

Robert C. McNeill
and
Donald B. Zobel
Department of Botany and Plant Pathology
Oregon State University
Corvallis, Oregon 97331

Vegetation and Fire History of a Ponderosa Pine-White Fir Forest in Crater Lake National Park

Abstract

This paper describes the structure and composition of the vegetation, and some of the environmental factors controlling it, on 7.5 km² of Crater Lake National Park, Oregon. It also gives the approximate dates and locations of most fires that burned in the area between 1750 and 1902. We sampled the vegetation in 64 plots. Wedges cut from 49 fire scars revealed the dates of fires at 24 locations.

Eight communities occur in the four recognized habitat types. Soil formed in alluvial parent material supports the relatively dry *Abies concolor*/*Symphoricarpos mollis* habitat type. Punice alluvial parent material supports an *Abies concolor*/*Chimaphila umbellata* habitat type. Punice alluvial soils have considerably greater plant moisture stress than those on punice. Species community occurs in areas with the water table near the surface in the spring, which probably due to different frequencies of fire before 1902 as well as to the climatic changes with elevation. Fires occurred at a location ranging from nine to forty-two years. The mean interval between fires was generally longer at higher elevations. Areas on opposite sides of a canyon usually did not burn in the same year, and fire years do not correspond with drought years indicated by *Pinus dendrochronological* studies. The occurrence of a widespread fire appeared to reduce the intensity or size of fires occurring in the same area in the following ten years. Most trees now present on the study area started growing during the first forty years after the last fire in 1902; compositional change in overstory and understorey, apparently due to fire exclusion, is obvious in several communities.

Introduction

Much recent literature has emphasized the importance of fire in many of the primeval coniferous forests in North America (Arno, 1976; Habeck and March, 1973; Heinzel, 1973). The absence of fire because of fire control has led to major changes in forest vegetation. Fire is being re-introduced in many ecosystems as a management technique; returning the vegetation in National Parks toward its primeval state is one of the recent uses of fire (Kilgore, 1973a). To use fire successfully in management, certain information is necessary about each individual area, since the effect of fire depends on such things as weather, topography, fuels, vegetation, soils, and the intensity and frequency of the fires. The purpose of this study was to determine the present vegetation structure and composition (with an estimate of that in the primeval forest) and the fire history for an *Abies concolor*-*Pinus ponderosa* forest in Crater Lake National Park. This background information was to be used in the introduction of prescribed burning. This in-

¹Present address: Box 5809, Raleigh, North Carolina 27650

formation can also be used to find some characteristics of naturally occurring fires, and thus can contribute to an understanding of fire as a component of ecosystems and as a factor in evolution. The relationships of vegetation to fire and soils in the study area are probably representative of those over a considerable area in south central Oregon.

The Study Area

The study area is about 7.5 km², located just inside the south boundary of Crater Lake National Park, Oregon, at the base of the east slope of the Cascade Mountains. Except for the 15 to 60 m deep, ravine-like canyon of Annie Creek (Fig. 1), it has a fairly even slope averaging 3.5 percent between 1340 m elevation at the southern end and 1550 m at the northwest edge.

Most of the area was covered by a glowing avalanche deposit of punice from an eruption of Mt. Mazama about 7000 years ago (Olsson, 1970; Rubin and Alexander, 1960; Williams, 1942). This eruption resulted in deposits of sub-rounded punice cobble and gravel in a sand matrix. The soils on the punice resemble the Lapine (Dyrmess and Youngberg, 1966) and the Steiger series (U.S. Bureau of Indian Affairs *et al.*, 1958).

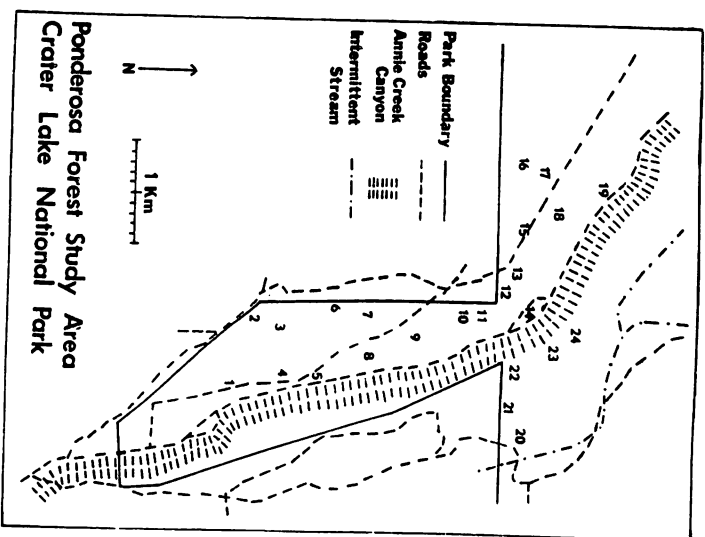


Figure 1. Spots where fire scars were sampled. The number refers to the data reported in Table 4. Two trees were sampled at each spot.

large amount of water at low tensions for a coarse-textured soil (Youngberg and Dyrness, 1964).

The area lies on the strong climatic gradient east of the Cascade Mountains (Franklin and Dyrness, 1973). The mean precipitation is probably between 65 and 85 cm yr⁻¹ (U.S. Dep. Agr., 1964). About 70 percent falls from November to March and less than 10 percent falls from June to August (Sternes, 1963). It is probably safe to assume that the soil is at field capacity shortly after snowmelt, and that soil moisture declines through the summer.

Trappers first entered Klamath County about 1825, but there probably were no white settlements near the study area until about 1863, when a road was built through the area (Good, 1941). Crater Lake National Park was established in 1902, about the time the last fire burned in the area. The "panhandle," which includes much of the study area, was not added until 1932. Parts of this later addition had been logged between 1909 and 1927.

Methods

We sampled the vegetation in 64 plots, 50 of them randomly located along ten east-west transects, which had been selected in a stratified random manner. Fourteen plots were randomly located in vegetation units not adequately sampled on the transects. The data collected at each plot were similar to those of Daubenmire and Daubenmire (1968). All trees over 20 cm tall were tallied by diameter at breast height (dbh) class. Coverage of shrubs and herbs was recorded for each species in fifty 20 x 50 cm microplots. Classification was done in a manner similar to that described by Franklin, Dyrness, and Moir (1970). Nomenclature follows Hitchcock *et al.* (1955, 1959, 1961, 1964, 1969) and Peck (1961) for the few species not in Hitchcock *et al.*

The vegetation can be divided into habitat types based on what the climax dominants of each area appear to be (Daubenmire and Daubenmire, 1968). In the absence of direct evidence of what the climax tree dominants probably would be, the density of small trees of the various species, their shade tolerance, and their apparent health. We assessed the probable shrub and herb dominants by the composition of the understory beneath a nearly closed canopy of the apparent climax dominants, *Abies concolor* or *A. magnifica* var. *shastensis*. The habitat types were sub-divided into communities with relatively homogeneous present vegetation.

Moisture stress of 1-2 m *Abies concolor* saplings was measured at one location in each of five communities before dawn on 17 September 1974, as the pressure potential of the xylem sap, using a pressure chamber (Scholander *et al.*, 1965).

A ground fire may kill a section of cambium at the base of a tree. The thin bark growing over the wound and the pitch which exudes from its edge make this tissue especially susceptible to damage by later fires. These fire scars were used to reconstruct the fire history of individual *Pinus ponderosa* trees. "Scar" or "fire scar" means the whole wound caused by several fires, and "scar" means the wound caused by an individual fire. Scars with a large number of scars were selected at 24 widely dispersed spots (Fig. 1). None were available in the logged area. At each spot two trees, usually within 100 m of each other, were sampled to insure that few fires would be missed, since not all fires scar all scarred trees (Arno, 1976). The fire history for each tree was found by

cutting a wedge from one side of the fire scar and counting the rings outside the individual scars. There were problems with narrow, missing or indistinct rings, insect holes, decay, and later fires destroying evidence of earlier scars. Even the most accurate dates could be off 2 percent of the difference between the date of the fire and 1974. There were sometimes inconclusive indications of a scar; we recorded these. Since fires often reduce growth rate drastically for a few years (Keen, 1937), we also recorded sudden decreases in ring width which occurred during an unusually long interval between scars. We cross-dated the fires to determine the probable dates for individual scars. This system probably gives accurate dates for large fires, but smaller fires are more likely to be dated inaccurately; small fires may be inappropriately grouped with other fires by this method.

Ages of trees of selected sizes along transects in three communities were determined at 20 cm from the ground with an increment borer. In order to estimate the relationship between age and population density, we assumed the distribution of ages within a size class in the vegetation data corresponds exactly to the distribution of ages in the age sample for that size class. For instance, if the ages of four trees of a given species in a given size class were determined, a quarter of the trees in the size class were assumed to be the same age as each of the four trees. The number of age determinations for a given size class of one species ranged from ten for the more common size classes to one for the rare ones within each community.

Results and Discussion

Vegetation

Four habitat types, with eight communities, were recognized and mapped (Fig. 2, Tables 1 and 2). The communities can be separated along gradients of moisture, elevation, and succession, and by type of soil parent material (Table 3). These gradients are not completely independent. Logging and fire history, and relative abundance and sizes of *Pinus* and *Abies* were used to estimate the position of each community on the successional gradient (Table 3).

The *Abies concolor*/*Symphoricarpos mollis* habitat type appears to be the driest (Table 3). It is on soil formed from sandy alluvium deposited after the collapse of Mt. Mazama. The soil in much of the *Melica* community is similar to the soil in the punice flow; however, non-punice gravel is present, varying from almost none to almost all of the gravel. Much of the soil in the logged *Symphoricarpos* community has a darker, thicker A1 horizon with a generally lower proportion of punice. It is questionable whether *A. concolor* would be the sole climax tree dominant in the logged *Symphoricarpos* community (Table 2). However, disturbance often favors plants from drier communities (Franklin and Dyrness, 1973), and the abundant *Carex pensylvanica* may slow tree establishment (USDA Forest Service, 1972).

The *Abies concolor*/*Chimaphila umbellata* habitat type occurs on soil derived from punice flow deposits, and, as is the case with the other types on punice, apparently experiences little moisture stress. This habitat type differs from the one on alluvium in that it has much more *Pinus contorta* and *Salix scouleriana*; several species, including *Symphoricarpos mollis*, *Senecio integerrimus*, *Melica aristata*, and *Hieracium* spp. are less common here (Tables 2 and 3). This habitat type is relatively large and occurs over

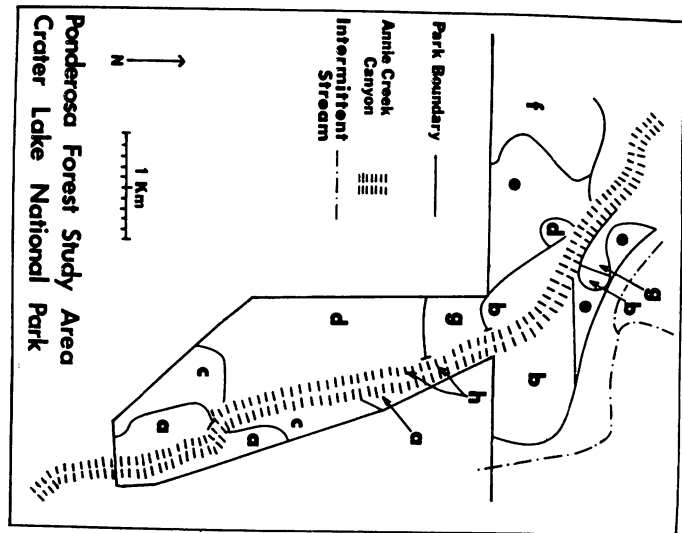


Figure 2. Location of plant communities and habitat types: *Abies concolor*/*Symphoricarpos molli* habitat type: (a) Logged *Symphoricarpos molli* community, (b) *Melica* community, *Abies concolor*/*Chimaphila umbellata* habitat type: (c) Logged *Chimaphila umbellata* community, (d) *Pinus lambertiana* community, (e) Closed *Abies concolor* community, (f) *Abies magnifica* var. *shastensis*/*Chimaphila umbellata* habitat type: *Abies concolor*/*Mesic Species* habitat type: (g) *Mesic Species* community, (h) *Castanopsis* community.

a greater range of elevation than the others. Differences in vegetation within it are probably caused by environmental differences as well as by differences in fire history. For example, *Arctostaphylos nevadensis* occurs only above ca. 1390 m, and *Apocynum androsaemifolium* rarely occurs above 1520 m. At lower elevations much of the *A. concolor* is in patchy, dense thickets of saplings, but at higher elevations it gradually becomes generally distributed. However, inferences about environmental causes are risky; elevation and disturbance are correlated, because the lowest elevations were logged, and the higher elevations were burned less frequently, giving it the aspect of a closed, relatively mature forest.

As one moves up in elevation within the *Abies concolor*/*Chimaphila umbellata* habitat types, the division between the *Pinus lambertiana* and the closed *Abies concolor* communities is approximately at the point at which understory dominants change from *Ceanothus velutinus* and *Arctostaphylos nevadensis* to mostly *Carex pensylvanica* and *Chimaphila umbellata* (Table 3). This division is also approximately where *Pyrola*

TABLE 1. Average density by species and community (trees/ha). Only trees taller than 20 cm are included.

Species	dbh class (cm)	A. concolor/ Symphoricarpos		Habitat Type			Abies magnifica		A. concolor/ Mesic Species	
		Logged Symphoricarpos	Melica	Logged Chimaphila	Pinus lambertiana	Closed A. concolor	Abies magnifica	Mesic Species	Castanopsis	
Populus tremuloides	20-35	3								
	10-20	63								
	0-10	872		129						
Calocedrus decurrens	0-10				16				128	
Pinus lambertiana	95+				2					
	55-75			4						
	20-35				2					
	10-20			4	9					
	0-10			15	375					7
Pinus contorta	35-55				4					33
	20-35			11	4	16	18			
	10-20			114	36	14	68		106	
	0-10			163	231	25	59		27	
Abies magnifica	95+			220	967	103	332			
var. shastensis	75-95						6			
	55-75						15			
	35-55						21			
	20-35					4	30			
	10-20					5	47			
	0-10		7		75	391	3970		10	
Pinus monticola	20-35						3			
	10-20						6			
	0-10					2	201		5	
Tsuga mertensiana	10-20					23	3			
Pseudotsuga menziesii	95+						47			7
	75-95									20
	55-75									26
	35-55									27
	20-35									14
	10-20									
	0-10					2				
Pinus ponderosa	95+		7		20					107
	75-95			4	16	11	12	21		
					11	14	9	10		

TABLE 2. (Continued)

Species	dbh class (cm)	A. concolor/Symphoricarpos		Habitat Type		A. concolor/Mesic Species		Castanopsis
		Logged Symphoricarpos	Melica	Logged Chimaphila	A. concolor/Chimaphila Community	Abies magnifica	Mesic Species	
<i>Ribes viscosissimum</i>								
<i>Clintonia uniflora</i>			+ /50					0.9/60
<i>Ribes lacustre</i>								0.2/75
<i>Rubus parviflorus</i>	+ /13							0.6/60
<i>Rosa gymnocarpa</i>	+ /13							0.1/60
<i>Pteridium aquilinum</i>								+ /40
<i>Carex pensylvanica</i> + <i>C. brainerdii</i>	39.8/100							+ /40
<i>Chimaphila umbellata</i>	+ /13	27.2/100	16.5/100		6.3/58			0.8/60
<i>Chimaphila menziesii</i>	+ /50	0.4/75	0.3/100		1.0/100			0.8/50
<i>Pyrola picea</i>	+ /38	0.2/100	+ /57		+ /58			3.9/100
<i>Brachythecium leibergii</i> + <i>Pohlia nutans</i>	+ /13	+ /25	+ /43		+ /42			0.1/100
<i>Pteropora andromedea</i>	+ /38	0.2/50	+ /71		0.1/67			+ /60
<i>Antennaria rosea</i>	0.2/38	+ /50	+ /71		+ /25			0.2/80
<i>Gayophytum nuttallii</i>	0.8/13		+ /43					+ /40
<i>Coralorrhiza</i> spp.								
<i>Lisiera caurina</i>								
<i>Anaphalis margaritacea</i>	+ /38							
<i>Eriogonum umbellatum</i>	+ /13							
<i>Melica subulata</i>								
<i>Ruellia ruellii</i>								
Number of Plots	8	4	7	12	15	9	5	4

TABLE 3. Position of communities on gradients of soil, moisture, elevation, and succession. ND means not determined.

Community	Soil parent material	Predawn moisture stress (bars)	Elevation (m)	Relative successional stage
Logged <i>Symphoricarpos mollis</i>	Alluvial	-19	1340-1430	Early
Melica	Alluvial	-17	1430-1520	Late
Logged <i>Chimaphila umbellata</i>	Pumice	-7	1340-1410	Early
<i>Pinus lambertiana</i>	Pumice	ND	1370-1520	Middle
Closed <i>Abies concolor</i>	Pumice	-7	1480-1550+	Late
<i>Abies magnifica</i>	Pumice	-6	1510-1550+	Middle
Mesic species	Alluvial and Pumice	ND	1450-1550+	Late
<i>Castanopsis</i>	Alluvial	ND	1340-1450	Middle

secunda and *Goodyera oblongifolia* begin to occur, where *A. concolor* greater than 35 cm dbh become more important, and where small *Pinus ponderosa* almost disappear (Tables 2 and 3). Several understory plants, such as *Epilobium angustifolium* and *Salix scouleriana*, are less important at higher elevation. These changes are not sudden, and there are exceptions to the generalizations.

At higher elevations *Abies magnifica* var. *shastensis* becomes progressively more important. Where the *A. magnifica* var. *shastensis* less than 10 cm dbh outnumber *Abies concolor* of the same size, we recognize the *A. magnifica* var. *shastensis*/*Chimaphila umbellata* habitat type. Uncertainty about successional relationships of the two *Abies* necessitates the use of such an arbitrary distinction. Generally the understory is similar to the upper parts of the *A. concolor*/*Chimaphila* habitat type, with the sparse cover contributed by only a few species, except in some patches in which large *Pinus ponderosa* are located and *Arctostaphylos nevadensis* and *Carex pensylvanica* are fairly abundant (Table 3).

The *Abies concolor*/Mesic Species habitat type occurs in an area with the water table near the surface during the spring and in Annie Creek canyon. It contains several species that indicate moist conditions, such as *Smilacina* spp., *Adenocaulon bicolor*, *Galium triflorum*, and *Clintonia uniflora* (Table 3). The Mesic Species community separates the *Pinus lambertiana* and closed *Abies concolor* communities (Fig. 2). *Abies concolor* is the most important tree, but small areas have important components of *Pinus contorta* or *Picea engelmannii*, and there is a small meadow-like area. The *Castanopsis* community lies in Annie Creek canyon. *Pseudotsuga menziesii* is more important here than elsewhere. The top of the canyon often resembles the *Abies concolor*/*Symphoricarpos mollis* habitat type, and the vegetation becomes more mesic down into the canyon.

The vegetation is described in more detail by McNeil (1975); some communities recognized here result from combinations of the smaller ones he described.

Fire History

Fires rarely burned both east and west of Annie Creek during the same year (compare spots 20-24 with others in Table 4). The Mesic Species community stopped some fires from moving farther north (e.g., 1892, 1841, 1812), but did not stop others (e.g., 1902, 1879, 1846, 1818). So the area can be divided into three parts with different fire his-

TABLE 4. Fire incidence at different spots, 1748-1902. For spot locations, see Fig. 1. A. Each spot includes sears on two trees, usually within 100 m of each other. x = sear formed; (x) = possible sear formed—usually a growth rate decrease and some hint of sear present; map = sears at nearby spots indicate a fire may have burned this one also; interval = usually long interval without a fire; GR = decrease in growth rate that coincided with a fire year; . = date before the first sear on one tree at the spot; | = date before the first sear on both trees at the spot. B. Mean interval between fires, using (1) only definite sears, and (2) all indicators of fire occurrence.

Spot:	Panhandle										Northwest part							Northeast part					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1902		x	x			map	x	x	x	x	x	x	x	x									
1897								x	x														
1892	x	map	x	x	x	x	x	x	x				x										
1889																							
1883	x	x	x																	x	x	x	map
1879				x	x	x	x	x	x	x													
1877													x	x									
1870	x		x																x				
1864	x	x	x	map	x	x	x	x	x	x	x	x	x	x				map	x				
1859																							
1855																				x	GR	Interval	x
1849		x								x													
1846	x			x	GR	GR	x	(x)	x	map	x	x	x	x	x	x	x	x					
1841	x	x	x	x	x	x	x	x	x														
1831																							
1829	x																						
1826					GR	GR		x	x														
1818	x	map	x	map	x	map	x	map	x	x	x	x	x	x	x	x	x	x					
1815																							
1812	x	x	x	x	x	x	x	x	x														(x)
1804	(x)																						
1800	x																						(x)
1798																							
1797	x	x	map	x	x	x	x																
1791																							
1788																							
1786																							
1782-84	x		x		x	x	x		x	x													
1779																							
1776	GR	x																					
1775																							
1773																							
1771																							
1770																							

TABLE 4. Fire incidence at different spots, 1748-1902. For spot locations, see Fig. 1. A. Each spot includes sears on two trees, usually within 100 m of each other. x = sear formed; (x) = possible sear formed—usually a growth rate decrease and some hint of sear present; map = sears at nearby spots indicate a fire may have burned this one also; interval = usually long interval without a fire; GR = decrease in growth rate that coincided with a fire year; . = date before the first sear on one tree at the spot; | = date before the first sear on both trees at the spot. B. Mean interval between fires, using (1) only definite sears, and (2) all indicators of fire occurrence.

A.	Panhandle										Northwest part							Northeast part						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1769	x	x	x	x	x	x				GR														
1762																								
1759	x						map	x	x	x			x	x	x					x	x	x	x	
1755	x			x																				
1751																								
1748																								
B. Mean interval between fires.																								
(1) Sears only	9	14	15	15	15	18	12	14	13	30	19	14	18	15	28	42	22	33	18	22	—	23	22	—
(2) All indicators	9	12	13	12	12	12	11	12	12	24	19	14	18	15	28	42	22	24	18	19	—	18	20	—

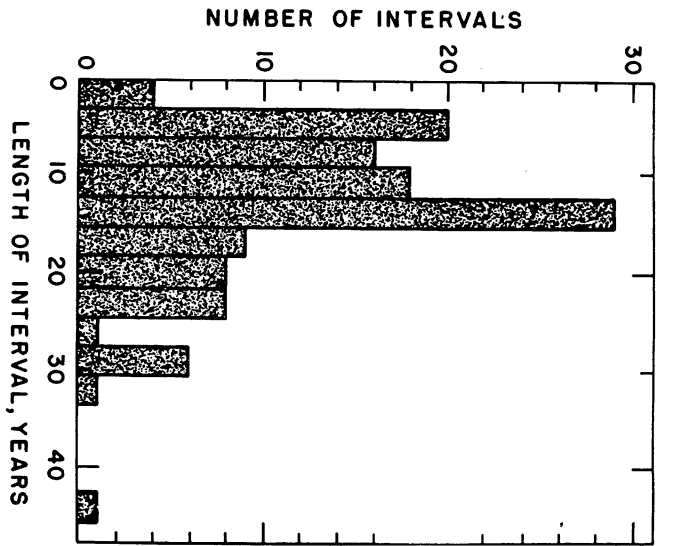


Figure 3. Frequency distribution of intervals between fires on fire scars in the panhandle area.

ories: 1) the panhandle; 2) the northwest part; and 3) the northeast part. The difference between the "long" and "short" estimates for the mean interval between fires at a spot (Table 4) is small when compared with the variance of intervals between fires (Fig. 3). These means are comparable to those found in other parts of Central Oregon (Keen, 1937; Sherman, 1969; Soeriatmadja, 1965) and somewhat longer than in the mixed conifer forest for the Sierra Nevada (Wagner, 1961; Kilgore, 1973a). In order to maintain a "natural" mosaic of communities with prescribed fire, it may be necessary to imitate the frequency distribution rather than just the mean interval. For instance, intervals of 15 years or more without fire were not uncommon (Fig. 3). These spots may have provided refuge for species poorly adapted to fire—for example, those which require that long to reproduce.

Fire frequency and vegetation are correlated to some extent. Fire incidence decreases with increased elevation toward the northwestern part of the study area (Table 4, Fig. 1). It is somewhat lower in the Mesic Species community than immediately above or below. *Ceanothus velutinus* is dominant only where the mean interval between fires was 15 years or less, and it is almost absent where the interval was greater than 20 years. Others have noted that fire history can cause important differences in vegetation in this region (Dyrness and Youngberg, 1966; West, 1969).

Comparison of the dates of the fires with Keen's (1937) dendrochronological record for south central Oregon indicates that there is little relation between the years that fires occurred and those in which *Pinus ponderosa* growth was less than average, which Keen concludes are the drier years. Of forty fire years, sixteen had growth less than average; eighteen had better than average growth; the other six were very close to average. Of seventeen years with extensive fires (those which left scars at more than half the spots in one of the three parts of the study area), seven had greater than average growth. The inference that fires are not limited to the driest years is supported by the occurrence of fires in different years on the two sides of Annie Creek (Table 4). Years dry enough to allow extensive fire appear to have been fairly common.

One factor controlling the intensity and size of a fire is the fuel accumulation since the last fire. Evidence for its effectiveness occurred in our data. The upper limit to the percentage of trees scathed by a major fire increases with time since the last large fire (Fig. 4). This effect can be seen by comparing the panhandle and the northwest part for the 1846 and 1818 fires (Table 4): these fires were apparently less intense, scarring fewer trees, in the panhandle where a large fire had recently burned.

Parts of the closed *Abies concolor* community have not burned since 1846, probably

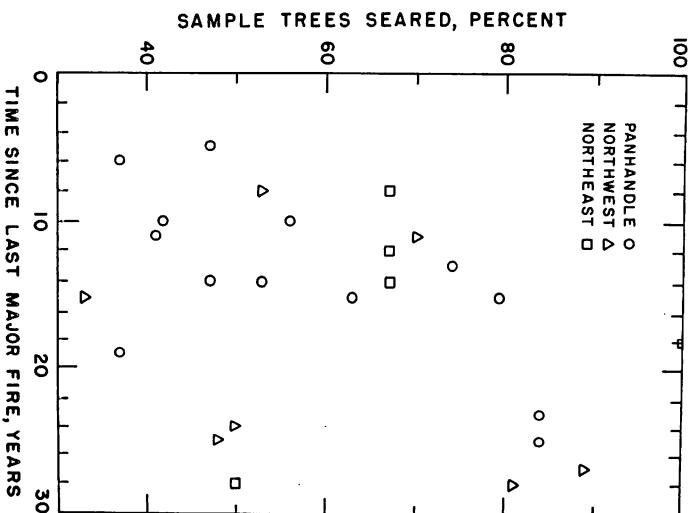


Figure 4. Relationship between years since last major fire and the proportion of sampled trees that were scathed, for all major fires between 1748 and 1902.

accounting for its high density of *Abies* and its sparse understory. The fact that fire did not occur here from 1846 to 1902 and that there are few 10-55 cm dbh *Pinus ponderosa* may indicate that this area would become dominated by *A. concolor* even without fire control.

Because of the small size and irregular shape of the study area, little can be said about the size of the fires. The large fires burned outside the study area, so their area is more than the 400 ha west of Annie Creek. Many of the small fires may also have burned outside the study area. From 1800 to 1902 there were about 15 fires that seared three or more adjacent spots; however, 12 to 16 or more fires seared only one or two spots that were well separated from any other spots seared the same year. This large number of small fires is somewhat surprising, because between 1930 and 1974 only two lightning fires were recorded in the study area (Fire Atlas, Crater Lake National Park). However, in each of the two years of this study we observed one large *Pinus ponderosa* killed by lightning, so lightning strikes probably are fairly common.

Effects of Fire Exclusion

Figure 5 shows the tree age-density relationships for one community. These and sim-

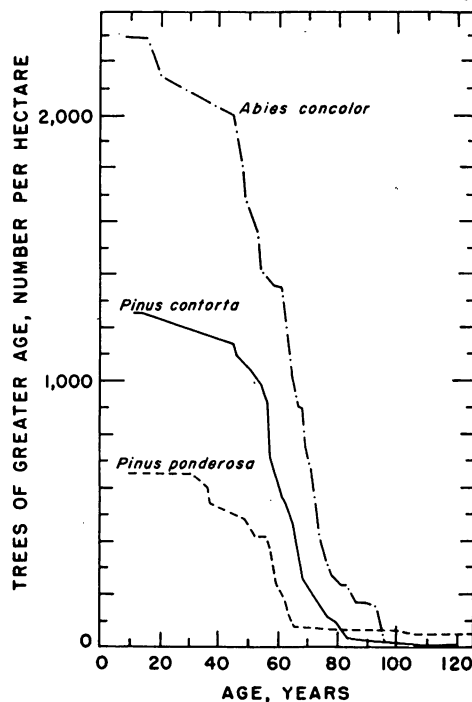


Figure 5. Estimate of the relationship between tree age and density for major trees in the *Pinus lambertiana* community. The position of the line for a given year represents the density of all trees that age and older.

ilar data from other communities indicate that most of the trees over 20 cm tall germinated within 30 or 40 years after the last fire; since then establishment of trees has decreased. It appears that *Abies concolor* may have become established more rapidly after the last fires than *Pinus ponderosa* or *Pinus contorta*, but this finding may be an artifact resulting from difficulty of counting rings in these severely suppressed *Pinus*. Repeated fire would have favored *Pinus* (Kilgore, 1973b; Lunan and Habeck, 1973), probably because of the thick bark of some species (Franklin and Dyrness, 1973) and their low shade tolerance (Atzet and Waring, 1970). Other changes are taking place in the understory due to increased shade or litter accumulation; for example, dead shrubs of *Ceanothus* and *Arctostaphylos* are common in areas where a closed *Abies* canopy has recently been established.

Acknowledgments

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Tim W. Clark
Department of Biology
Idaho State University
Pocatello, Idaho 83209

A Listing of Reports on Black-Footed Ferrets in Wyoming (1851-1977)

Abstract
One hundred and forty-eight black-footed ferret (*Mustela nigripes*) reports from Wyoming (1851-1977) are recorded, complete with an evaluation of each.

Black-footed ferrets (*Mustela nigripes*) are one of North America's rarest mammals (Cahlane, 1954; Lindner and Hillman, 1973; Clark, 1976). In states which are undergoing rapid change through energy and mineral development and mushrooming human population, information is imperative on rare, threatened, and endangered species for distribution to the largest possible audience. From knowledge of the distribution and precarious situation of this species, plans can be made to minimize human impacts on them. Comprehensive ferret listings for several states have been published, but none currently exists for Wyoming. The first listing of eight Wyoming ferret reports was by Long (1965). Hershkovitz (1966) reported seeing a ferret in central Wyoming. Clark (1973) gave 18 additional reports. The first major effort to collect and evaluate ferret reports in Wyoming was initiated in 1973 (Clark, 1978). The increased number of reports in recent years does not reflect an increase in ferrets, but instead a growing concern for the animal's decreasing numbers. The following list of 148 reports gives ferret information from 1851-1977.

The following table gives all those ferret reports which appeared to be positive or probably so. Each report was classified as: 1) *Positive*—if the observer showed physical evidence (e.g., skin, photograph or ferret trenches); or if he was a biologist or professional field-oriented worker (e.g., geologist, range manager), if the region had a documented history of ferret sightings, and if the habitat was characterized by abundant ground-dwelling scurrids (especially prairie dogs). If the sighting was in white-tailed prairie dog habitat, presence of suitable prairie prey during winter was required. 2) *Probable*—if the observer gave an accurate description, identified a ferret from a series of muskeld pictures, and characterized the animal's behavior in detail. The report had to be supported by other independent sightings, or other evidence of ferrets in the immediate area.

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