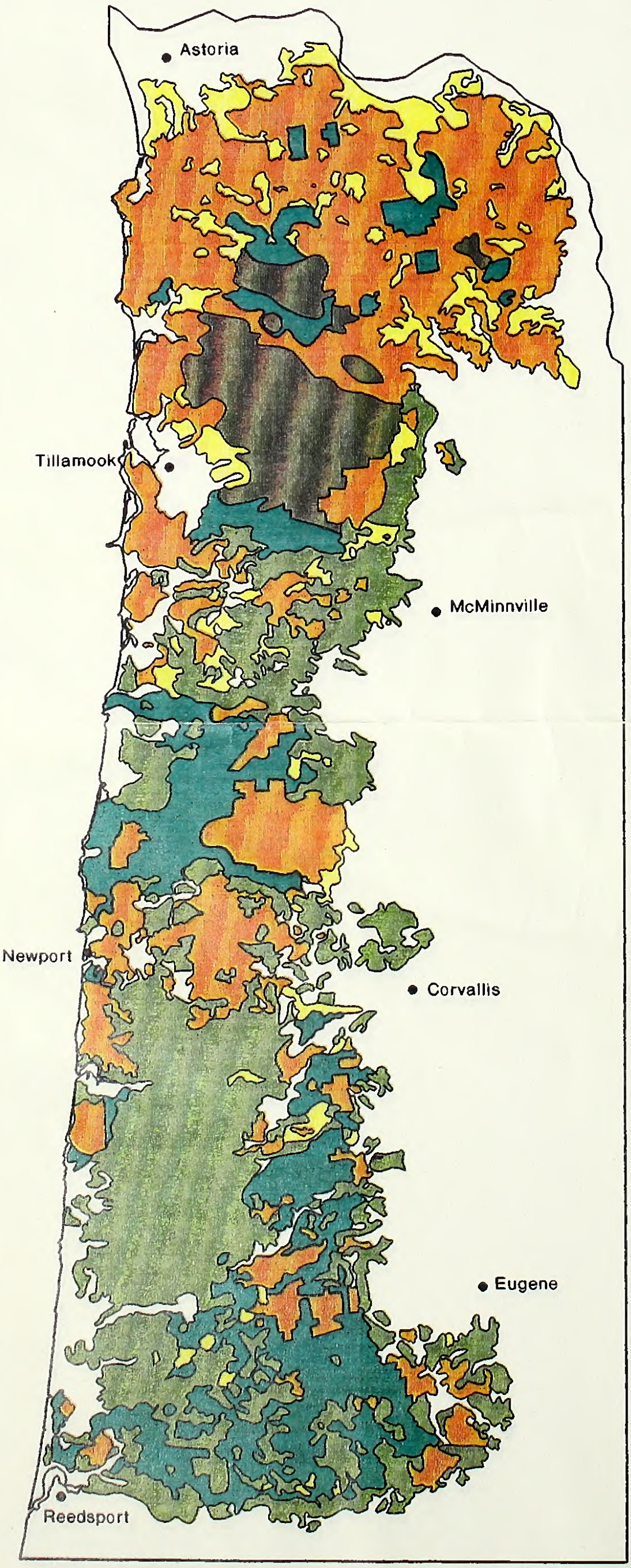
Appendix B

Forest Stand Age Classes of the Oregon Coast Range

(percentage by age class)

Year	Burned	0–49	50–100	100–199	200+	Total
1850	34.5	1.3	2.2	22.0	40.0	100
1890	5.2	23.7	19.6	5.2	46.3	100
1920	6.1	4.4	19.8	19.8	49.9	100
1940	7.3	33.5	8.7	31.9	18.6	100

FOREST STAND AGE CLASSES
OREGON COAST RANGE, 1940



LEGEND

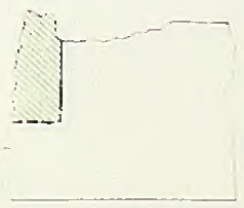
- 200 + Years
- 100 -199 Yaars
- 50 - 99 Years
- 0 - 49 Years
- Recently Burned

20.8 0 MILE 20.8

20.8 0 20.8 KILOMETER

SCALE 1:850,000

N



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Note:
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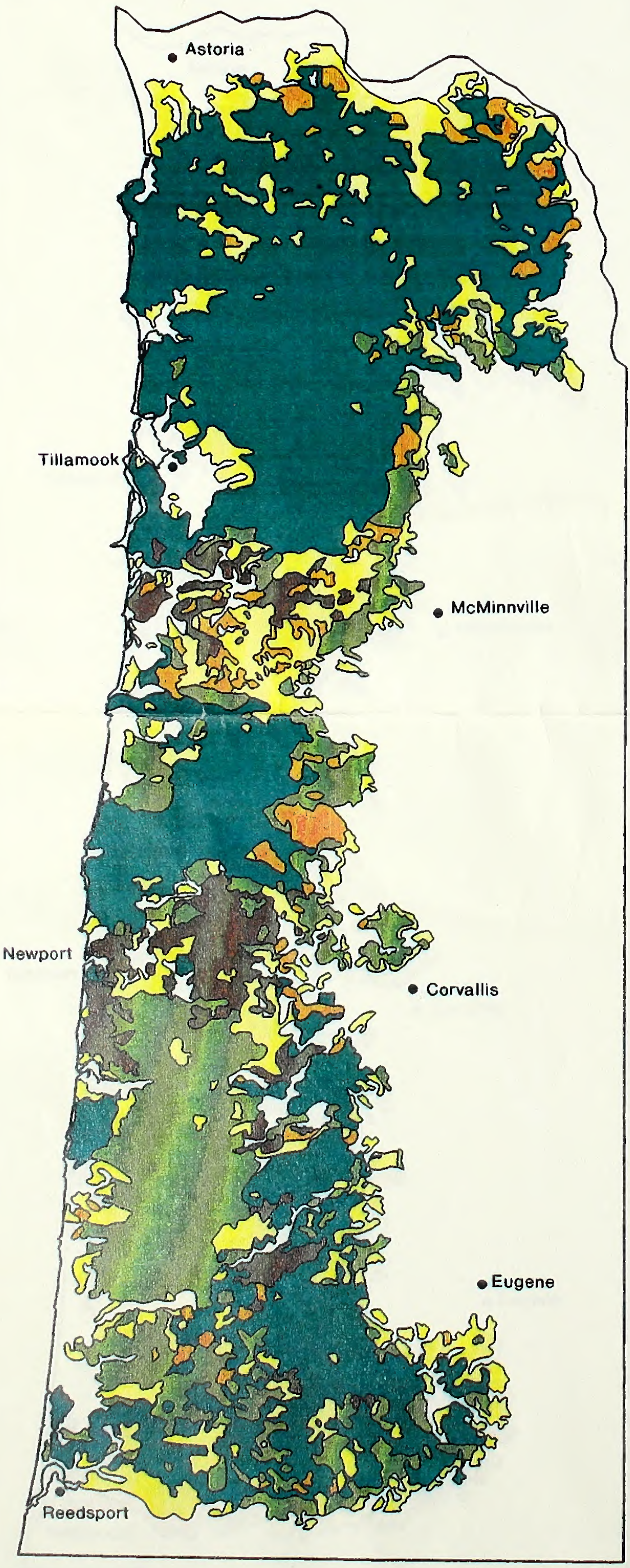
FOREST STAND AGE CLASSES
OREGON COAST RANGE, 1920



LEGEND

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- 50 - 99 Years
- 0 - 49 Years
- Recently Burned

20.8 0 MILE 20.8

20.8 0 20.8 KILOMETER

SCALE 1:850,000

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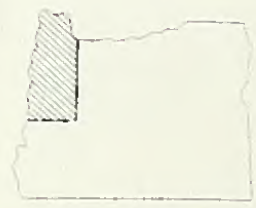

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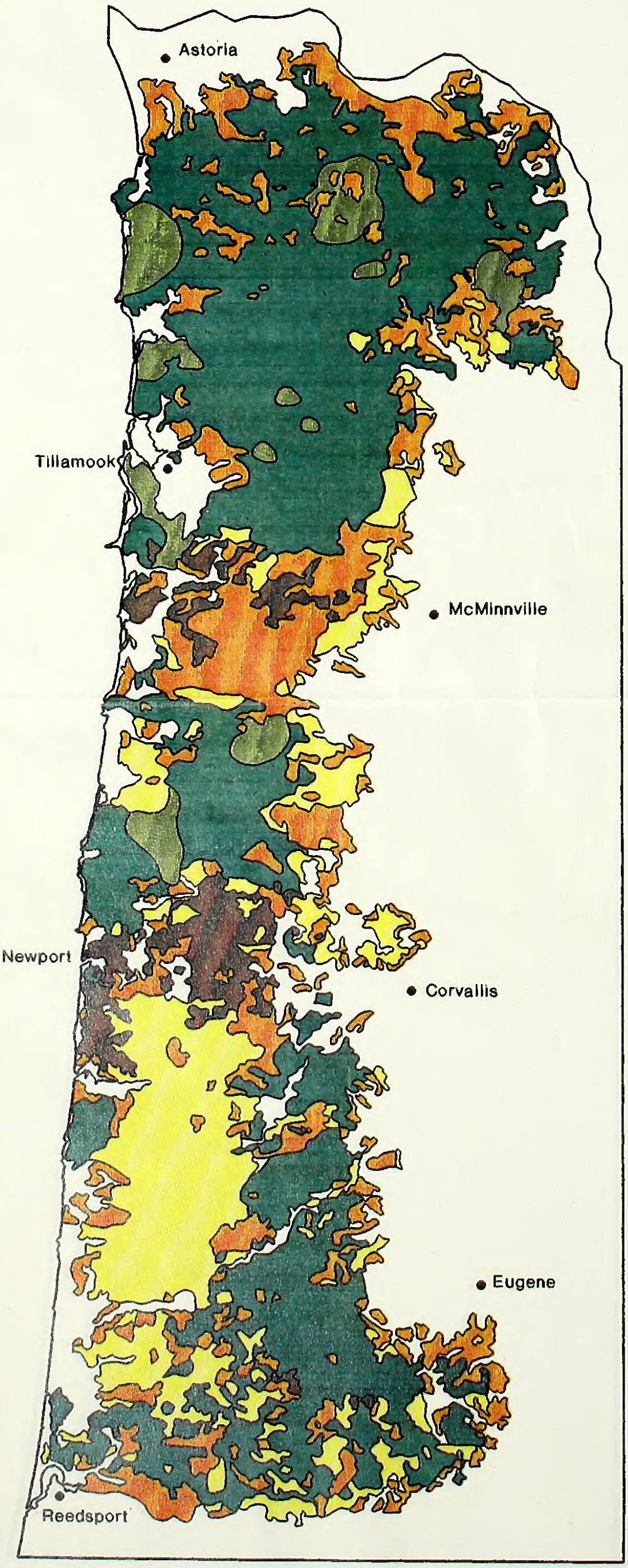
Note:
This map was compiled from reconnaissance field notes. It was digitized from hand interpolated source materials and may differ spatially from digital mapping compiled from other source data. Prepared by Salem District and Oregon State Office, Bureau of Land Management, Sept., 1991.

FOREST STAND AGE CLASSES OREGON COAST RANGE, 1890



LEGEND

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

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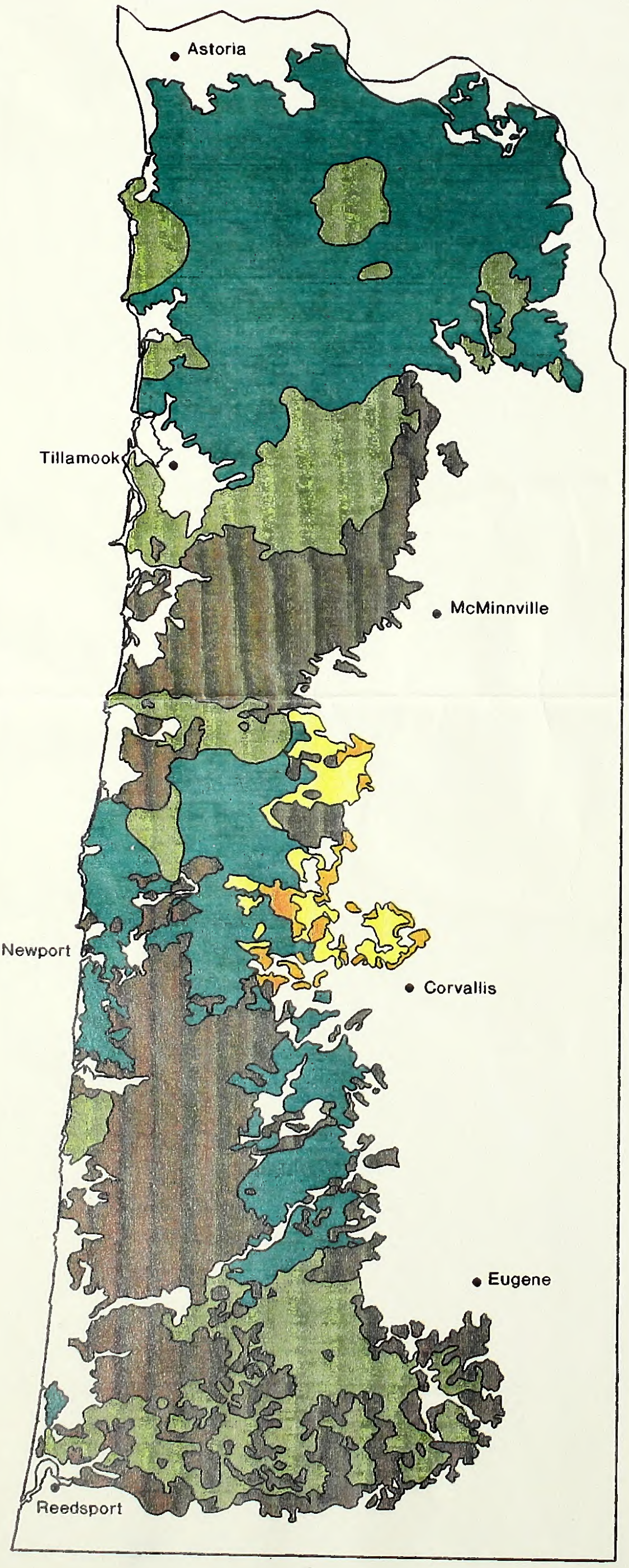
FOREST STAND AGE CLASSES OREGON COAST RANGE, 1850



LEGEND

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

20.8 0 MILE 20.8

20.8 0 20.8 KILOMETER

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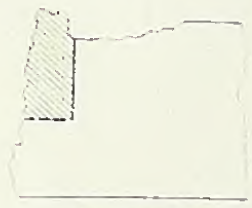

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