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SUMMARY OF OREGON PINE IPS DAMAGE IN PACIFIC NORTHWEST From 1952 to 1962 and SUGGESTED MEASURES FOR AND PREVENTING IPS OUTBREAKS IN YOUNG PONDEROSA PINE STANDS

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SUMMARY OF OREGON PINE IPS INFESTATIONS IN PACIFIC NORTHWEST From 1952 to 1962 and SUGGESTED MEASURES FOR PREVENTING IPS OUTBREAKS IN YOUNG PONDEROSA PINE STANDS

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SUMMARY

A total of 388,800 acres of young ponderosa pine in the Pacific Northwest was infested with Oregon pine ips from 1954 to 1963. 1/ About 84 percent of the damage occurred in Oregon and 16 percent in Washington. Outbreaks of this beetle appear to be related to stand disturbances, climatic variations, and site conditions. Losses caused by Oregon pine ips in or near thinning areas can be minimized by restricting thinning operations to trees 3-inches D.B.H. and smaller year-round or to thinning trees 3 to 5 inches D.B.H. when the beetles are least active, usually August through January. Thinning trees larger than 5 inches is a calculated risk January through August. The susceptibility to beetle attack appears to be related to spring precipitation. Beetle losses tend to increase as moisture decreases.

INTRODUCTION

Managing young ponderosa pine stands for the future is of primary concern to today's forester. Considering that over 80 percent of the five million acres in the Pacific Northwest Pine Subregion is overstocked with ponderosa pine poles and saplings, new management problems are arising as foresters apply silvicultural methods to improve these stands (11).2/ These silvicultural methods are desirable to improve the quality and vigor of the trees. One silvicultural method is thinning.

Thinning is an artificial method of obtaining desired stocking by removing some trees from the stand to provide sufficient growing space for the leave trees. If this condition is not met, there is a gradual decrease in tree and stand vigor. Weakened trees fade slowly from the stand, sometimes taking years to die. In a weakened condition, the trees may be attacked by insects and diseases which sometimes build up to epidemic proportions, endangering the entire stand.

One of the most common group of insects that build up to epidemic proportion in young ponderosa pine stands are the various pine engravers belonging to the genus Ips. In Oregon and Washington, the most serious is the Oregon pine ips, Ips pini Say.

1/ Ips pini Say

2/ Underlined numbers in parenthesis refer to Literature Cited, page 15.

This report summarizes past Oregon pine ips damage in the Pacific Northwest by administrative area, establishes hazard zones, and discusses factors that influence outbreak as well as those controlling outbreaks. Although many gaps still exist, the information at hand may provide a better understanding of the problem and aid in management of affected pine areas to lessen the Oregon pine ips hazard.

HISTORY OF LOSSES

Before 1954

When the annual aerial detection survey began in 1947, only damage caused by insects of major concern was reported. Oregon pine ips was not included in this group until 1953 when spectacular losses were reported (9). In previous surveys and unpublished reports, references were made only to "ips years", with no acreage or number of trees killed being reported. The term "ips years" has been used to describe the spectacular losses that occur periodically over fairly wide areas.

A brief resume of the 1953 annual survey report showed a total of 122 infestation centers had occurred on 75,700 acres in the Pacific Northwest. The majority of the losses occurred in Oregon where 108 infestation centers on 71,900 acres were reported. In Washington, tree killing was light with only 14 infestation centers on 3,800 acres. The 1953 report also commented that heavier losses had occurred in 1952. Although no additional information is available, 1952 as well as 1953 were classified as "ips years".

After 1954

From 1954 through 1962, a total of 1,636 Oregon pine ips outbreaks occurred on 388,800 acres in the Pacific Northwest (tables 1 and 2). The generalized problem areas are shown in figure 8 in the appendix. This damage ranged from 91,940 acres in 1956 to 10,840 acres in 1958. The year 1956 was classified as an "ips year". There were other "ips years". Spectacular losses occurred in 1955 when 51,910 acres of young pine were reported infested, and again in 1959 when 63,240 acres of trees were damaged.

A total of 327,330 acres or 84 percent of the total infestation in the Pacific Northwest occurred in Oregon. This damage varied from a low of 7,520 acres in 1958 to a high of 82,720 acres in 1956 (table 1, figure 1). The average yearly infestation was 36,370 acres.

Oregon pine ips damage in Washington has generally been moderate to light. Only 61,470 ips-infested acres or 16 percent of the total regional loss was reported between 1954 and 1962 (tables 1, 2; figure 1). The annual total number of acres infested ranged from a high of 25,800 acres in 1959 to a low of 1,760 acres in 1957 (table 1, figure 1). The average infested area during the nine-year study period was 6,831 acres.

HAZARD ZONES

Normally, Oregon pine ips outbreaks are light, quite widespread, and may cause some alarm locally. However, there are areas in Oregon and Washington where the beetle outbreaks have persisted causing some losses from year to year, changing not only in the degree of infestation but in size. Based on frequency and degree of these losses, three hazard zones--high, moderate, and low--were arbitrarily established for the Pacific Northwest Region (figure 7). The high-hazard zone represents the area where tree losses have been heavy and continuous. The moderate zone encompasses the area of medium but continuous losses; the low-hazard zone is comprised of areas where losses have been light and intermittent.

The heaviest and most frequently infested area has been the Blue Mountains, located in the northeast corner of Oregon and southeast corner of Washington (figure 8). This area accounted for 67 percent or 260,055 acres of the losses in the Pacific Northwest. The majority of these losses occurred on or near the State of Oregon's Central District, the Umatilla Indian Reservation, and the Wallowa-Whitman, Malheur, and Umatilla National Forests (table 3, 4; figures 2, 3, 5). Losses on the Umatilla National Forest and nearby forest lands were recorded as occurring either in Oregon or Washington.

The area outlined as the moderate hazard zone represented 31 percent, or 121,505 acres, of the Regional losses. This zone includes the Spokane, Colville, Yakima, and Warm Spring Indian Reservations; the Colville, Kaniksu, Okanogan, Wenatchee, Fremont, Mt. Hood, Ochoco, and Rogue River National Forests; and the Northeast and Glenwood Districts of the Washington State Department of Natural Resources. The remaining two percent, or 7,240 acres, of damage occurred on the Deschutes and Winema National Forests in Oregon. This area was the low-hazard zone (figure 7).

Oregon pine ips damage reported on the Colville and Kaniksu National Forests and the Washington State Department of Natural Resources Northeast District is for a three-year period from 1960 through 1962 (table 6, figure 5). Previously, this area was surveyed by U.S. Forest Service, Region 1 entomologists and not until 1960 was Region 6 given the responsibility for making the annual insect and disease surveys.

Oregon pine ips damage is not restricted to the east side of the Cascade Range. Some tree killing has occurred in the ponderosa pine stands on or near the Willamette, Siuslaw, Umpqua and Siskiyou National Forests. During the nine-year period, 1954 through 1962, 23 infestation centers on 8,380 acres were reported on these areas (table 5). Most of the damage reported on these areas was of light intensity with the largest proportion occurring on the dry, rocky pine sites on the Siskiyou National Forest and adjacent forested areas. No hazard rating was given to this area.

FACTORS INFLUENCING OREGON PINE IPS OUTBREAKS

Most Oregon pine ips outbreaks can be traced to environmental factors such as stand disturbances, climate and site.

STAND DISTURBANCES

Stand disturbances, caused either by nature or man, may at times trigger an Oregon pine ips outbreak in young ponderosa pine stands. Some of the natural causes include windfall, snow breakage, fires and drought. Man-made causes include fires, logging and any other forms of land clearing that create slash material or injure standing trees. Chief among these are the construction of roads, telephone lines, pipelines, powerlines and the precommercial thinning of young pine stands.

CLIMATIC FACTORS

Probably the most important environmental factor influencing an ips outbreak is the intricate relationship that exists between temperature, light, precipitation, humidity and wind, known as climate and weather.

The various physical climatic and weather factors are continually operating and affecting an insect population directly and indirectly. Direct effects often regulate natural control of the beetle population from egg to adult, while the indirect effects influence the host condition which predispose the host tree to insect attack.

SITE FACTORS

Site factors are difficult to measure because the interacting forces are not fully understood or adequately integrated in any description of site. The standard practice used today for measuring ponderosa pine sites is either based on quality by measuring the optimum height of mature dominant trees or by establishing an index based on tree height at 100 years (6). Generally, Oregon pine ips damage has been heavier on the lower-quality ponderosa pine sites than on higher-quality pine sites. In the Pacific Northwest these poor sites are usually found along the fringe of timber adjacent to the sagebrush and on rockflats and outcroppings.

PREDICTING AND CONTROLLING OREGON PINE IPS OUTBREAKS

Predicting Oregon pine ips outbreaks is imprecise because much of the biological information pertaining to the exact conditions favoring an outbreak is lacking. Since the beetles can never be eradicated, when too thin, what size of stand to thin, and how to dispose of the resulting slash are important factors to consider before starting large scale thinning operations. Failure to adequately assess the influence of these factors may cause a beetle outbreak.

WHEN TO THIN

Stands can be thinned year-around, but there is always a chance of causing a beetle outbreak. A study by W.J. Buckhorn showed that many outbreaks could be avoided if trees are not thinned or logging slash created during the period February through July (1). He found fewer green standing trees were

attacked by Oregon pine ips when slash was created between August through January.

His data are as follows:

HAZARD TO RESIDUAL STAND		LIMITED-HAZARD TO RESIDUAL STAND	
Month of cutting	Percent of loss	Month of cutting	Percent of loss
February	10.4	August	1.0
March	18.2	September	.7
April	19.3	October	.3
May	24.2	November	.3
June	18.1	December	.7
July	5.5	January	1.3
Total	95.7		4.3
		Total	100.0

Slight variations of the above periods may occur due to weather conditions. These conditions are changing continually. Probably the two most important factors influencing a beetle outbreak are precipitation and soil moisture.

A study made by R.C. Hall showed the percent of normal precipitation between April and July to be sufficient for predicting the degree of ips infestation in California (2). The base for making the prediction is as follows:

Precipitation Percent of Normal	Prediction Degree of Loss
150 or greater	very light
100 to 150	light
75 to 100	medium
Less than 75	heavy

This method has been used in California since 1950 and the predictions have been about 75 percent correct. Discrepancies often occur during years of about normal precipitation. The predictions have been fairly accurate at the extremes of 150 percent and greater at 50 percent. Predictions in the normal precipitation range are often inaccurate.

An analysis of 1957 to 1962 precipitation data and Oregon pine ips losses in northeast Oregon was made using Hall's method for predicting ips losses (figure 6). Northeast Oregon was selected because it is the most heavily-infested area and the only high-hazard zone in the Region (figure 7). The boundary of this zone closely followed the U.S. Weather Bureau's Northeast Division from which the precipitation data were collected (12). The precipitation long-term mean for the period between April and July is 5.72 inches. For the seven-year period from 1957 through 1963, precipitation fluctuated from a high of 7.88 inches or 138 percent of average rainfall in 1958 to a low of 3.62 inches or 63 percent of average in 1961 as shown in the tabulation on page 6.

Year	Precipitation Percent of Average	Tree Killing Predicted	Tree Killing Actual
1957	100	Moderate	Moderate
1958	138	Light	Light
1959	68	Heavy	Heavy
1960	99	Moderate	Heavy
1961	63	Heavy	Light
1962	81	Moderate	Heavy
1963	95	Moderate	Moderate

This analysis indicated that Hall's method is applicable in Oregon. Some years, however, predictions are not accurate. Predictions in 1960, 1961 and 1962 were unreliable, indicating that some factor other than precipitation influences Oregon pine ips outbreaks. Hall found this to be the case some years in California, also (2).

Other studies have shown soil moisture is an underlying cause in many beetle epidemics (2, 7, 14). No correlation could be made with this test because soil moisture data for the area under consideration were not available.

Although Hall's method does not actually determine when to thin, it does aid in predicting loss that can be expected when the stand is thinned. The only factor needed to make this prediction is the total rainfall between April and July. Rainfall data can be obtained from the U.S. Weather Bureau's Monthly Climatological Bulletins. These bulletins list total rainfall by stations and also indicate how much moisture fell above or below the normal for each station.

To use Hall's method, select five or ten weather stations near the proposed thinning area and determine the average annual rainfall for the period between April and July. This figure remains constant while the current rainfall for the same period fluctuates. Divide the average annual rainfall by the current rainfall to determine what percent of normal precipitation fell between April and July. Using the same percentage base established by R.C. Hall, the degree of loss can then be predicted.

Based on the results of Buckhorn's and Hall's studies, trees thinned during the hazardous period are a calculated risk, and this risk increases with every percentile of spring precipitation below normal.

These studies by Buckhorn and Hall have shown the forester when the beetle hazard to the residual stand is low and how to predict possible tree losses. Results of a survey made by D.C. Mook on the Malheur National Forest indicate that the beetle can also cause loss of tree growth, quality, and even change the stand type (8). This study showed that many young pine killed by the Oregon pine ips were often replaced by other trees in thinned and unthinned stands. In the thinned stands where heavy ips losses were reported, 19 percent of the dead pine were replaced by either white fir or a Douglas-fir. For areas where very heavy ips tree killing was reported, only 5 percent of the dead trees were replaced. Replacement trees in thinned stands were seedlings not removed during thinning operations.

About 70 percent of the dead trees were replaced in the unthinned pine stands where heavy tree killing was reported. For those stands where very heavy tree killing occurred, 80 percent of the dead pines were replaced by another tree, usually white fir or Douglas-fir. Besides the loss of several years' growth, many of these replacements were the suppressed undesirable tree species rather than the ones left as crop trees in the thinning program.

WHAT TO THIN

The size of tree to cut is an important factor to consider in keeping beetle losses to a minimum, and meet the thinning objectives. Oregon pine ips attack trees and slash 2 to 10 inches in diameter, but seldom complete their development in trees or slash less than 3 inches in diameter. This is probably due to the fact that smaller diameter trees usually have thinner bark and tend to dry out faster than the larger diameter trees. Trees over 5 inches in diameter appear to be the favored size class for Oregon pine ips.

There is a direct relationship between bark thickness and diameter (4), but the optimum bark thickness beneath which most Oregon pine ips broods develop is not known. However, a study made in northern California on the California five-spined engraver, Ips confusus (Lec.), a species closely related to the Oregon pine ips, revealed that most insects were produced under bark 1/4 to 1/2-inch thick (10). Vigorous broods were also found under bark as thin as 1/8 inch and as thick as 3/4 inch. No broods were found in trees with bark more than 1 inch thick.

Thinning specifications on Forest Service lands in the Pacific Northwest are based on diameter limits. Those stands averaging over 5 inches D.B.H. are not usually thinned but held in anticipation of a roundwood market developing in the near future. Stands averaging under 5 inches D.B.H. have been designated for precommercial thinning with first priority given to stands averaging under 3 inches D.B.H.

Thinning trees 3 inches and smaller--Stands averaging less than 3 inches D.B.H. can be thinned all year with little beetle hazard. Slash of this size is often attacked but does not afford sufficient cambium area to accommodate large concentrations of beetles. The slash dries out rapidly, even when partially shaded. Beetles do not favor old, soured, or partially dried slash as a brood site.

Thinning trees three to five inches--Ponderosa pine stands between 3 inches and 5 inches in diameter can be thinned safely during the period when the beetles are least active, usually August through January. Trees of this size can be thinned during the more hazardous period between February and July, but some risk may be involved. Beetle losses may or may not occur from populations developing in slash laid down in this period. This material usually has the bark thickness of 1/4 to 1/2-inch that favors beetle attack and development.

SLASH DISPOSAL

When a stand is thinned, the following factors should be considered to keep beetle losses at a minimum:

1. It is better not to leave thinning or logging slash in the shade. Whenever possible, heavy concentrations of slash should be scattered into openings for rapid drying.

2. Trees should be felled into openings to avoid damage to pole and sapling stands. Oregon pine ips and other bark beetles often attack trees injured during logging and thinning.

Slash disposal may be necessary regardless of the precautions taken. If the need arises, infested slash should be destroyed or treated before the beetles emerge to attack green standing trees, usually by late June. Slash can be destroyed mechanically or treated with chemicals.

Mechanical methods include lopping, scattering, chipping, or piling and burning. Chipping may be the best method to use along roads and in recreational sites. The advantage in chipping is that the chipper can be used during the fire season up to the time the beetles fly. The pile and burn method is restricted to low-hazard burning seasons, usually early spring.

Chemical methods are costly, but can be used during the fire season up to the time the beetles fly. The most promising chemical developed so far for treating ips infested material is a solution of lindane in fuel oil (3, 5) This is applied to infested material at the rate of one pint per 20 square feet.

Lindane is a residual-type insecticide that crystallizes when dry and should be applied one to two weeks prior to beetle flight. The beetles are killed as they emerge from the treated material. Timing is important when using lindane.

DETECTION OF OREGON PINE IPS OUTBREAKS

Generally, Oregon pine ips outbreaks are sporadic, short-lived and seldom persist on a given area for longer than two seasons. The beetles first appear in early spring and continue through fall. In southern Oregon, there are generally three to five generations annually; while in central and eastern Washington, there may be two to three generations annually depending upon location. Usually an outbreak subsides as quickly as it arises, disappearing the first year, but occasionally continuing into the second year or longer if conditions remain favorable.

Continuous tree killing may occur on any one area for several years. Hence, the area of infestation might be recorded on the same area during several successive aerial surveys. However, tree killing is no longer recorded when all trees in an area have been killed or the number of trees attacked falls below the epidemic level of 20 trees per section.

Early detection of outbreaks is important. An annual aerial survey is made to detect and map insect infestations by previously-established

standards. Since the aerial survey is usually made late in summer, most of the damage observed and mapped is the result of the previous fall attacks and the present spring beetle activity. Classification of Oregon pine ips damage from the air is based on the number and distribution of red-top trees per section and the number of dead trees in a group (13).

Infestation Intensity	Number Trees per Section	Number Trees per Group
Light	20 - 50	0 - 5
Moderate	50 - 100	6 - 10
Heavy	100 - 200	11 - 20
Very Heavy	200 or more	21 or above

Green infested trees cannot be seen from the air. For this reason, the responsibility for prompt and early detection remains with the forester in the field.

Once an outbreak has been detected on the ground, determine when the attack occurred. New attacks can be identified by the reddish-brown bark dust or frass around the tree on the ground, in bark crevices, on branches, and in cobwebs on the tree. The color of the newly infested tree crown will vary from green to yellowish depending upon the age of the attack. To verify a successful beetle attack, remove a portion of the bark from the tree to reveal the egg gallery and brood. Old attacks are easily distinguished by reddish to dark brown foliage color and beetle emergence holes in the bark. As the tree dies, the foliage changes progressively from green through yellow to reddish-brown. This color change begins to appear by late June and early July. The trees are dead before the new broods have emerged and the crown has completely changed color. Usually, a dead tree will lose most of its needles during the winter months following attack, but some may retain needles for one or more seasons.

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Table 1.--Extent of Oregon pine ips infestations in eastern Oregon and Washington by administrative area

Administrative Area 1/	1954		1955		1956		1957		1958		1959		1960		1961		1962		Total	
	Infestation centers: No.	Area: Acres	Infestation centers: No.	Area: Acres	Infestation centers: No.	Area: Acres	Infestation centers: No.	Area: Acres	Infestation centers: No.	Area: Acres	Infestation centers: No.	Area: Acres	Infestation centers: No.	Area: Acres	Infestation centers: No.	Area: Acres	Infestation centers: No.	Area: Acres	Infestation centers: No.	Area: Acres
Oregon:																				
Deschutes N.F.	0	0	0	0	5	960	3	1,280	0	0	0	0	12	2,760	0	0	0	0	20	5,000
Fremont N.F.	0	0	2	640	8	2,000	3	320	5	480	4	1,280	31	2,920	1	160	4	1,740	58	9,540
Malheur N.F.	2	980	4	1,060	36	13,120	7	2,400	4	480	26	5,360	53	4,560	5	2,240	109	13,580	246	43,780
Mt. Hood N.F.	0	0	4	1,120	8	2,560	11	3,840	2	480	6	2,800	10	800	0	0	3	200	44	11,800
Ochoco N.F.	0	0	8	1,760	39	11,360	25	3,680	4	640	16	2,480	24	1,960	0	0	10	3,090	126	24,970
Rogue River N.F.	1	160	1	640	17	2,400	28	6,240	10	1,920	3	800	29	3,280	28	5,920	13	2,240	130	23,600
Umatilla N.F.	13	2,880	16	9,760	42	8,160	7	1,120	5	1,280	40	7,840	38	9,800	4	1,520	30	3,135	195	45,495
Wallowa-Whitman N.F.	31	31,220	63	31,810	87	37,280	17	3,200	12	2,240	76	16,080	44	11,640	12	2,680	128	16,960	470	153,110
Winema (Klamath I.R.) N.F. 2/	0	0	0	0	3	720	1	160	0	0	1	800	3	200	0	0	3	360	11	2,240
Umatilla I.R.	0	0	1	160	1	80	3	800	0	0	0	0	0	0	0	0	3	105	8	1,145
Warm Springs I.R.	1	640	0	0	4	1,200	4	1,120	0	0	0	0	4	200	0	0	0	0	13	3,160
Central Oregon Dist. (O.S.D.F.)	1	450	0	0	15	2,880	1	160	0	0	0	0	0	0	0	0	0	0	17	3,490
Oregon areas	49	36,330	99	46,950	265	82,720	110	24,320	42	7,520	172	37,440	248	38,120	50	12,520	303	41,410	1,338	327,330
Washington:																				
Colville I.R.	0	0	6	1,920	3	140	0	0	5	1,120	17	6,880	1	120	1	320	4	110	37	10,610
Colville N.F. 3/	0	0	0	0	0	0	0	0	0	0	0	0	3	120	1	40	7	100	11	260
Glenwood Dist. (W.S.D.N.R.)	0	0	0	0	20	1,720	9	800	1	160	20	1,960	0	0	2	40	2	20	54	4,700
Kaniksu N.F. 3/	0	0	0	0	0	0	0	0	0	0	0	0	7	280	2	360	4	140	13	780
Okanogan N.F.	0	0	3	640	14	1,440	1	160	2	480	29	6,640	0	0	0	0	2	35	51	9,395
N.E. Wash. Dist. (W.S.D.N.R.) 3/	0	0	0	0	0	0	0	0	0	0	0	0	3	120	7	5,560	16	400	26	6,080
Spokane I.R.	0	0	0	0	4	60	0	0	4	440	5	400	1	40	5	240	2	10	21	1,190
Umatilla N.F.	0	0	2	1,600	13	2,880	0	0	1	160	10	4,960	9	1,280	4	1,000	18	1,155	57	13,035
Wenatchee N.F.	3	3,520	1	320	4	2,980	2	640	3	960	7	4,080	2	960	0	0	0	0	22	13,460
Yakima I.R.	0	0	1	480	0	0	1	160	0	0	2	880	2	440	0	0	0	0	6	1,960
Washington areas	3	3,520	13	4,960	58	9,220	13	1,760	16	3,320	90	25,800	28	3,360	22	7,560	55	1,970	298	61,470
All areas	52	39,850	112	51,910	323	91,940	123	26,080	58	10,840	262	63,240	276	41,480	72	20,080	358	43,380	1,636	388,800

1/ N.F., National Forest; I.R., Indian Reservation; W.S.D.N.R., Washington State Department of Natural Resources; O.S.D.F., Oregon State Department of Forestry

2/ Winema National Forest was formed from lands of the Klamath Indian Reservation after its termination in 1960.

3/ The Kaniksu and Colville National Forests, and the Northeast Washington District were survyed by Region 1 prior to 1960; data not available between 1954-59.

Table 2.--Extent of Oregon pine ips infestations in eastern Oregon and Washington by intensity and administrative area, 1954-62

Administrative area 1/2/	Infestation centers	Degree of damage				
		Light	Moderate	Heavy	Very Heavy	Total
	Number	Acres				
Oregon:						
Wallowa-Whitman N.F.	470	47,470	50,430	50,420	4,790	153,110
Umatilla N.F.	195	17,335	15,955	11,605	600	45,495
Malheur N.F.	246	14,250	15,030	11,420	3,080	43,780
Ochoco N.F.	126	7,970	12,160	3,400	1,440	24,970
Rogue River N.F.	130	13,780	7,740	1,760	320	23,600
Mt. Hood N.F.	44	6,440	3,400	1,960	0	11,800
Fremont N.F.	58	4,260	4,640	640	0	9,540
Deschutes N.F.	20	1,360	3,640	0	0	5,000
Central Oregon Dist. (O.S.D.F.)	17	1,280	640	1,570	0	3,490
Warm Springs I.R.	13	1,680	680	800	0	3,160
Winema N.F.	11	840	560	840	0	2,240
Umatilla I.R.	8	80	905	160	0	1,145
Oregon areas	1,338	116,745	115,780	84,575	10,230	327,330
Washington:						
Wenatchee N.F.	22	2,100	7,200	4,160	0	13,460
Umatilla N.F.	57	4,400	6,850	1,715	70	13,035
Colville I.R.	37	4,170	1,960	4,480	0	10,610
Okanogan N.F.	51	3,315	2,800	2,480	800	9,395
N.E. Wash. Dist. (W.S.D.N.R.)	26	5,815	165	100	0	6,080
Glenwood Dist. (W.S.D.N.R.)	54	1,340	1,920	1,440	0	4,700
Yakima I.R.	6	480	1,480	0	0	1,960
Spokane I.R.	21	680	430	80	0	1,190
Kaniksu N.F.	13	775	5	0	0	780
Colville N.F.	11	250	10	0	0	260
Washington areas	298	23,325	22,820	14,455	870	61,470
All areas	1,636	140,070	138,600	99,030	11,100	388,800

1/ N.F., National Forest; I.R., Indian Reservation; W.S.D.N.R., Washington State Department of Natural Resources; O.S.D.F., Oregon State Department of Forestry.

2/ Lands west of the Cascade Mountain range not included (Siuslaw, Siskiyou, Umpqua and Willamette

Table 3.--Epidemic Oregon pine ips infestation, in Oregon by administrative area, 1954-62 [1/]

Administrative area [2/]	Year	Infestation: centers	Intensity of infestation: Light	Moderate	Heavy	Very heavy	Total
		Number	Acres				
Deschutes N.F.	1956	5	40	920	0	0	960
	1957	3	480	800	0	0	1,280
	1960	12	840	1,920	0	0	2,760
		20	1,360	3,640	0	0	5,000
Fremont N.F.	1955	2	0	640	0	0	640
	1956	8	480	1,520	0	0	2,000
	1957	3	320	0	0	0	320
	1958	5	320	0	160	0	480
	1959	4	800	480	0	0	1,280
	1960	31	2,280	320	320	0	2,920
	1961	1	0	0	160	0	160
	1962	4	60	1,680	0	0	1,740
		58	4,260	4,640	640	0	9,540

See footnotes at end of table.

Table 3.--Epidemic Oregon pine ips infestation, 1954-62 [1/] ... (Continued)

Administrative area [2/]	Year	Infestation centers	Intensity of infestation: Light	Moderate	Heavy	Very heavy	Total
		Number	Acres				
Malheur N.F.	1954	2	980	0	0	0	980
	1955	4	300	440	320	0	1,060
	1956	36	1,280	4,960	4,960	1,920	13,120
	1957	7	640	1,760	0	0	2,400
	1958	4	320	0	160	0	480
	1959	26	3,280	1,120	960	0	5,360
	1960	53	3,600	960	0	0	4,560
	1961	5	800	1,440	0	0	2,240
	1962	109	3,050	4,350	5,020	1,160	13,580
		246	14,250	15,030	11,420	3,080	43,780
Mt. Hood N.F. (East Side)	1955	4	0	800	320	0	1,120
	1956	8	1,280	480	800	0	2,560
	1957	11	3,520	320	0	0	3,840
	1958	2	160	0	320	0	480
	1959	6	1,360	1,440	0	0	2,800
	1960	10	120	360	320	0	800
	1962	3	0	0	200	0	200
		44	6,440	3,400	1,960	0	11,800

See footnotes at end of table.

Table 3.--Epidemic Oregon pine ips infestation, 1954-62 1/ ... (Continued)

Administrative area 2/	Year	Infestation: centers	Intensity of infestation: Light	Moderate	Heavy	Very heavy	Total
		Number	Acres				
Ochoco N.F.	1955	8	0	480	1,280	0	1,760
	1956	39	2,240	6,400	1,280	1,440	11,360
	1957	25	1,920	1,760	0	0	3,680
	1958	4	480	160	0	0	640
	1959	16	2,000	480	0	0	2,480
	1960	24	1,320	640	0	0	1,960
	1962	10	10	2,240	840	0	3,090
		126	7,970	12,160	3,400	1,440	24,970
Rogue River N.F.	1954	1	0	0	160	0	160
	1955	1	640	0	0	0	640
	1956	17	500	1,500	80	0	2,400
	1957	28	4,640	1,280	0	320	6,240
	1958	10	160	800	960	0	1,920
	1959	3	800	0	0	0	800
	1960	29	800	2,400	400	0	3,280
	1961	28	4,800	1,120	0	0	5,920
	1962	13	1,440	640	160	0	2,240
		130	13,780	7,740	1,760	320	23,600

See footnotes at end of table.

Table 3.--Epidemic Oregon pine ips infestation, 1954-62 1/ ... (Continued)

Administrative area 2/	Year	Infestation centers	Intensity of infestation: Light	Moderate	Heavy	Very heavy	Total
		Number	Acres				
Umatilla I.R.	1955	1	0	0	160	0	160
	1956	1	80	0	0	0	80
	1957	3	0	800	0	0	800
	1962	3	0	105	0	0	105
		8	80	905	160	0	1,145
Warm Springs I.R.	1954	1	0	0	640	0	640
	1956	4	400	640	160	0	1,200
	1957	4	1,120	0	0	0	1,120
	1960	4	160	40	0	0	200
		13	1,680	680	800	0	3,160
Central Oregon Dist. (O.S.D.F.)	1954	1	0	0	450	0	450
	1956	15	1,120	640	1,120	0	2,880
	1957	1	160	0	0	0	160
		17	1,280	640	1,570	0	3,490

1/ The years free of an epidemic were not entered.
2/ N.F., National Forest; I.R., Indian Reservation; O.S.D.F., Oregon State Department of Forestry.
3/ Winema National Forest was formed from lands of the Klamath Indian Reservation after its termination in 1960.

Table 3.--Epidemic Oregon pine ips infestation, 1954-62 [1/] ... (Continued)

Administrative area [2/]	Year	Infestation centers	Intensity of infestation: Light	Moderate	Heavy	Very heavy	Total
		Number	Acres				
Wallowa-Whitman N.F.	1954	31	4,960	5,660	19,200	1,400	31,220
	1955	63	8,000	12,180	11,630	0	31,810
	1956	87	15,200	12,640	7,200	2,240	37,280
	1957	17	1,440	1,440	320	0	3,200
	1958	12	1,600	640	0	0	2,240
	1959	76	8,480	7,440	160	0	16,080
	1960	44	3,320	5,240	3,080	0	11,640
	1961	12	1,360	1,000	320	0	2,680
	1962	128	3,110	4,190	8,510	1,150	16,960
		470	47,470	50,430	50,420	4,790	153,110
Winema N.F. [3/]	1956	3	240	480	0	0	720
	1957	1	160	0	0	0	160
	1959	1	0	0	800	0	800
	1960	3	200	0	0	0	200
	1962	3	240	80	40	0	360
		11	840	560	840	0	2,240

See footnotes at end of table.

Table 4.--Epidemic Oregon pine ips infestations on Umatilla National Forest, 1954-62 [1/]

Area	Year	Infestation centers	Intensity of infestation: Light	Moderate	Heavy	Very heavy	Total
		Number	Acres				
Umatilla National Forest:							
Oregon	1954	13	0	1,000	1,280	600	2,880
	1955	16	4,160	800	4,800	0	9,760
	1956	42	3,040	3,800	1,320	0	8,160
	1957	7	960	160	0	0	1,120
	1958	5	480	800	0	0	1,280
	1959	40	3,520	2,880	1,440	0	7,840
	1960	38	4,000	4,520	1,280	0	9,800
	1961	4	560	960	0	0	1,520
	1962	30	615	1,035	1,485	0	3,135
		195	17,335	15,955	11,605	600	45,495
Washington	1955	2	320	1,280	0	0	1,600
	1956	13	1,120	1,760	0	0	2,880
	1958	1	160	0	0	0	160
	1959	10	1,280	2,560	1,120	0	4,960
	1960	9	560	520	200	0	1,280
	1961	4	800	200	0	0	1,000
	1962	18	160	530	395	70	1,155
		57	4,400	6,850	1,715	70	13,035
All		252	21,735	22,805	13,320	670	58,530

1/ The years free of an epidemic were not entered.

Table 5.--Epidemic Oregon pine ips infestations by intensity and administrative area west of the Cascade Mountain range, 1956-62 [1/]

National Forest [2/]	Year	Infestation centers	Intensity of infestation: Light	Moderate	Heavy	Very heavy	Total
		Number	Acres				
Siskiyou	1957	3	640	0	0	0	640
	1958	1	0	0	160	0	160
	1960	1	40	0	0	0	40
	1961	3	2,880	480	0	0	3,360
	1962	8	1,800	400	60	0	2,260
		16	5,360	880	220	0	6,460
Siuslaw	1957	1	0	0	0	640	640
Umpqua	1957	4	960	0	0	0	960
Willamette	1957	2	0	320	0	0	320
All		23	6,320	1,200	220	640	8,380

1/ The years free of an epidemic were not entered.

2/ These figures were not included in table 1 because ponderosa pine is not a major timber species in these areas.

Table 6.--Epidemic Oregon pine ips infestations in Washington by intensity and administrative area, 1954-62 [1/]

Administrative area [2/]	Year	Infestation centers	Intensity of infestation				
			Light	Moderate	Heavy	Very heavy	Total
		Number	Acres				
Colville N.F.	1960	3	120	0	0	0	120
	1961	1	40	0	0	0	40
	1962	7	90	10	0	0	100
		11	250	10	0	0	260
Kaniksu N.F.	1960	7	280	0	0	0	280
	1961	2	360	0	0	0	360
	1962	4	135	5	0	0	140
		13	775	5	0	0	780
Okanogan N.F.	1955	3	0	640	0	0	640
	1956	14	800	640	0	0	1,440
	1957	1	160	0	0	0	160
	1958	2	480	0	0	0	480
	1959	29	1,840	1,520	2,480	800	6,640
	1960	2	35	0	0	0	35
		51	3,315	2,800	2,480	800	9,395

See footnotes at end of table.

Table 6.--Epidemic Oregon pine ips infestation, 1954-62 [1/] ... (Continued)

Administrative area [2/]	Year	Infestation: centers	Intensity of infestation: Light	Moderate	Heavy	Very heavy	Total
		Number	Acres				
N.E. Wash. District (W.S.D.N.R.)	1960	3	120	0	0	0	120
	1961	7	5,480	80	0	0	5,560
	1962	16	215	85	100	0	400
		26	5,815	165	100	0	6,080
Wenatchee N.F.	1954	3	800	2,400	320	0	3,520
	1955	1	0	320	0	0	320
	1956	4	100	1,280	1,600	0	2,980
	1957	2	160	480	0	0	640
	1958	3	640	320	0	0	960
	1959	7	240	2,400	1,440	0	4,080
	1960	2	160	0	800	0	960
		22	2,100	7,200	4,160	0	13,460
Glenwood District (W.S.D.N.R.)	1956	20	0	320	1,400	0	1,720
	1957	9	640	160	0	0	800
	1958	1	160	0	0	0	160
	1959	20	480	1,440	40	0	1,960
	1961	2	40	0	0	0	40
	1962	2	20	0	0	0	20
		54	1,340	1,920	1,440	0	4,700

See footnotes at end of table.

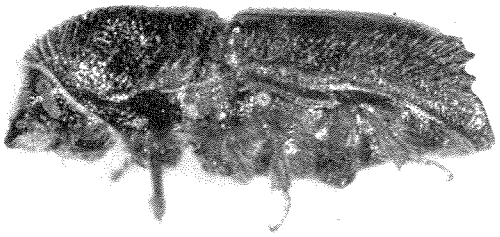
Table 6.--Epidemic Oregon pine ips infestation, 1954-62 [1/] ... (Continued)

Administrative area [2/]	Year	Infestation centers	Intensity of infestation: Light	Moderate	Heavy	Very heavy	Total
		Number	Acres				
Colville I.R.	1955	6	320	480	1,120	0	1,920
	1956	3	20	120	0	0	140
	1958	5	960	160	0	0	1,120
	1959	17	2,320	1,200	3,360	0	6,880
	1960	1	120	0	0	0	120
	1961	1	320	0	0	0	320
	1962	4	110	0	0	0	110
		37	4,170	1,960	4,480	0	10,610
Spokane I.R.	1956	4	30	30	0	0	60
	1958	4	360	0	80	0	440
	1959	5	0	400	0	0	400
	1960	1	40	0	0	0	40
	1961	5	240	0	0	0	240
	1962	2	10	0	0	0	10
		21	680	430	80	0	1,190
Yakima I.R.	1955	1	480	0	0	0	480
	1957	1	0	160	0	0	160
	1959	2	0	880	0	0	880
	1960	2	0	440	0	0	440
		6	480	1,480	0	0	1,960

1/ The years free of an epidemic were not entered.

2/ N.F., National Forest; I.R., Indian Reservation; W.S.D.N.R., Washington State Department of Natural Resources.

THE OREGON PINE IPS
Ips pini Say



Adult female X 15 side view.

Adult male X 15 side view.

Egg galleries, nuptial chambers, and larval mines on a ponderosa pine branch.

Group of pole-sized ponderosa pine killed by the Oregon pine ips.

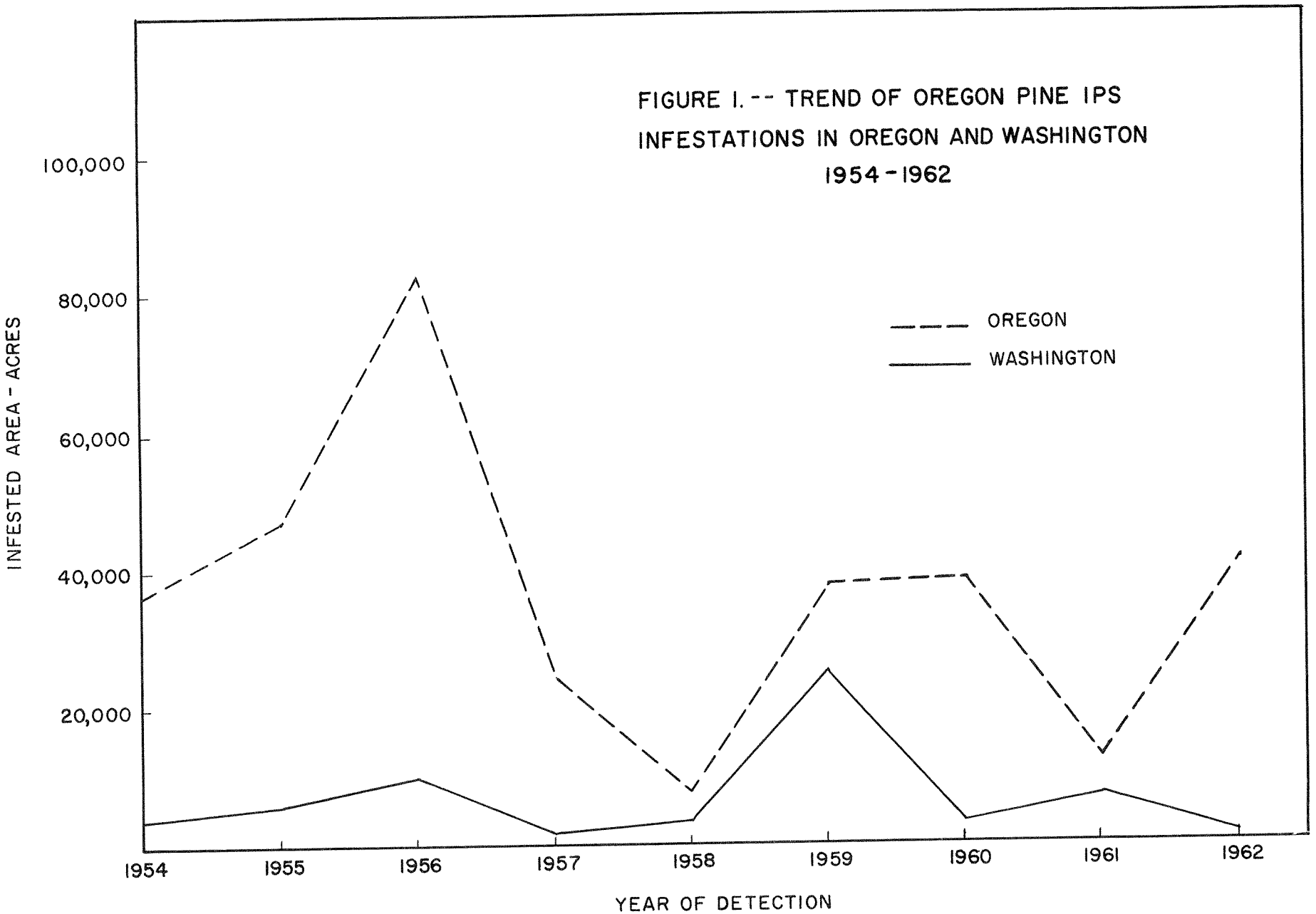
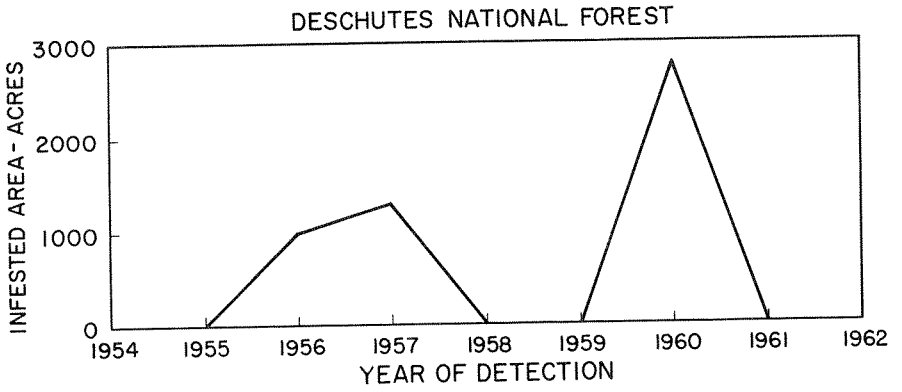
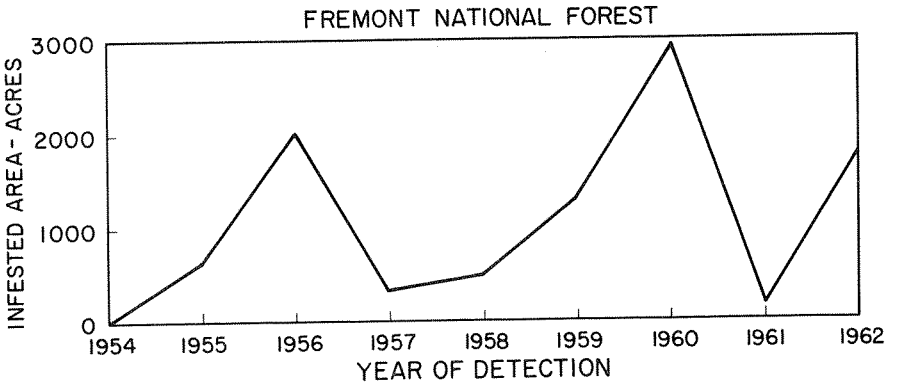
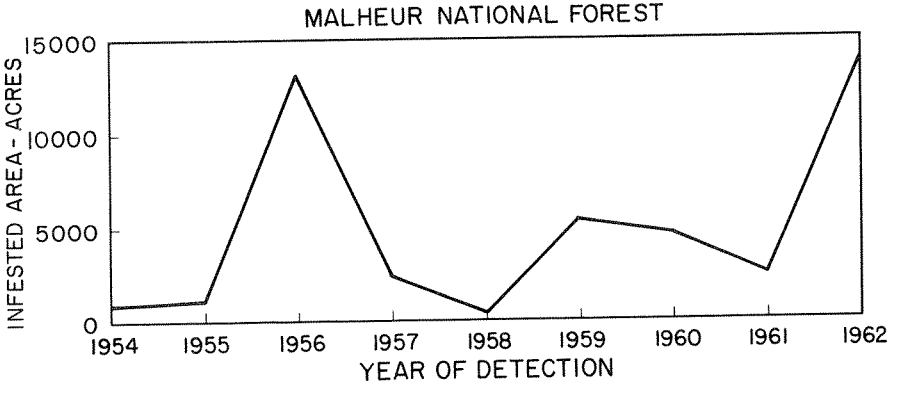


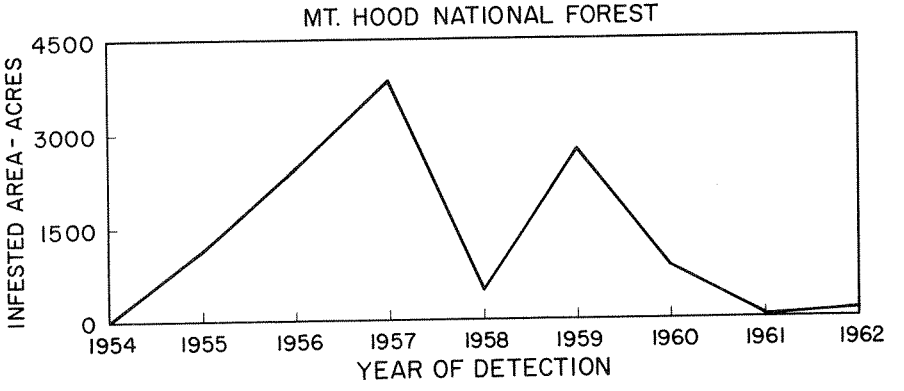
FIGURE I. -- TREND OF OREGON PINE IPS INFESTATIONS IN OREGON AND WASHINGTON 1954 - 1962
OREGON
WASHINGTON
INFESTED AREA - ACRES
100,000
80,000
60,000
40,000
20,000
1954
1955
1956
1957
1958
1959
1960
1961
1962
YEAR OF DETECTION

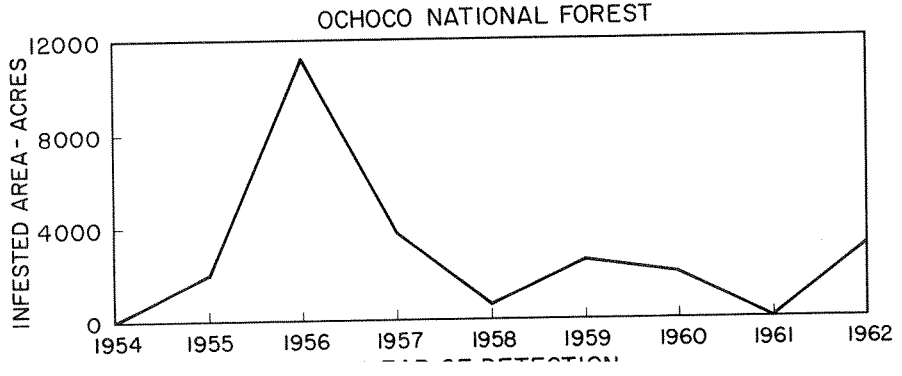
FIGURE 2 - OREGON LANDS











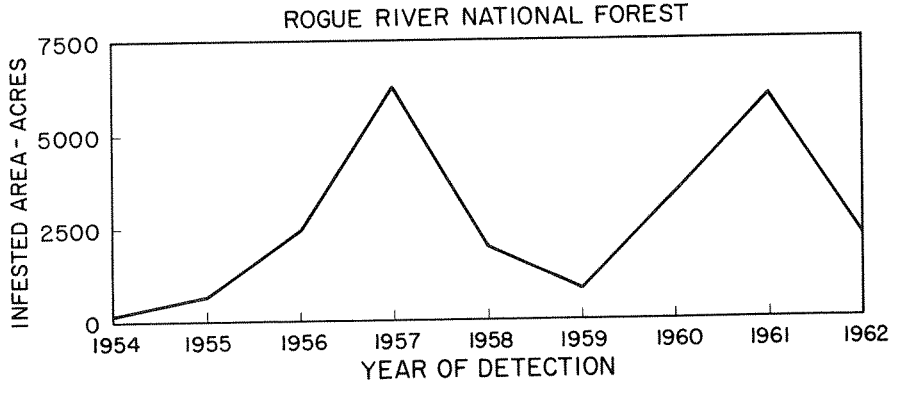
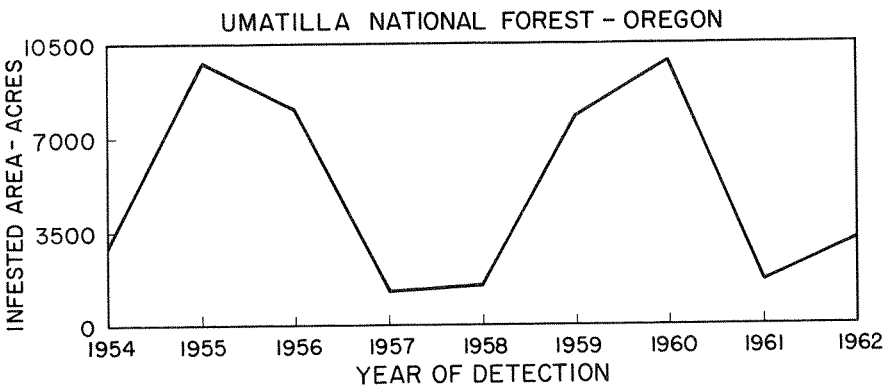
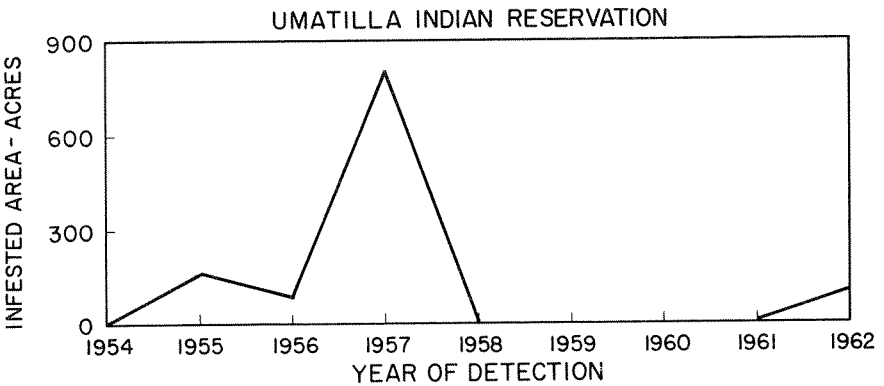
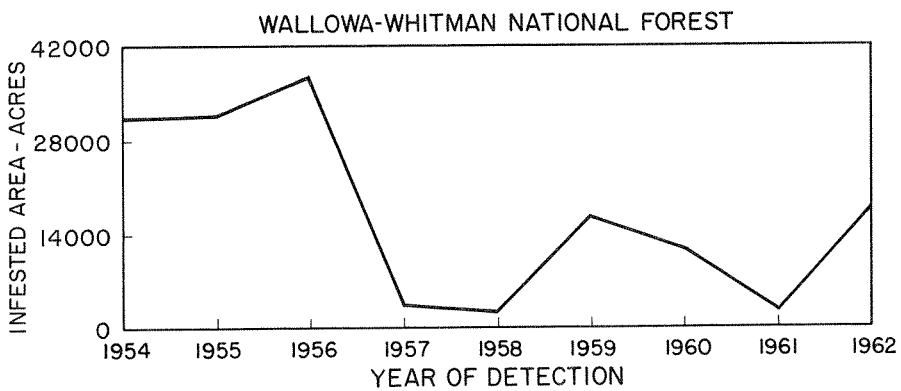
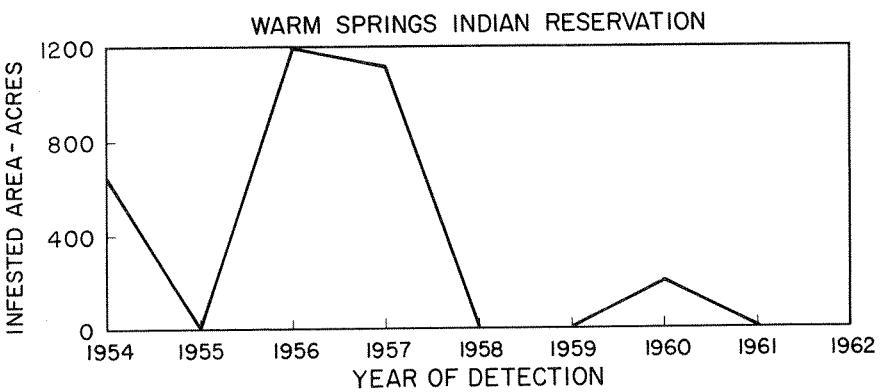


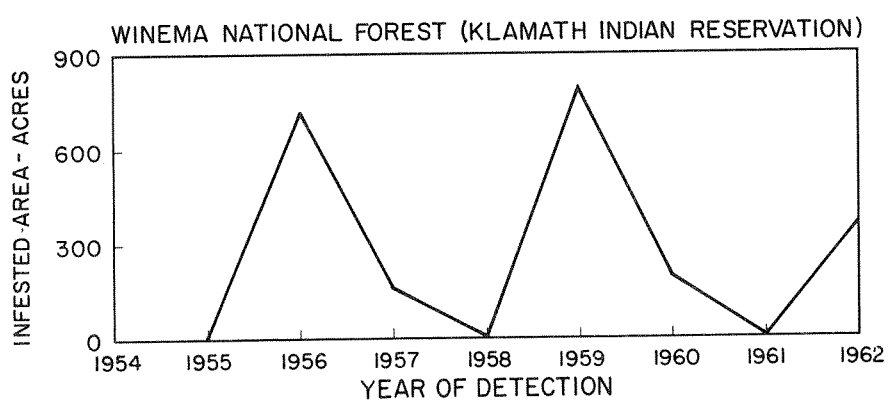
FIGURE 3 - OREGON LANDS











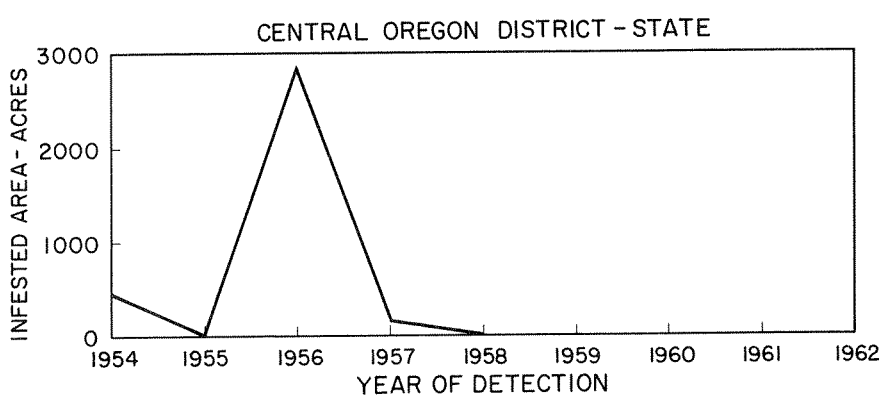
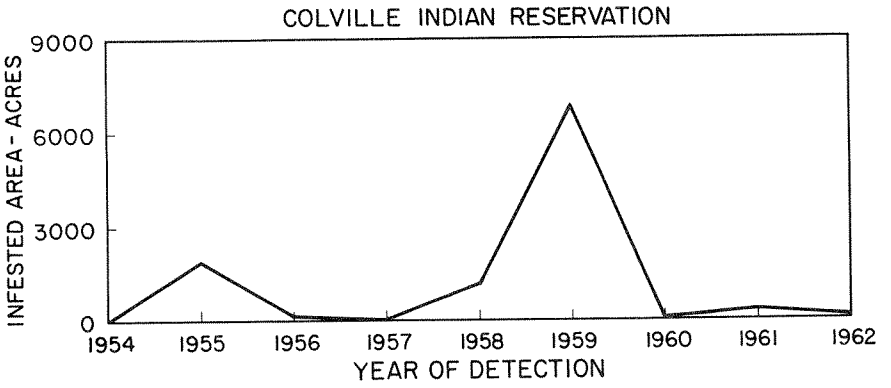
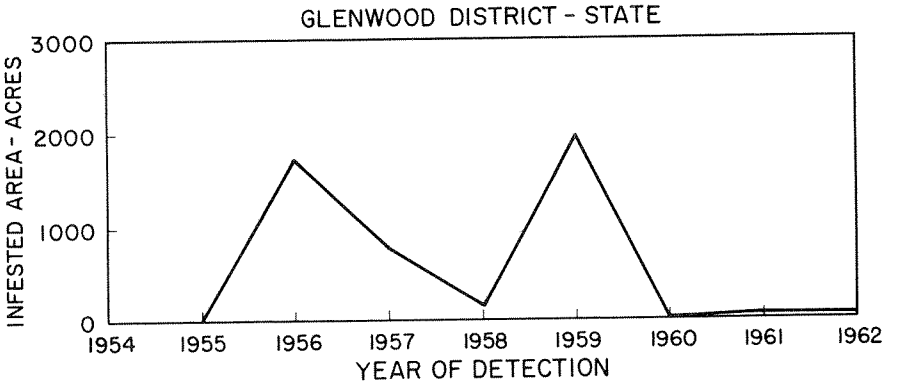
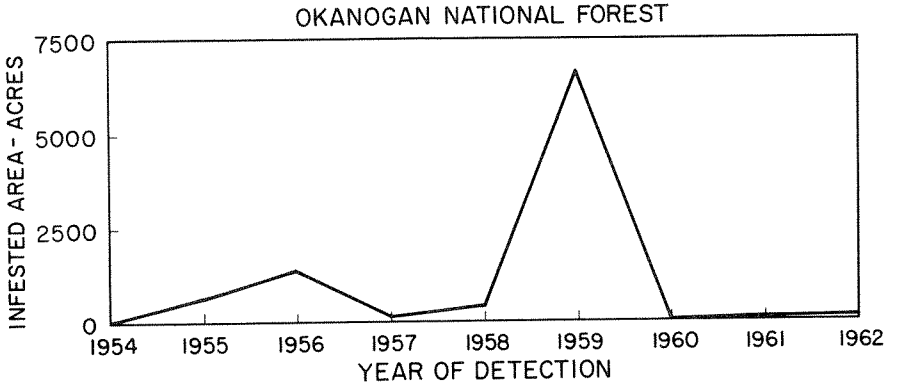
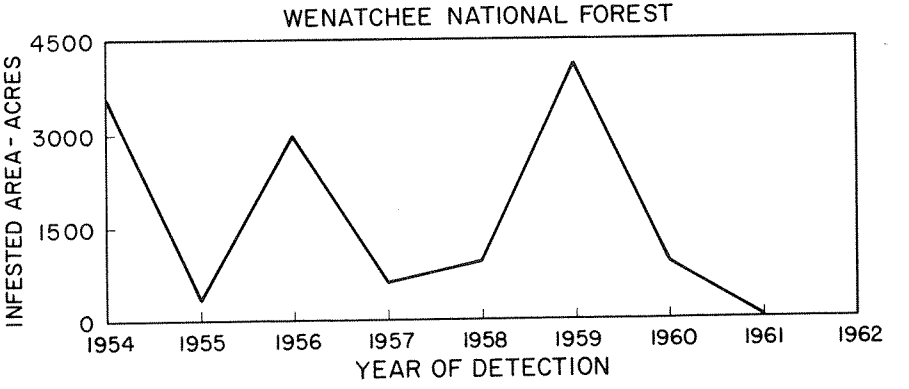


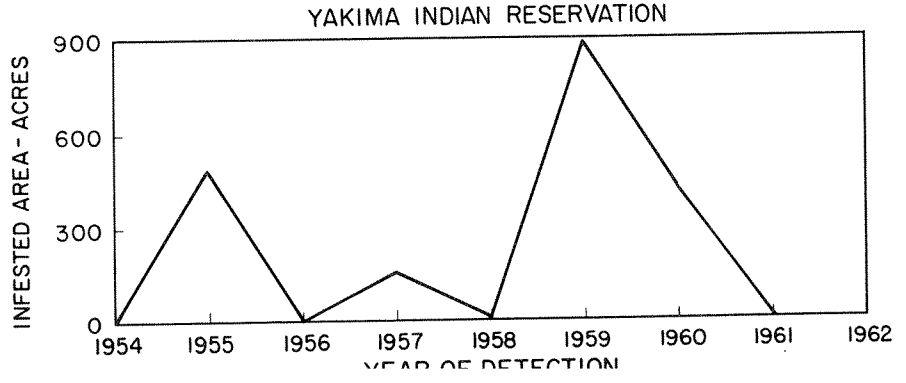
FIGURE 4 - WASHINGTON LANDS











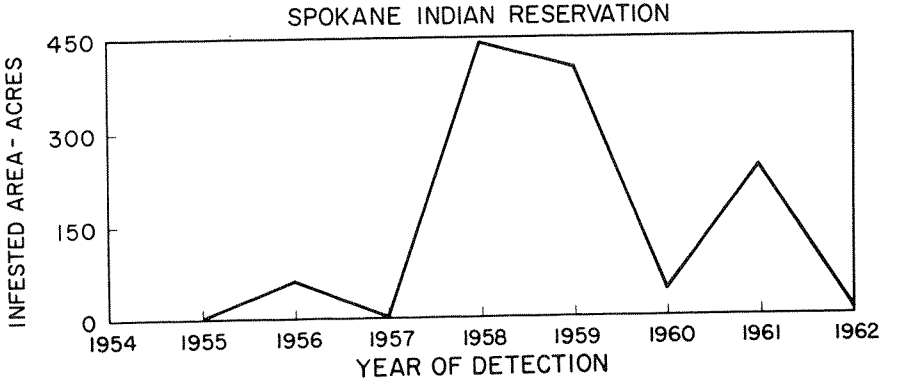
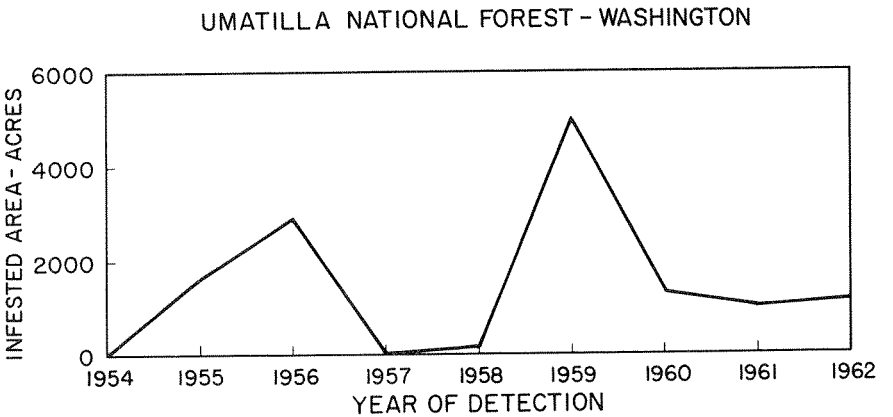
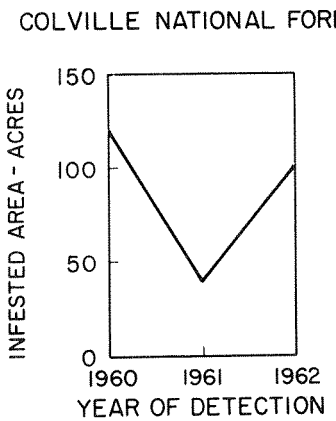
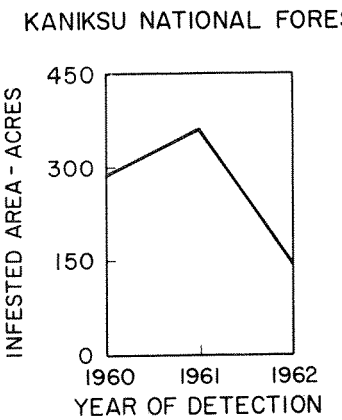


FIGURE 5 - WASHINGTON LANDS







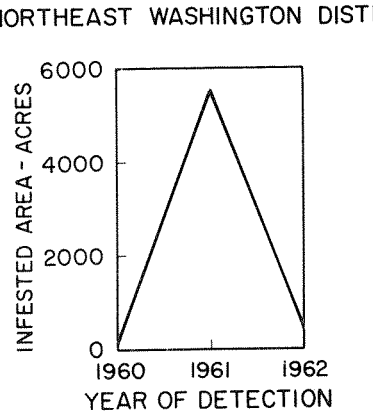
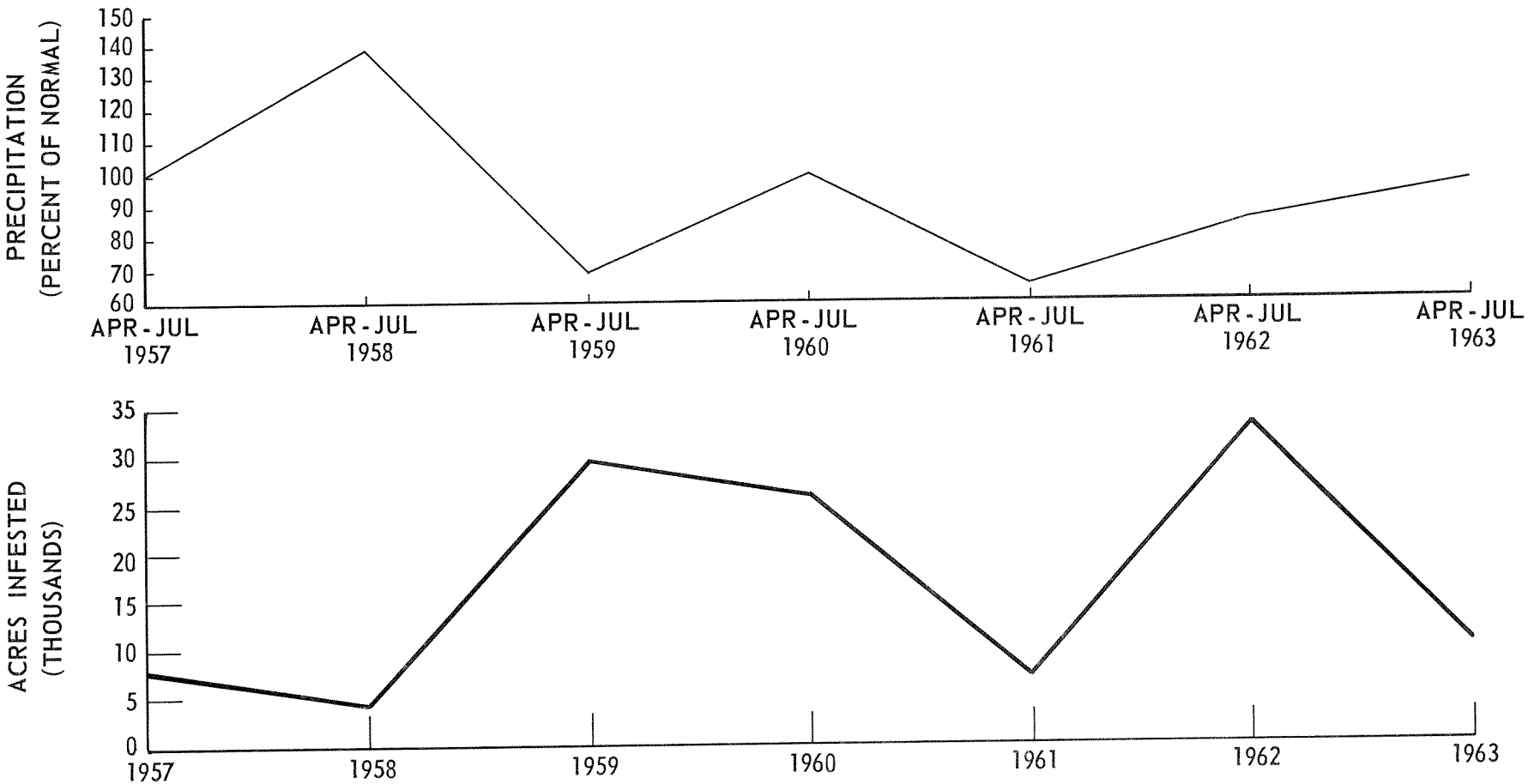


FIGURE - 6

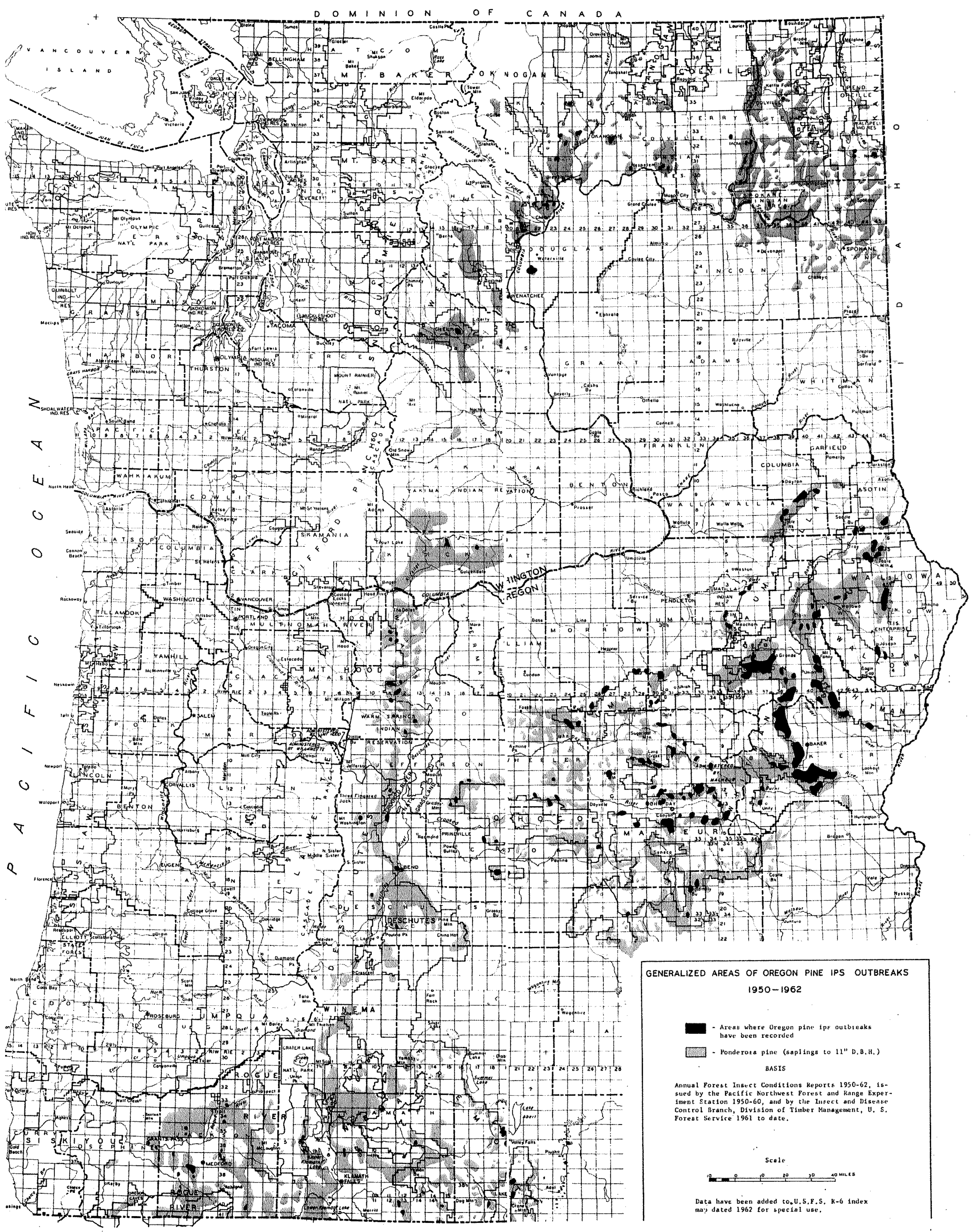
APRIL - JULY PRECIPITATION AND IPS DAMAGES

NORTHEAST OREGON, 1957 TO 1963



C A N A D A
I D A H O
P A C I F I C O C E A N
WASHINGTON
OREGON
C A L I F O R N I A
N E V A D A
I D A H O
Bellingham
Seattle
Tacoma
OLYMPIA
Aberdeen
Wenatchee
Spokane
COLUMBIA
SNAKE
RIVER
Walla Walla
Pendleton
Portland
SALEM
Bend
Roseburg
WILLAMETTE
DESCHUTES
JOHN DAY
UMPQUA
ROGUE
SISKIYOU
MALHEUR
OLYMPIC NATL PARK
MT RAINIER NAT'L PARK
QUINAULT IND. RES.
YAKIMA IND. RES.
GIFFORD PINCHOT
MT HOOD
OKANOGAN
MT BAKER
SNOQUALMIE
KANIKSU
10 0 10 20 30 40 50
SCALE IN MILES
LEGEND
Forested Areas
National Forest Boundaries
Reservation and Park Boundaries
U.S. FOREST SERVICE
PORTLAND, OREGON
Figure 7
OREGON PINE IPS
OUTBREAK FREQUENCY
High
Moderate
Low

Figure 8


DOMINION OF CANADA
PACIFIC OCEAN
IDAHO
VANCOUVER ISLAND
WASHINGTON
OREGON
GENERALIZED AREAS OF OREGON PINE IPS OUTBREAKS
1950—1962
- Areas where Oregon pine ips outbreaks have been recorded
- Ponderosa pine (saplings to 11" D.B.H.)
BASIS
Annual Forest Insect Conditions Reports 1950-62, issued by the Pacific Northwest Forest and Range Experiment Station 1950-60, and by the Insect and Disease Control Branch, Division of Timber Management, U. S. Forest Service 1961 to date.
Scale
40 MILES
Data have been added to U.S.F.S. R-6 index map dated 1962 for special use.