

***FOREST PEST CONDITIONS
IN CALIFORNIA
1963***

Official Report of the

CALIFORNIA FOREST PEST CONTROL ACTION COUNCIL

The California Forest Pest Control Action Council was formed in 1951 in recognition of the need for close cooperation among land managers concerned with forest pest problems. Primarily an advisory and coordinating group, the Council sponsors a Statewide cooperative forest pest detection survey; publishes an annual report of forest pest conditions; studies; endorses, and supports desirable pest control actions; reviews control needs and programs, and stimulates action where needed; and provides a forum for the exchange of pest control information. The California State Board of Forestry has designated the Council as its official advisory group for forest insect, disease and animal problems.

The Council comprises the following organizations:

California Forest Protective Association
California Redwood Association
State of California
 Department of Agriculture
 Department of Conservation
 Department of Fish and Game
 Department of Parks and Recreation
 University of California
U. S. Department of Agriculture
 Forest Service
U. S. Department of the Interior
 Bureau of Indian Affairs
 Bureau of Land Management
 Sport Fisheries and Wildlife Service
 National Park Service
Western Pine Association

FOREST PEST CONDITIONS IN CALIFORNIA - 1963 was prepared by the Forest Service and the Sport Fisheries and Wildlife Service in cooperation with other member organizations of the Council. It was duplicated and distributed by the California Division of Forestry.

Cover: A section of decayed root from a windthrown white fir showing the typical black mycelial strands (rhizomorphs) characteristic of this disease. The rhizomorphs are an important means of underground spread.
(Photo enlarged x 2)

FOREST PEST DETECTION IN CALIFORNIA - 1963

The detection of insect, disease, and animal damage is the initial step in the control of these destructive pests and is of major concern to foresters and forest-land managers throughout the State. The principal forest pest detection measures employed in California in 1963 are listed below.

THE CALIFORNIA COOPERATIVE FOREST PEST DETECTION SURVEY was initiated by the Council in 1951 to provide the broadest possible base for pest-condition appraisals, and to enlist the services of as many field observers as possible. It operates in the following way: pest conditions, ranging in size from single damaged trees to major outbreaks involving hundreds of acres, are detected by individual cooperators in the course of their usual field duties. In many cases, the cause of damage is unknown and the cooperator is interested primarily in having the pest identified. The Forest Service Regional Office in San Francisco acts as a clearing house for pest detection reports, identifying unknown insects and diseases, evaluating outbreak conditions where the need arises, and summarizing and interpreting the accumulated data. In 1963, 617 reports were received: 383 for insects, 175 for disease, and 59 for animal pest damage. The Sport Fisheries and Wildlife Service evaluates reports of animal damage.

THE FOREST DISEASE SURVEY has been conducted by the Forest Service since 1958. Designed to inventory forest tree diseases on a Statewide basis, the survey employs randomly selected, temporary plots on which all trees are examined closely by pathologists. Although a statistically significant sample will not be available until about 1967, the survey has been planned so that interim summaries will yield useful results. To date, 612 plots supporting 15,300 trees have been examined. For many diseases, the information now available is adequate to indicate major trends. Cumulative data for the period 1958 - 1963 is given in Table 4.

A ROOT DISEASE SURVEY was conducted by the Forest Service this year to take advantage of the unique opportunity for root examination afforded by the extensive blowdown of October 1962. In all, 48 temporary plots, most of which were located in areas of scattered blowdown, were studied and 2,120 trees, mainly firs, were examined carefully; results are given in Table 5. This survey will not be continued in 1964.

INSECT BUILDUP IN BLOWDOWN TIMBER throughout northern California was surveyed by Forest Service entomologists in 1963. In the course of the survey 270 trees were examined for the presence of destructive insects; results are reported in the Highlights section and Status of Insect Pests section. Additional survey work will be done in the spring of 1964.

A PLANTATION DAMAGE SURVEY aimed at both insect and disease pests was conducted by the Forest Service. Seasonal technicians sampled 73 plantations in northern California and examined over 7,000 trees. Survey data have not yet been analyzed.

HIGHLIGHTS OF FOREST PEST CONDITIONS IN 1963

INSECT PESTS. The western pine beetle populations in the Mother Lode Infestation declined sharply this year as a result of recent aggressive control actions, favorable weather conditions, and a buildup of natural predators. High populations of the western pine beetle occurred in Modoc County and in southern California, but elsewhere populations declined or are static at relatively low levels. The mountain pine beetle continued to take a heavy toll of old- and young-growth sugar pine in the southern Sierra Nevada and in young-growth ponderosa pine in Modoc County; a serious outbreak of this insect developed in old-growth ponderosa pine in the south Warner Mountains, Modoc County. Tree killing by it and by other insects in the latter area, occurred on 22,000 acres and resulted in a loss of 17 million board feet of saw timber.

There was a noticeable decline in the Statewide epidemic of the fir engraver in true fir stands, but significant losses continued at many locations. Defoliation by the Douglas-fir tussock moth and the white-fir sawfly increased substantially, with scattered small to moderately large infestations in white fir in many counties in the central Sierra Nevada and in northeastern California.

A pandora moth outbreak caused light to almost complete defoliation of Jeffrey pine on a 7,500-acre area in Tulare and Kern Counties. Spruce budworm populations declined sharply in white fir stands on the Warner Mountains, Modoc County. Jeffrey pine beetle populations remained low throughout most of the State, but a serious infestation occurred in the south Warner Mountains, Modoc County. The red turpentine beetle was more aggressive than in previous years, particularly in reserve trees in thinned stands in northern California and in several areas in southern California.

Elsewhere in the State there were local infestations of the pine reproduction weevil, needle sheath miner, and a pine tip moth in pine plantations; the fall webworm in hardwoods; the black pine leaf scale on sugar pine; grasshoppers on ponderosa pine; a needle midge in a Douglas-fir plantation; and sawflies on pinyon pine.

DISEASE PESTS. Precipitation during the winter of 1962-1963 was normal or above in the northern end of the State, about normal in the central portion and below normal in the extreme southern end. Generally, trees throughout most of California made exceptionally good growth, and with increased tree vigor most diseases favored by drought conditions abated in intensity. Foliage diseases, which were favored by a wet winter and spring, showed an upward trend.

Mounting survey evidence is focusing attention on root diseases, mainly Fomes annosus and Armillaria mellea, as important forest pests in California. Both diseases were reported from new locations in 1963 and A. mellea in particular was found to be a contributing factor in scattered windthrow.

Always a threat to seedlings in nurseries, root diseases again were held in check where it was possible to fumigate soil according to prescribed schedules. At Placerville, where wet spring weather prevented soil fumigation, however, damping off increased considerably.

Cytospora canker of red and white fir working either in conjunction with dwarf-mistletoe or independently of it abated somewhat in the northern end of the State, but increased slightly in intensity in the southern Sierra.

The status of dwarfmistletoe, white pine blister rust, the gall rusts, Elytroderma needle blight, yellow witches' broom, and the chlorotic decline of ponderosa pine in southern California (X-Disease) continued without appreciable change in 1963.

Comandra blister rust was found damaging young ponderosa pine in a plantation near Burney Falls.

ANIMAL PESTS. Animal damage reports received in 1963 indicate that the majority of damage occurred to plantations and reproduction; only five of the reports concerned young saw timber and none were for old-growth stands.

Porcupines again were responsible for the largest number of detection reports with deer, woodrats, and rabbits causing most of the remaining damage reports.

BLOWDOWN: COLUMBUS DAY, 1962. A single, minor western pine bark beetle outbreak in the Yolla Bolly-Middle Eel Wilderness area on the Shasta-Trinity National Forest (where no salvage was done) resulted from insects building up in timber blown down in the Columbus Day Storm of 1962. In spite of the tremendous buildup of ips in the down trees, no serious problem involving this insect developed. Buildup of the fir engraver, Jeffrey pine beetle, and mountain pine beetle was light. However, buildup of the Douglas-fir beetle was generally heavy in the North Coast area. Since these broods will not emerge until next spring, no evaluation of this problem is now possible.

The excellent cooperative salvage effort of industry, the State and Federal agencies was instrumental in holding the buildup of damaging insect populations to this low level. Practically all of the accessible merchantable pine timber was removed before bark beetle broods emerged.

THE STATUS OF FOREST INSECT PESTS

WESTERN PINE BEETLE, Dendroctonus brevicomis. There was a definite decline in the Mother Lode Infestation, an outbreak that covered over one million acres of the ponderosa pine type on the westside of the central and southern Sierra Nevada. An extensive fall survey of ponderosa pine losses on those areas that are merchantable and accessible, indicates that there are 119,000 currently infested trees, with a volume of 50 million board feet, on approximately 737,000 acres in the surveyed area.

Although similar figures are not available for the same area for previous years, this condition is believed to represent a reduction in infested trees of over 75 percent since 1962. The decline in tree losses results from a combination of factors, the principal of which are: (1) intensive logging and direct control of insect infested trees; (2) weather conditions that favored host resistance and reduced the number of insect generations; (3) an increase in insect predators, and (4) continued woodpecker activity. Areas of continued moderate to heavy loss include the Cold Spring Meadow-Bishop Creek Area, and Wagner Ridge-Monotti Hill area, Mariposa County; Bass Lake and Cedarbrook, Madera County; Ross Crossing, Fresno County; Blue Mountain, Calaveras County; Soap Creek, Tuolumne County; Camp Nelson-Balch Park area, Tulare County; Capinero Creek, Tulare County; and Little Poso Creek, Kern County.

Elsewhere in northern California increasing ponderosa pine losses occurred in localized areas such as the Bowman Ridge-Ski Hi area, Glenn County; Tomhead Mt., and Little Red Mt., Tehama County; Hat Creek, Shasta County; Grouse Mountain, Crowder Flat, and the south Warner Mountain area, Modoc County. In this latter area of 22,500 acres, a ground survey found that ponderosa pine losses for 1963 were 2.8 million board feet.

In southern California western pine beetle populations increased or remained at a high level at the following locations: Arrowhead, San Bernardino County; San Jacinto and Hemet, Riverside County; Julian and Palomar Mountains, San Diego County; and Ranger Peak, Santa Barbara County. The Ranger Peak infestation is a new problem caused by the Davy Brown burn of July 22, 1963. Logging and bark spray control methods will be used. The Arrowhead and San Jacinto infestations are in maintenance control units where continued effort is being made to hold tree losses to an acceptable level. The Julian, Palomar, and Hemet infestations are not included in maintenance control units. Elsewhere in southern California losses due to this insect are within acceptable limits because of continued effective maintenance control programs. Inadequate precipitation is an important factor in southern California insect conditions. During the period of October 1962 - September 1963, moisture was normal or better for most of the State north of the Tehachapi Mountains, but southern California continued to suffer with 60 to 80 percent rainfall; 1958 was the last normal year.

MOUNTAIN PINE BEETLE, Dendroctonus monticolae. Heavy losses of young-growth sugar pine continued in the Miami Creek area, Mariposa and Madera Counties, where infested trees and green poles were logged in an attempt to correct an overstocked condition in this area. Similar losses in young-growth sugar pine occurred near Shaver Lake, Fresno County.

Loss of mature sugar pine increased in portions of the central Sierra Nevada and in the Cascade Range, and losses remained at a fairly high level in the southern Sierra Nevada. Areas of concentrated loss include the Chinquapin-Wawona area, Yosemite National Park; Ellis Meadow-Central Camp area, Madera County; Buffin Meadow-Soquel-Gray's Meadow area, Madera County; and Rodgers Ridge, Fresno County.

An outbreak in the south Warner Mountains, Modoc County, killed mature ponderosa pines totaling 8.1 million board feet of timber on 22,000 acres. Additional pine losses were sustained in this same area from outbreaks of the western pine beetle and Jeffrey pine beetle.

Losses in pole-sized ponderosa pine continued at a very high level in the Joseph Creek area in Modoc County. In southern California, populations of this beetle remained endemic.

Losses in lodgepole pine were about the same as last year, with moderate to heavy tree killing in the Skunk Cabbage Creek and Camp One areas, Modoc County, and light tree killing in Tuolumne Meadows, Yosemite National Park.

FIR ENGRAVER, Scolytus ventralis. The Statewide epidemic of the fir engraver, in true fir stands, continued at a fairly high level but insect populations have diminished since 1962. Areas of heavy tree loss include the Warner Mountains, Modoc County; Big Valley Mountain, Lassen County; Military Pass, Siskiyou County; Sierraville, Sierra County; Highway 108 above Strawberry, Tuolumne County; the Lake Tahoe area in Placer and El Dorado Counties; Sawpit Canyon and Sugar Loaf Mountain, San Bernardino County; and Palomar Mountain, San Diego County.

DOUGLAS-FIR TUSSOCK MOTH, Hemerocampa pseudotsugata. This defoliator caused light to heavy defoliation of white fir in the following areas: Knox Mountain (Rush Creek), Modoc County - 20,000 acres; Peddler Hill, Amador and El Dorado Counties - 80 acres; and Iron Mountain, El Dorado County - 600 acres. Light feeding damage was reported from these same locations in 1962. A preliminary appraisal of surveys made this fall in the latter two areas indicates that there is a light overwintering population; this is probably due to heavy parasitism of mature larvae and pupae.

WHITE-FIR SAWFLY, Neodiprion abietis. Sawfly populations showed a general increase in white fir stands throughout most of northern and central California. Damage to white fir stands in the Knox Mountain area (Rush Creek), Modoc County, increased considerably since 1962 and now covers an estimated 22,000

TABLE 1--VOLUME OF TIMBER LOGGED FOR INSECT CONTROL IN 1963 ^{1/}

COMPANY OR AGENCY	ACRES TREATED	THOUSAND BOARD FEET REMOVED			TREE SPECIES
		INSECT INFESTED TREES	INSECT SUSCEPTIBLE TREES	WINDTHROW OR FIRE-KILLED TREES	
PRIVATE LANDS					
American Forest Products	450	400	800	50	PP, SP, WF
Bear Valley Mutual Water	-	20	-	-	PP, JP
Cal Pacific	100	30	500	40	PP, WF, DF
Covelo Lumber	1,000	500	3,000	200	PP, SP
Fruit Growers Supply	2,640	5,776	750	1,831	PP, SP, WF, DF, RF
Glenco Forest Products	3,000	2,176	9,171	1,029	PP, WF
Hazel Valley Lumber	50	50	200	-	PP, SP
Hearst Wynton Tree Farm	4,341	-	-	43,000	PP, WF, DF, SP
International Paper	3,775	2,000	36,000	1,000	PP, SP, WF, DF, IC
Kimberly-Clark Corporation	5,000	3,000	8,000	30,000	PP, SP, WF
McCloud River Lumber	-	-	-	85,000	PP, SP, WF, DF
Michigan-California Lumber	1,500	2,000	25,000	-	PP, SP
Mt. Whitney Lumber	100	150	500	-	SP
Pickering Lumber	1,180	100	2,000	-	PP, SP, WF, DF
J. F. Sharp Lumber	280	50	300	1,440	DF, WF
Trinity Alps Lumber	695	100	1,000	1,500	SP, DF, WF
U. S. Plywood	4,903	2,000	2,000	1,500	PP, SP, WF, DF, IC
Winton Lumber	2,736	4,300	9,200	-	PP, SP, WF
PRIVATE LAND SUBTOTAL	31,750	22,652	98,421	166,590	
NATIONAL FOREST LANDS					
NATIONAL FOREST SUBTOTAL	-	73,000	306,000	148,000	
TOTAL FOR CALIFORNIA					
STATE TOTAL	-	95,652	404,421	314,590	

^{1/} Based on the data submitted by companies or agencies reporting; not complete for the State.

TABLE 2--INSECT CONTROL PROJECTS ACCOMPLISHED IN 1963, BY AGENCIES AND AREAS

LOCATION	NO. ACRES	NO. TREES	INSECT	HOST	CONTROL METHOD	COST
STATE AGENCIES AND PRIVATE OWNERS						
Corte Madera, San Diego	3,120	57	Mc-Ips	JP, CP	Chemical	\$ 988
Julian-Cuyamaca	1,200	177	Mc, Db, Ips	JP, CP, PP	Chemical	4,641
Lost Valley-Palomar	770	1,100	Db-Ips, Mc	PP-CP	Chemical	5,941
Mother Lode 5 Projects	85,026	3,736	Db, Ips	PP	Fall, burn, chemical	29,141
San Bernardino 2 Projects	20,300	2,112	Db, Dm, Dj, Mc, Ips	PP, JP, SP, CP	Fall, burn, chemical	23,922
San Jacinto	14,200	1,328	Db, Ips, Dj	PP, JP, CP	Chemical	20,857
Sequoia and Kings Canyon	8,000	5,002	Db, Ips	PP	Fall, burn, chemical	4,161
Wrightwood	2,280	119	Mc, Ips	JP	Chemical	267
STATE AND PRIVATE SUBTOTAL	134,896	13,631				\$ 89,918
FEDERAL AGENCIES						
Yosemite - bark beetles	12,000	3,322	Db, Dm	PP, SP	Chemical	\$102,900
Yosemite - needle miners	3,986	-	Em	LP	Chemical	51,990
Lassen - bark beetles	9,200	1,286	Db, Dm, Dj	SP, PP, JP	Chemical	14,337
Sequoia and Kings Canyon - bark beetles	9,020	1,225	Db, Dm	PP, SP	Chemical	46,503
Sequoia and Kings Canyon - needle miners	250	-	Rm	LP	Chemical	4,553
NATIONAL PARK SUBTOTAL	34,456	5,833				\$220,283
Tuolumne Rancheria (Tuolumne County)	100	118	Db, Ips	PP	Logged	No direct control costs
Tule River Reservation	40	23	Db	PP	Chemical	\$ 218
BUREAU OF INDIAN AFFAIRS SUBTOTAL	140	141				\$ 218
BUREAU OF LAND MANAGEMENT SUBTOTAL	5,000	1,000	Db, Ips	PP	Chemicals	\$ 10,000
Angeles	4,855	98	Db, Mc, Dm, Dj	PP, JP, CP, SP	Chemical	\$ 1,815
Cleveland	7,533	956	Mc, Ips, Db	JP, CP	Chemical	15,089
Eldorado	102,600	12,306	Ips, Db	JP, PP	Chemical, log	18,412
Lassen	35,776	5,240	Db, Dj, Ips, Dm	JP, PP, SP	Chemical, log	7,495
Los Padres	15,083	521	Mc, Ips, Db	CP, JP, PP	Chemical, log	17,538
Mendocino	10,470	3,174	Db, Ips, Dm	PP, SP	Chemical	9,343
Modoc	18,200	2,520	Db, Ips	PP	Log	2,700
Plumas	480	69	Db, Ips, Dm	PP, SP, WF	Chemical, log	1,005
San Bernardino	27,560	1,869	Ips, Db, Dm, Dj, Mc	PP, JP, SP, CP	Chemical, log	47,112
Sequoia	20,070	9,557	Dj, Db, Ips, Dm	PP, SP, JP	Chemical, log	24,516
Shasta-Trinity	7,505	1,080	Db, Dm, Ips	PP, SP	Chemical, log	7,391
Sierra	50,434	7,920	Db, Dm, Ips, Dj	PP, JP, SP	Chemical, log	63,120
Stanislaus	459,966	33,749	Db, Ips, Dm, Dj	PP, SP, JP	Chemical, log	50,180
Tahoe	26,000	3,313	Db, Ips, Dm	PP, SP	Chemical, log	250
NATIONAL FOREST SUBTOTAL	786,532	82,372				\$265,966
STATE TOTAL	961,024	102,977				\$586,385

TABLE 3--FOREST INSECT CONTROL ACTIONS RECOMMENDED BY THE COUNCIL

INFESTATION AREA	ESTIMATED ACREAGE	COUNTY	INSECT	HOST	RECOMMENDED ACTION
COMMERCIAL TIMBERLANDS					
Bailey Ridge	300	Calaveras	Hp	WF	Evaluation
Big Pines	100	Los Angeles	Nr	PY	Surveillance
Bowman Ridge	3,000	Glenn	Db	PP	Log and treat infested trees
Chalk Mt.	3,000	Shasta	Na	WF	Evaluation
Crowder Flat	3,500	Modoc	Db	PP	Evaluation
Dry Lake	15,000	Siskiyou	Ta, Sv	RF	Log infested trees
Hat Creek	3,000	Shasta	Db	PP	Evaluation
Iron Mt.	600	El Dorado	Hp	WF	Evaluation
Joseph Creek	1,000	Modoc	Dm	PP	Surveillance and evaluation
Knox Mt.	22,000	Modoc	Na, Hp	WF	Evaluation
Little Red Mt.	1,000	Tehama	Db	PP	Evaluation
Lumberyard	80	El Dorado and Amador	Hp	WF	Evaluation
McGee Burn	5	Fresno	G	PP	Evaluation
Miami Creek-Lewis Fork-Big Creek	10,800	Madera, Mariposa	Dm	SP, PP	Log or treat infested trees
Military Pass, Black Fox	13,000	Siskiyou	Na	WF	Evaluation
Mother Lode Infestation	*	El Dorado, south to Kern	Db	PP	Log or treat infested trees
Northeastern California Plantations	*	Siskiyou, Modoc, Lassen Statewide	Aw Ce, Misc.	B&R PP, JP, SP, DF	Evaluation Detection, evaluation as needed
Seed Production Area	*	Northern California	C&S	PP	Evaluation
Sentinel Meadows	2,200	Inyo	Rm (Near)	LP	Surveillance
Snow Valley	100	San Bernardino	Nr	PY	Surveillance
Soup Creek-Parker Creek	15,000	Modoc	Db, Dj	PP, JP	Log infested trees
Taylor Creek, Bartolas Country	100	Tulare	Nr	PY	Surveillance
Taylor Meadows, Ski-Hi	7,500	Tulare and Kern	Cp	JP	Evaluation
Towhead Mt.	1,500	Tehama	Db	PP	Evaluation
True Fir Areas	*	Statewide	Sv	WF, RF	Evaluation and surveillance
Warner Mts.	5,000	Modoc	Cf	WF	Evaluation
Warner Mts.	500	Modoc	Cc	QA	Surveillance
All National Forests State Forests Private Timber Land Managers Bureau Land Management Bureau of Indian Affairs	*	Statewide	Dm, Dj, Sv, Dp, Dv	PP, JP, SP, WF, DF, LP	Sanitation-salvage and control with chemical sprays where warranted.
STATE AND NATIONAL PARKS					
Cuyamaca Rancho State Park	8,000	San Diego	Mc, Db	JP, PP	Maintenance control
Lassen Volcanic National Park	3,000	Shasta-Lassen	Dj, Db, Dm	JP, PP, LP, SP	Treat infested trees
San Jacinto State Park	700	Riverside	Db, Ips	CP, PP	Maintenance control
Sequoia and Kings Canyon N.P.	8,500	Fresno, Tulare	Db, Dm, Rm	PP, SP, LP	Maintenance control and special projects
Yosemite National Park	57,700	Mariposa-Tuolumne	Db, Dm, Dj, Rm	PP, SP, JP, LP	Maintenance control and special projects
FOREST RECREATION AREAS					
Arrowhead-Crestline	46,000	San Bernardino	Dm, Db, Ips, Dj	PP, CP, JP, WF	San.-salvage, treat inf. trees
Arroyo Seco	*	Los Angeles	Db, Ips, Mc	PP, CP, JP	San.-salvage and maint. control
Bass Lake	9,000	Madera	Db, Ips	PP	Log or treat infested trees
Big Bear Valley	8,800	San Bernardino	Dj, Ips, Mc, Sv	JP, WF	Log or treat infested trees
Corte Madera	1,600	San Diego	Db, Ips, Mc, Dv	CP, JP, PP	Maint. control according to plan
Idyllwild-San Jacinto	37,000	Riverside	Mc, Db, Ips Dm, Sv	PP, CP, JP, WF	San.-salvage and maint. control
Laguna Mt.	9,700	San Diego	Db, Mc	CP, JP	Maint. control according to plan
Laguna Mt.	*	San Diego	Cp	JP	Surveillance
Lost Valley	4,000	San Diego	Db, Ips	CP	Maint. control according to plan
Mt. Baldy	1,500	Los Angeles	Ips, Dj, Dm Mc, Db	PP, JP, CP	San.-salvage and maint. control
Mt. Pinos	7,900	Ventura and Kern	Mc, Db, Ips	JP, PP	San.-salvage and maint. control
Palomar Mt.	6,600	San Diego	Db, Sv	CP	Surveillance
San Geronimo	25,000	San Bernardino	Db, Dj, Dm, Mc, Sv, Ips	PP, JP, CP, WF	San.-salvage and maint. control
Santa Maria	700	Santa Barbara	Db, Ips, Dv	PP, CP	Fire salvage and maint. control
Valyermo	14,600	Los Angeles	Mc, Ips, Sv	JP, WF	San.-salvage and maint. control
Wrightwood	7,700	San Bernardino	Mc, Ips	JP	Maintenance control
EXPERIMENTAL AREAS					
Institute of Forest Genetics	8,200	El Dorado	Db, Ips	PP	Treat infested trees
Tanbark	30	Los Angeles	Ips	CP, KP	Treat infested trees

* Acreage not known.

acres; defoliation on 3,000 acres is heavy. Part of this area is being managed for Christmas tree production, and the damage to the trees has seriously curtailed harvesting. The private landowners involved are considering direct control of this outbreak next year if conditions then warrant such action.

Heavy feeding damage on white fir occurred on 3,000 acres in the Chalk Mountain-Summit Lake area, Shasta County; on 13,000 acres in the Military Pass-Black Fox area, Siskiyou County; and on a few hundred acres on Bailey Ridge, Calaveras County. Light feeding damage was reported from numerous localities in Tuolumne, Calaveras, Lassen, Modoc, and Siskiyou Counties.

PANDORA MOTH, Coloradia pandora. Pandora moths in a 7,500-acre infestation caused light to heavy defoliation of Jeffrey pine in the Taylor Meadow-Bartolas Country area of Tulare and Kern Counties. This outbreak has been in progress for at least two years (the insect has a two-year life cycle) and some tree killing has resulted. A survey of the insect population will be made in 1964 to determine the trend of the infestation. Small infestations of this pest were reported from Laguna Mountain and Julian in San Diego County.

JEFFREY PINE BEETLE, Dendroctonus jeffreyi. With two exceptions, populations remained low throughout northern California.

In the southern Warner Mountains, Modoc County, a Jeffrey pine beetle outbreak killed an estimated 3.5 million board feet of Jeffrey pine on 22,000 acres in 1963. This was but part of a destructive buildup of several primary bark beetles in the coniferous stands in this area. (See section on Mountain Pine Beetle.)

Numerous individual trees and small groups of Jeffrey pine died on the inaccessible northern part of the Kern Plateau, Tulare County, as a result of continued attacks by the Jeffrey pine beetle and the California flatheaded borer.

IPS, Ips spp. Damage remained low throughout the State for the second year in succession. The intensive control programs of recent years as well as improved host resistance resulting from late winter and spring precipitation and to cool weather during the late spring and early summer are believed responsible.

DOUGLAS-FIR BEETLE, Dendroctonus pseudotsugae. Although losses remained at a low level Statewide, insect broods were numerous in windthrown Douglas-fir in Humboldt, Del Norte, Trinity, and Siskiyou Counties. This windthrow occurred during the Columbus Day Storm of 1962. Broods in the down trees may emerge and attack the surrounding green standing trees in the spring of 1964.

RED TURPENTINE BEETLE, Dendroctonus valens. Aggressive attacks caused moderate to heavy damage in reserve ponderosa and Jeffrey pine trees in thinned areas in Mendocino, Modoc, and Lassen Counties. A moderate to heavy buildup of this insect was observed in the pine blowdown in Lassen, Modoc, Shasta, Siskiyou, and Trinity Counties.

In southern California aggressive populations of this beetle developed in fire-damaged ponderosa pines at Ranger Peak, Santa Barbara County, and at Corte Madera, San Diego County. Populations of this bark beetle are high throughout most of southern California. The bases of standing pines were sprayed with lindane as a preventive measure in a few areas.

CALIFORNIA FLATHEADED BORER, Melanophila californica. Flatheaded borer activity declined throughout the State except for heavy buildup in blown down timber in northern California and an outbreak at Lake Hemet in Riverside County. Several persistent infestations of this insect in southern California appear to have been suppressed by effective maintenance control programs.

Control of this insect by aerial application of malathion has been underway in the Tuolumne Meadows outbreak since 1959. In 1963, the appearance of previously treated stands continued to improve. An additional 4,200 acres, most of which had not been sprayed earlier, were also treated in 1963, and surveys indicate that the insect population was reduced 89 percent on about 4,000 acres of the treated area; on the remaining 200 acres a 52 percent reduction was achieved.

In Kings Canyon National Park, a 450-acre outbreak at Woods Creek was treated in the same way. Here, a 62 percent reduction resulted.

PINE REPRODUCTION WEEVIL, Cylindrocopturus eatoni. Moderate losses continued in plantations and in natural regeneration at several locations in the low-elevation pine type in central and northern California. The most noteworthy infestations are in the Shasta Brushfield and Lava Burn Plantations, Siskiyou County, and the Spinning Wheel and Tuolumne Rim Plantations, Tuolumne County.

LODGEPOLE NEEDLE MINER, Recurvaria milleri. An additional infestation, of what is presumably this insect, continued in Sentinel Meadows, Mono County.

SPRUCE BUDWORM, Choristoneura fumiferana. Heavy defoliation of white fir in midsummer resulted in some top killing on several thousand acres in the Benton Meadows and Upper Joseph Creek areas of the Warner Mountains, Modoc County. However, a survey of budworm eggs, made in August on five permanent sample plots, disclosed reductions of up to 99 percent in the numbers of eggs laid in 1963, as compared with similar egg counts made in 1962. This drastic reduction is believed to be due to serious frost damage in the 1963 foliage. No serious defoliation by this insect is expected in this area in 1964.

NEEDLE SHEATH MINER, Zelleria haimbachi. Fairly heavy defoliation of the current year's growth of ponderosa pine occurred in the Shasta Brushfield Plantation, Siskiyou County, and at the Institute of Forest Genetics, El Dorado County. Light defoliation of ponderosa pine was observed in plantations and in natural regeneration throughout much of the pine type in central and northern California. A tip moth, Rhyaciona zozana, also caused light feeding damage in many plantations and natural stands.



Pest Control Action



PREVENTION OF ANIMAL DAMAGE

Aluminum bands fastened to trees in intensively managed seed-production areas prevent squirrels from climbing the trees and cutting the cones.

FOREST DISEASE DETECTION

Illustrated is a windthrown white fir typical of those examined during the root disease survey. Armillaria root rot had weakened the tree to the point that it was no longer wind-firm. Note the shiny black rhizomorphs and rotted wood typical of this disease.

◁ PREVENTION OF INSECT DAMAGE

Stagnating young-growth stands of ponderosa pine in parts of California are being ravaged by bark beetles. Since healthy trees are better able to withstand insect attacks, overstocked stands are being thinned to increase tree vigor and to reduce or prevent further insect damage.

BARK BEETLE SUPPRESSION ▷

Recent research shows that the insecticide, lindane, can be used year round, thus replacing the more costly ethylene dibromide that was formerly necessary in winter months.



in California - 1963



BROWSE AND RANGE INSECTS. A sagebrush defoliator, Aroga websteri, caused moderate to complete defoliation of sagebrush on over a million acres in northern California. The heaviest damage occurred in Modoc and Lassen Counties. The defoliation of bitterbrush, saltbrush, and mountain mahogany was reported from several locations in this same general area. The insects responsible for this defoliation have not yet been identified.

OTHER INSECTS. Feeding damage on aspen by the large aspen tortrix declined significantly in the Homestead Flat and Long Valley areas, Modoc County; however, the damage from last year's feeding is still evident.

An outbreak of the blue-sided tent caterpillar on oak showed a marked decline in the Mt. Wilson-Red Box area, Los Angeles County.

Localized infestations of a pinyon sawfly, probably Neodiprion rohweri, were reported at Big Pines, Los Angeles County, and Taylor Creek, Tulare County.

An outbreak of the fall webworm resulted in extensive defoliation of madrone and other broad-leaved trees along the Klamath River in Siskiyou County; no permanent damage is expected.

Grasshoppers seriously defoliated pine seedlings and other associated plants on areas of up to five acres on the Potato Hill Plantation, Lake County, and the McGee Burn Plantation, Fresno County.

Populations of the black pine leaf scale on sugar pine increased at many scattered localized areas in northern California.

THE STATUS OF FOREST DISEASES

ROOT DISEASES. Several groups of dead pines killed by a joint attack of root diseases and insects were found at Boggs Mountain State Forest; similar infection centers were found on the Shasta, the Eldorado, and the Inyo National Forests. The root diseases responsible are Fomes annosus, Armillaria mellea, and Verticicladiella wagnerii.

Fomes annosus: Trees killed by Fomes annosus were found at many locations in the Boggs Mountain State Forest; in all, about 70 individual infection centers of Fomes root disease have been located in the Forest. Other new infection centers found this year were: in a plantation of pine hybrids (ponderosa x montezuma) at Rider Gulch on the Klamath National Forest; on a ponderosa pine beside Beartrap Creek about 10 miles southwest of McCloud; in the Hat Creek area, and near Big Springs on Highway 89 north of Lassen Volcanic National Park. F. annosus was also found beside Clarks Fork River in Alpine County, and along a tributary of Deadman Creek in Mono County. The disease was again reported from Blacks Mountain in Lassen County and a few infected trees were found along Butt Creek in Plumas County. The disease is still active at the Institute of Forest Genetics near Placerville and infected young ponderosa pines were found near Camino in El Dorado County. Fourteen F. annosus centers on Coulter and ponderosa pine were found in the Monterey Division of the Los Padres National Forest in Monterey County.

Armillaria mellea: The root disease survey established that Armillaria root rot is widespread and often present in the roots of trees windthrown during storms of the past year. It was also found at many other areas where root systems could be examined. Of the 2,120 root systems examined in the root disease survey, 50 percent were infected with Armillaria mellea. Armillaria was present at 21 of the 22 areas examined on the Shasta-Trinity and at 17 of the 19 areas examined on the Lassen National Forest. Heavy infection occurred in the Sterling Mountain area near Hilt and in Shovel Creek near Dorris, in Siskiyou County, where 39 of 44 root systems examined were infected. It was present at four of five areas examined on the Mendocino National Forest and on 11 of the 20 red firs examined near Summit Lake in Lassen Volcanic National Park. Additional centers were located at Boggs Mountain State Forest.

In addition to the areas discovered during the root disease survey, Armillaria was located in one or more campgrounds in each of the following counties: Shasta, Trinity, Plumas, El Dorado, Tuolumne, and Fresno.

Verticicladiella wagnerii: The root and butt disease producing a dark stain in affected wood continued to be active in previously located areas. One new location at Old Camp 10 (Silver Hill area) in El Dorado County was found during the summer. What appears to be Verticicladiella wagnerii was seen in the roots of dying pinyon pine in the foothills of the White Mountains in Inyo County.

Polyporus schweinitzii: Thirty-four or two percent of the windthrown trees had roots that were damaged by butt rot caused by Polyporus schweinitzii.

Considerable damping-off damage occurred at the Placerville Nursery where the wet spring prevented soil fumigation. A combined Pythium and Rhizoctonia infestation, and later in the season a charcoal root rot Sclerotium bataticola infestation resulted in heavier losses than usual.

DWARFMISTLETOE. Dwarfmistletoe occurrence in California is best revealed by the summary of Forest Disease Survey findings, Table 4,

NEEDLE DISEASES. Little change in the intensity of most needle blights, casts and molds occurred. Douglas-fir needle cast, Rhabdocline pseudotsugae, was reported from Del Norte, Humboldt and western Siskiyou Counties. Hypodermella arcuata on the needles of sugar pine was quite common in Siskiyou County near Hilt.

RUST ON CONIFERS. Due to spring and summer rains, white pine blister rust was more plentiful on ribes in the northern end of the State than usual. Since very little of the area is within control units, the heavy ribes infection has little practical significance. The intensity of blister rust damage decreases with distance southward from Oregon to the rust's southern known limit at Dodge Ridge in Tuolumne County. There has been no known southward extension of the rust's spread since its incidence at Dodge Ridge in 1944. Pinyon rust on ribes was present but not too common from Fresno County northward.

Comandra rust caused by Cronartium comandrae was found damaging ponderosa pine at the 12-year-old Long Valley Plantation west of Burney Falls. This is the first outbreak of this rust (the cankers were four to five years old) that has been observed for many years. Old cankers were observed on mature ponderosa pines along the road leading into Shovel Creek, Siskiyou County.

Damage caused by western gall rust, Peridermium harknessii, in young natural stands of ponderosa pine as well as in plantations was reported from both the Coast and the northern Sierra Nevada Ranges. Unlike most rusts, this parasite can spread directly from one tree to another.

Other rusts such as limb rust, stalactiform rust, the rust on red and white fir known as yellow witches' broom, and incense-cedar rust (the most widely distributed disease on a single-tree species in California) showed no change in status. The uredial stage of yellow witches' broom rust was quite common on chickweed (the alternate host) at areas examined in Tuolumne and Fresno Counties.

CYTOSPORA CANKER OF TRUE FIR. The intensity of the cytospora canker appears to be declining in the northern end of the State and on the increase in the central Sierra. Due to occasional rains, spore tendrils were seen throughout the summer and fall. Little is known about the timing of infection of this disease but it is quite possible it may increase in intensity at some locations in 1964.

TABLE 4--FOREST DISEASE SURVEY DATA - CALIFORNIA 1958 - 1963

TREE SPECIES	TOTAL SAMPLE		INFECTION BY NUMBER OF PLOTS AND TREES																
			DWARFMISLETOE	TRUE MISLETOES	ELLYTODERMA DEFORMANS	OTHER NEEDLE CASTS	UNCLASSIFIED FOLIAGE	CROMARTIUM RIBICOLA	GYMOSPORANGIUM LIBOCEDRI	MELAMPSORELLA CARY.	PERIDERMUM HARKNESSII	P. STALACTIFORME	CYTOSPORA ABIEITIS	UNCLASSIFIED LIMB CANKER	ECHINODONTIUM TINCTORIUM	FOMES PINI	POLYPORUS SCHWEINITZII	X-DISEASE	UNCLASSIFIED HEART ROTS
			UNIT	NO.															
Ponderosa Pine	Plots	349	75		84	141	11				8					11			80
	Trees	3859	369		324	482	34				15					13			145
Jeffrey Pine	Plots	143	20		36	45	2			4	1							4	25
	Trees	1353	84		154	129	3			10	1							27	49
Sugar Pine	Plots	224	55			19	4	9								3			44
	Trees	774	80			24	9	14								3			55
Lodgepole Pine	Plots	63	18		1	2	3			22	19							1	23
	Trees	765	198		1	14	9			67	55							1	63
Incense-Cedar	Plots	249		53		2			219										74
	Trees	1330		102		3			962										312
White Fir	Plots	311	90	20		40	35			5		129	17	21	3	1			208
	Trees	3292	548	45		84	122			5		484	28	34	4	1			656
Red Fir	Plots	83	33			2	5			14		78	6	5					49
	Trees	917	332			2	5			34		148	18	7					164
Douglas-Fir	Plots	210	10			7	10						38		70	20			107
	Trees	2203	41			25	21						225		182	27			298
Juniper	Plots	45		3		1	5												12
	Trees	193		6		3	15												19
Redwood	Plots	18																	9
	Trees	319																	156
Knobcone Pine	Plots	9	8		1	2				1									1
	Trees	55	33		1	5				7									1
Western Hemlock	Plots	4	1																3
	Trees	21	5																5
Western White Pine	Plots	23				3		2											7
	Trees	83				8		3											7
Digger Pine	Plots	6	1			1				1									
	Trees	13	1			4				1									

CHLOROTIC DECLINE OF PONDEROSA PINE (X-DISEASE). Chlorotic decline of ponderosa pine in southern California continued to be active and is slowly extending its zones of occurrence.

WEATHER. In parts of northern California unseasonable patterns of snowfall and low temperatures combined to create an unfavorable environment for seedlings and saplings, and at some locations, for older trees as well. Some areas, where snow generally begins to blanket the ground in November and December, weren't covered until well into March, and temperatures from mid-December 1962 to the end of June 1963, with the exception of February, were below normal. During subfreezing weather, the lack of snow allowed the surface layer of soil to freeze with the result that many of the shallow feeder roots were frozen for several consecutive days. With the roots frozen, transpired water could not be replaced and damage varying from a slight foliage burn on sheltered trees to a complete kill on fully exposed trees resulted. In both the Elk Creek area of Glenn County and the Trinity Lakes area of Trinity County even mature trees were injured in this way.

MISCELLANEOUS DISEASES. From one to several specimens of the following diseases were examined and identified during the past year:

1. Atropellis canker, Atropellis pinicola, on sugar pine was reported from Shasta, Placer and El Dorado Counties.
2. Bacterial canker of Douglas-fir, Bacterium pseudotsugae, occurred from Boggs Mountain State Forest northward.
3. Twig killing of Monterey pine at Deer Flat County Park in Monterey by Diplodia pinea was noted.
4. The roots of a rust-resistant sugar pine graft, killed by Armillaria mellea at the Badger Hill Seed Orchard, Placerville, were found to support species of a Phytophthora and Rhizoctonia solani, both generally saprophytic but capable of becoming virulent pathogens.
5. Coryneum canker, Coryneum cadinale, was found in a redwood plantation in the Navarro River area.
6. The leaves of California laurel were lightly to severely infected (some trees being completely defoliated) in the Coastal area by two fungi, Collectotrichum gloeosporioides, and Kabatiella phoradendri f. umbellulariae.
7. A snow mold caused by Neopeckia coulterii was reported on sugar pine in El Dorado County.
8. In southern California a bark canker caused by Cytosporina cerviculata severely damaged alder trees in a campground.

9. The Coast form of western gall rust, Peridermium cerebroides, reached damaging proportions in plantations of Monterey pine both at Fort Bragg and Arcata.
10. Needle diseases caused by Hypoderma pedatum and Naemacyclus niveus killed needles of Monterey pine in the Monterey area.
11. The needle cast, Hypodermella medusa, damaged Jeffrey pine in a plantation in Modoc County.
12. The lodgepole pine needle cast, Hypodermella montana, added to the insect damage at Tuolumne Meadows in Yosemite National Park.
13. Of little commercial significance but of interest, Elytroderma deformans was found on knobcone pine at the Dead Horse Summit area in Siskiyou County.
14. A needle cast, Lophodermellina pinastri, caused some damage to the foliage of Sitka spruce in Humboldt County.
15. Twig killing of manzanita growing in a campsite in Fresno County was attributed to Botryosphaeria ribes.
16. A few specimens of true fir needle-rust caused by Pucciniastrum goeppertianum were found on white fir in Trinity County.

TABLE 5--ROOT DISEASE SURVEY OF BLOWN DOWN TIMBER - NORTHERN CALIFORNIA - 1963

NUMBER OF TREES BY ROOT ROT BY PERCENTAGE OF DAMAGED ROOTS BY TREE SPECIES

TREE SPECIES	TREES EXAMINED	ROOT ROT PRESENT					NUMBER OF TREES BY PERCENTAGE OF DAMAGED ROOTS				
		P. SCHW.	A. MELLEA	FOMES ANNO.	OTHER	TOTAL	LESS 5	5-10	11-20	OVER 20	TOTAL
Douglas-Fir	240	15	67		14	96	59	14	4	16	93
Ponderosa Pine	297	7	64	1	44	116	72	22	7	13	114
Jeffrey Pine	6		2		1	3	2	1			3
Sugar Pine	149	6	43		12	61	40	7	6	5	58
Lodgepole Pine	48	2	14		1	17	12	2		3	17
Knobcone Pine	5		4			4	4				4
White Fir	1,297	4	837		101	942	473	102	75	286	936
Red Fir	31		17		4	21	10	9		2	21
Incense-Cedar	47		6		10	16	6	2	4	3	15
TOTAL	2,120	34	1,054	1	187	1,276*	678	159	96	328	1,261

* Each of fifteen trees had two root rots present.

THE STATUS OF ANIMAL PESTS

PORCUPINES. Porcupines accounted for the greatest number of animal pest detection reports with a total of 18. Damage by these animals is especially serious and noticeable in sapling-stage plantations and in natural reproduction, however, considerable girdling can also be found in plantations of younger trees. A single incidence of porcupine damage in a pine plantation was reported this year in the Coastal region of Humboldt County; porcupine damage in the past has usually not occurred in the north Coastal area. Baiting of porcupine dens, the use of the Weyerhaeuser-type bait box, and shooting, remain the primary tools of control. Better attractants than salt are greatly needed.

DEER. Nine reports attributing damage to deer were received. For the most part this type of damage involves browsing of the terminal portions of seedlings. If these seedlings are young or are newly planted, they usually die. Otherwise, they are retarded in growth. Some foresters are using repellents, screening, or piling brush over the seedlings to reduce deer damage. But in spite of these measures, deer browsing in new plantations continues to result in the greatest economic loss chargeable to animal damage. During the past year a special deer hunt was held on Rockport Redwood Company land in areas where serious damage was taking place. The hunt, which was conducted on a permit basis by the California Department of Fish and Game, removed 101 deer as planned.

WOODRATS. Woodrats caused more damage than usual this year, and were the subject of nine detection reports. Patches of bark removed from the trunks of conifers typifies damage by this animal, but may be confused with porcupine or squirrel damage. The work of porcupines, however, can usually be distinguished by the more prominent incisor marks on the exposed wood so that the main area of confusion is between squirrel and woodrat damage.

SQUIRRELS. Four occurrences of tree squirrel damage were reported. One of these concerned cone-cutting on a seed collection area and the others involved stripping of bark from the trunks of trees. Damage of this type (which could partially be caused by woodrats) is not intensive at any one location, but for the area as a whole, results in a number of trees being damaged. Often the terminal portion of 30- to 40-year-old trees are killed. Metal bands have been installed on about 7,000 cone collection trees to reduce squirrel cone-cutting activities. Two reports attributed seedling damage to ground squirrels.

RABBITS. Damage by rabbits continues to produce serious losses in some areas of the State, and a total of eight detection reports were received. Plantations of the Mendocino National Forest were especially hard hit. Although repellents appear to give good protection, they are temporary and seedlings are damaged as they grow taller and the repellent wears off.

POCKET GOPHERS. Pocket gopher damage occurs primarily in plantations and results in the killing of trees due to root cutting. Losses have been reported from four locations this year, and have been found to occur mainly in plantations that are a few years old. Control methods consist of probing for the underground burrows and baiting these with toxic grain or vegetable bait.

MOUNTAIN BEAVER. Mountain beaver, which damage young trees by pruning of the lateral limbs and removing bark from the trunk, were responsible for damage reported from two areas this year. Mountain beaver damage has never been considered serious in California, and occurrences have been limited to the northwestern portion of the State.

DEER MICE. Two reports of seed spot depredations were received. The depredations were reported to have occurred in spite of seed treatment which usually affords satisfactory protection from seed eating rodents.

ELK. Elk browsing in plantations and in natural regeneration continues to be a problem in the northwestern area, although only one damage report regarding this was received. The report concerned a Douglas-fir plantation in Humboldt County which was 25 to 30 percent damaged. In efforts to reduce elk numbers in localized areas, the California Department of Fish and Game conducted a special hunt during October in which 70 elk were taken. This hunt was conducted on a permit basis and applicants were required to take marksmanship and written examinations. Studies to determine the effects of this hunt on browse species and forest crops will be made.

BEAR. Although no field detection reports were received during the past year regarding bear damage to trees, damage by this animal continues to occur periodically in northwestern portions of the State.

BIRDS. Tree seed is now protected effectively by coating with chemical repellents such as Arasan or Anthraquinone. All State and Federal tree nurseries in California treat thousands of pounds of tree seed prior to sowing the nursery beds. Upon request, seed for seed-spotting projects in the field is treated at the seed bank before shipping.

ENDORSEMENTS BY THE CALIFORNIA FOREST
PEST CONTROL ACTION COUNCIL - 1963

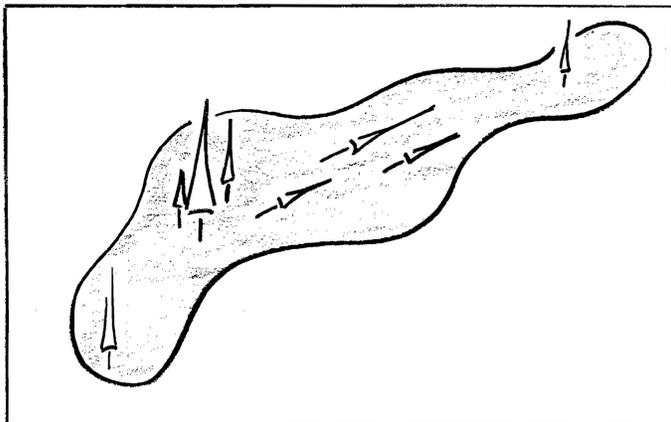
At its annual meeting in November, the Council took the following action:

1. Adopted a policy resolution regarding the use of pesticides, copies of which are available from the Council secretary.
2. Determined that the Blowdown Committee had completed the work for which it was formed and dissolved the Committee.
3. Determined that the Mother Lode Subcommittee had completed its work and was no longer needed.
4. Learned that a deer exclosure pamphlet will soon be published by the Council.
5. Received a special report on root diseases in windthrown timber.
6. Adopted a resolution urging the United States Bureau of Sport Fisheries and Wildlife Service to station a research biologist in California.
7. Adopted a resolution urging the Western Forestry and Conservation Association to support increased research into the biology and control of root diseases.
8. Elected the following new officers: John Callaghan, Chairman; Charles Eaton, Vice-Chairman; James Averell, Secretary.
9. Endorsed the insect control projects listed in Table 3.

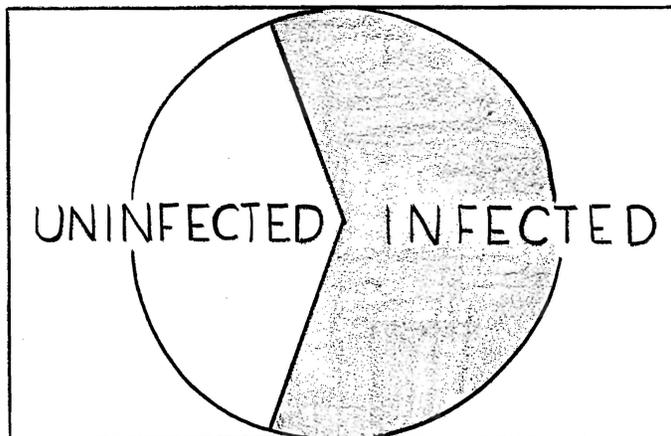
DURING THE SUMMER OF 1963 FOREST SERVICE PATHOLOGISTS SURVEYED ROOT DISEASES IN WINDTHROWN TREES FROM THE STORMS OF OCTOBER 1962



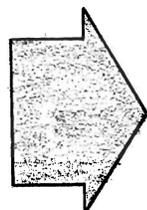
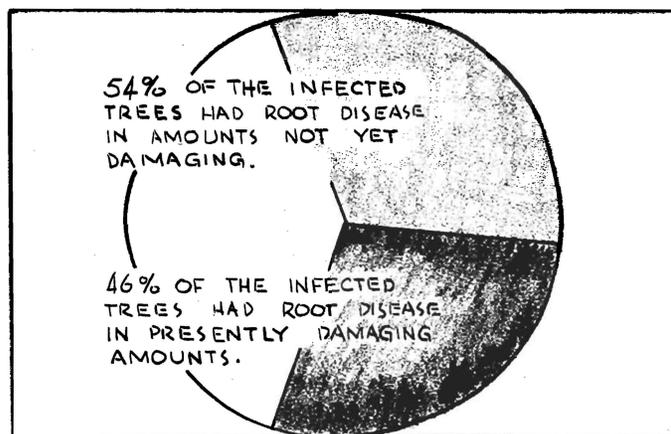
2120 WINDTHROWN TREES AT 48 SEPARATE BLOWDOWN LOCATIONS WERE EXAMINED FOR ROOT DISEASE.



60 PERCENT OF THE TREES WERE INFECTED WITH ONE OR MORE ROOT DISEASES.



DAMAGING AMOUNTS OF ROOT DISEASE WERE FOUND ON NEARLY HALF OF THE INFECTED TREES.



ON ONE - THIRD OF THE TREES EXAMINED, ROOT DISEASES WERE A WINDTHROW FACTOR