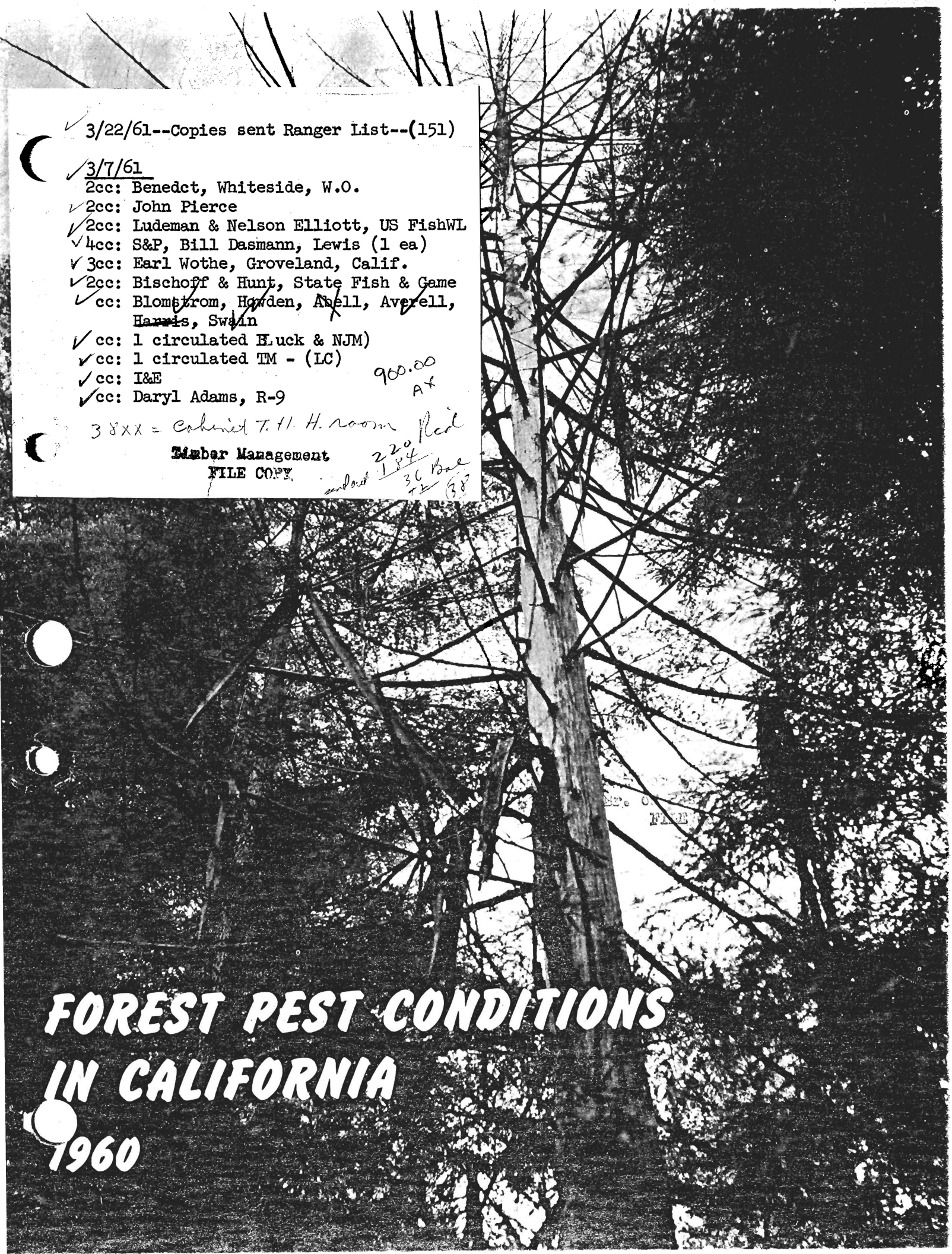

✓ 3/22/61--Copies sent Ranger List--(151)

✓ 3/7/61
2cc: Benedct, Whiteside, W.O.
✓ 2cc: John Pierce
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✓ cc: Blomstrom, Howden, Abell, Averell, Harris, Swain
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FOREST PEST CONDITIONS IN CALIFORNIA 1960

Official Report of the

CALIFORNIA FOREST PEST CONTROL ACTION COUNCIL

The California Forest Pest Control Action Council is composed of representatives of the following organizations:

California Forest Protective Association
California Redwood Association
State of California Department of Agriculture
State of California Department of Natural Resources
U. S. Bureau of Indian Affairs
U. S. Bureau of Land Management
U. S. Fish and Wildlife Service
U. S. Forest Service
U. S. National Park Service
University of California
Western Pine Association

Prepared by the U. S. Forest Service and U. S. Fish and Wildlife Service in cooperation with other members of the Council. Published by the California Division of Forestry.

Cover: Young redwood tree stripped of bark by bears in Humboldt County.

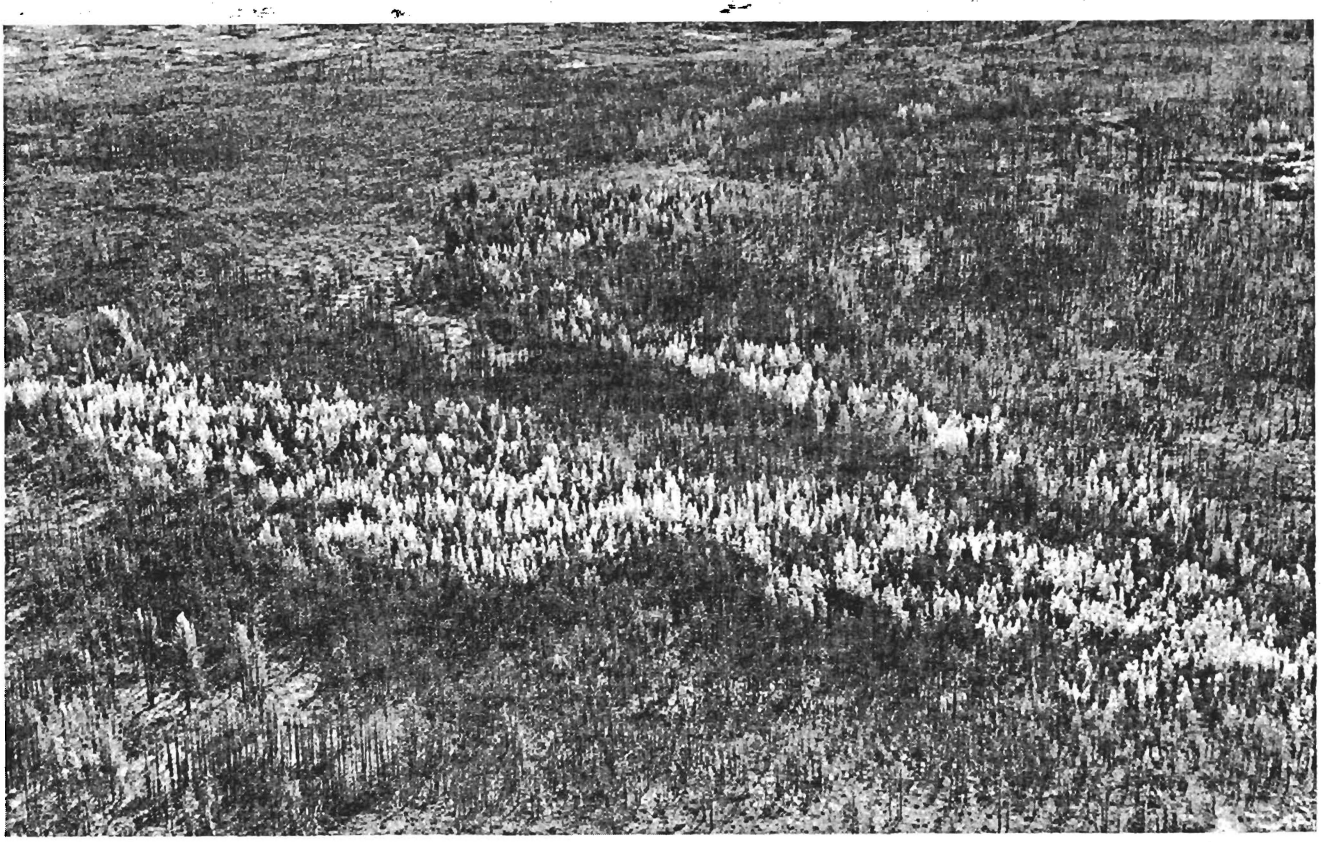
Sacramento February 1961

FOREST PEST CONDITIONS IN CALIFORNIA
As Revealed by Insect, Disease and Animal Damage Surveys During 1960

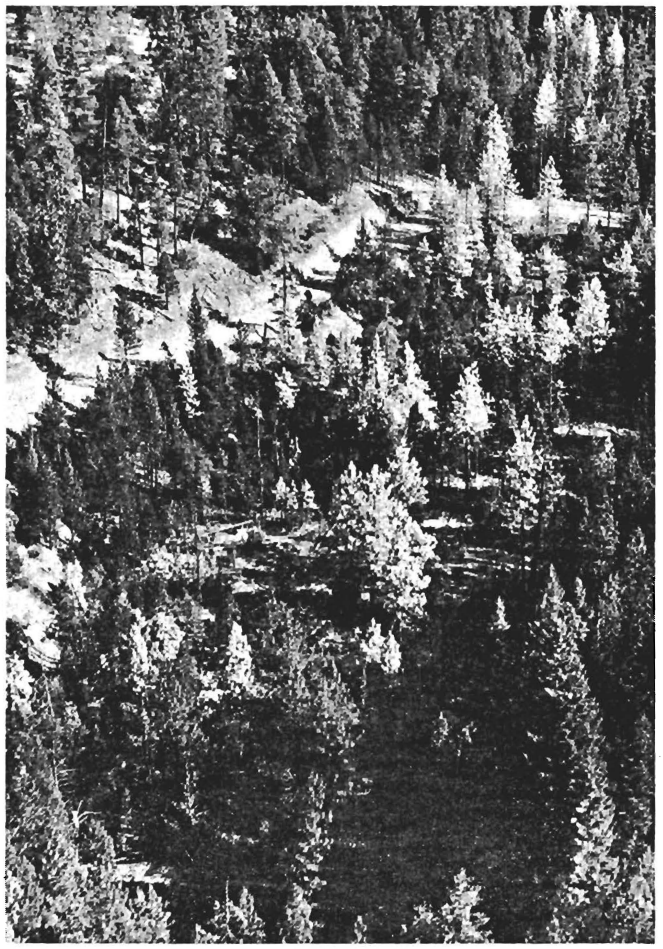
FOREST INSECTS

Forest insects in California were somewhat less destructive in 1960 than in 1959. Results of the cooperative forest pest detection survey program, coupled with on-the-ground observations by foresters and entomologists, showed that in some parts of the State the forest insect picture was about normal. In others, however, infestations continued out of control killing merchantable timber, reducing growing stock, and depleting the seed supply.

Pine bark beetle infestations generally did not become as critical statewide as had been indicated by the trend of developments last year. In part this was due to steps taken early in 1960 to suppress major infestations. A full fledged western pine beetle outbreak in Shasta and Lassen Counties near Hat Creek, for example, was successfully controlled by the combined efforts of industry, state and federal foresters. A second factor that helped keep the beetles from becoming more abundant was fast action in logging fire-injured trees damaged by the holocausts of 1959. Removing such trees before beetles could breed in them greatly reduced the number of potential infestation foci. Typical of accomplishments of this kind was the work done on the Lava Burn, and the Icehouse Burn, where most of the logging was completed by early summer. A third factor that may have deterred or delayed beetle development at the outset of the season was unusually cold, wet weather in the late spring months.



Knobcone pine killed by ips beetles on the Lava Burn, Modoc County.



Ponderosa pine killed by western pine beetle and ips as an aftermath of the Hillhouse Fire, Tehama County.

Despite these favorable developments, destructive infestations of certain pine bark beetles, the California flatheaded borer, the lodgepole needle miner, and many other well-known pests persisted, causing damage far exceeding tolerable levels. Other problems of more recent origin helped to complicate the situation. These included a resurgence of fir engraver infestations, discovery of an outbreak of the large aspen tortrix, and the threatened spread of the European pine shoot moth into California from Oregon where it was found for the first time in 1960. Last but not least was the tremendous increase in potential bark beetle infestation areas resulting from another year of extensive timber fires. And while bark beetle outbreaks around most 1959 burns were relatively minor, the second year after a fire is often critical; consequently these areas as well as the ones burned in 1960 remained a hazard.

In the following paragraphs, the status of major forest insect pests in 1960 is briefly discussed. Information on current infestations requiring action is contained in Table 1. These findings were derived from detection reports, ground and aerial surveys, periodic summaries from industry and government foresters, and special entomological studies. Detection surveys alone, the early warning system of the pest control program, produced 780 reports of insect infestations this year.

WESTERN PINE BEETLE, Dendroctonus brevicomis, perennially one of California's most destructive forest insects, continued to do damage, but the magnitude of its activities was quite variable in different parts of the State. Early spring control efforts seem to have been successful in reducing certain infestations. Some subsided naturally. Others, however, remained much the same as they were in 1959. In northeastern California, outbreaks were centered in ponderosa pine stands around Lava Camp and Round Mountain, and around Lava Peak. Farther south, heavy infestations persisted throughout the lower elevation ponderosa pine belt, from Mariposa County south to Tulare County. Some of the more important outbreaks in this part of the State were in the following areas: the South Fork of the Merced River drainage, along the western boundary of Yosemite National Park; Bass Lake; Big Creek drainage south of Shaver Lake; and Black Rock, on the north fork of the Kings River. The outbreak east of Eshom and Pierce Valleys continued to be one of the most serious in the State, having expanded eastward into the Redwood Creek drainage southwest of Grant Grove. In ponderosa and Coulter pine stands of southern California, outbreaks

TABLE 1. --CURRENT FOREST INSECT INFESTATION AREAS

AREA	ESTIMATED ACREAGE INFESTED	COUNTY	INSECT	HOST	ACTION
		COMMERCIAL TIMBERLANDS			
Black Mtn.	100	Humboldt	Md,Dp	DF	Log infested trees
Black Rock Mtn.	640	Trinity	Ips,Db	PP	Appraisal
E. Plumas N.F.	*	Plumas	Sv	WF	Surveillance
Lava Camp-Round Mt.	24,000	Modoc	Db	PP	Log infested trees
Eshom Area	5,000	Tulare	Db,Ips	PP	Log or treat infested trees
Ft. Bidwell	1,800	Modoc	Sv	WF	Surveillance
Hardin Flat	320	Tuolumne	Db,Ips	PP	Log infested trees
Hat Creek Rim	50,000	Shasta-Lassen	Ips,Db,Dj	PP-JP	Log infested trees
Hillhouse Burn	3,000	Tehama	Db,Ips	PP	Log or treat infested trees
Hyampom	1,200	Trinity	Ips,Db	PP	Appraisal
Icehouse Burn	*	El Dorado	Ips,Db	PP	Appraisal
Jones Burn	2,500	Trinity	Ips,Db	PP-SP	Appraisal
Joseph Creek	1,000	Modoc	Dm	PP	Surveillance
Lava Burn	600	Modoc	Ips	KP	Surveillance
Lava Peak-Gooch Valley	4,000	Lassen	Db,Dj	PP-JP	Log infested trees
May Valley	*	Riverside	Db,Ips,Mc	CP-JP	Sanitation-salvage
Military Pass	4,480	Siskiyou	Dm	LP	Log infested trees
Modoc N.F.	*	Modoc & Lassen	Cf	WF	Appraisal
Mountain House Burn	*	Yuba	Db, Ips	PP	Appraisal
Sentinel Mdws.	2,200	Inyo	Em	LP	Appraisal
Sierra N.F. area	100,000	Madera-Fresno	Db,Ips	PP	Log or treat infested trees
Smith Burn	*	Mariposa	Db,Ips	PP	Appraisal
Taylor Creek	*	Siskiyou	Sv	WF-RF	Surveillance
Warner Mts.	*	Modoc	Cc	Aspen	Appraisal
Wrights Creek	*	Tuolumne	Ce	PP-JP	Appraisal
		STATE AND NATIONAL PARKS			
Cuyamaca Rancho State Park	8,000	San Diego	Mc	JP	Treat infested trees
Lassen Volcanic National Park	3,000	Shasta & Lassen	Ips,Dj,Db,Dm	JP,PP,LP	Treat infested trees
San Jacinto State Park	*	Riverside	Db,Ips	CP,PP	Treat infested trees
Sequoia-Kings Canyon National Parks	8,500	Fresno & Tulare	Db,Dm	PP,SP	Treat infested trees
Yosemite National Park	57,700	Mariposa-Tuolumne	Db,Dm,Ips	PP,SP	Treat infested trees
	1,300	Mariposa-Tuolumne	Dm	LP	Treat infested trees
	62,000	Mariposa-Tuolumne	Em	LP	Aerial spray 4,000 acres
		FOREST RECREATION AREAS			
Arrowhead-Crestline	38,000	San Bernardino	Dm,Db,Ips,Dj	PP,CP,JP	Log or treat infested trees
Agua Tibia	*	San Diego	Db,Ips	CP	Appraisal
Alamo Mountain	6,500	Ventura	Dj,Mc,Db	JP,PP	Sanitation-salvage, followed by treating
Barton Flats	7,500	San Bernardino	Db,Dj	PP,JP	Log or treat infested trees
Bass Lake	600	Madera	Db,Ips	PP	Log or treat infested trees
Big Bear	*	San Bernardino	Dj,Ips	JP	Appraisal
Big Pines	2,500	Los Angeles	Mc	JP	Log or treat infested trees
Charlton Flats	3,000	Los Angeles	Db,Ips,Mc	PP,CP,JP	Log or treat infested trees
Corte Madera	1,600	San Diego	Db,Ips,Mc	CP,JP,PP	Treat infested trees
Crystal Lake	1,100	Los Angeles	Db,Dm,Dj	PP,SP,JP	Treat infested trees
Deadman Creek	10,000	Mono	Dj,Mc	JP	Log or treat infested trees
Figueroa Mountain	600	Santa Barbara	Db	PP,CP	Treat infested trees
Gold Lake	2,000	Sierra & Plumas	Dj	JP	Sanitation-salvage
Grade Valley	5,000	Ventura	Mc	JP	Log or treat infested trees
Idyllwild-San Jacinto	14,500	Riverside	Mc,Db,Ips,Dm	SP,PP,CP,JP	Log or treat infested trees
Laguna Mountain	1,500	San Diego	Db,Mc	CP,JP	Log or treat infested trees
Lost Valley	*	San Diego	Db,Ips	CP	Appraisal
Palomar Mt.	*	San Diego	Db,Ips	CP	Appraisal
Silver Lake	100	Plumas	Dm	LP	Treat infested trees
Winston Springs	*	Los Angeles	Mc,Jp	JP	Sanitation-salvage
Wrightwood	7,680	San Bernardino	Mc,Ips	JP	Treat infested trees
		EXPERIMENTAL AREAS			
Institute of Forest Genetics	8,200	El Dorado	Db,Ips	PP	Treat infested trees
Browns Flat	32	Los Angeles	Db	PP	Treat infested trees

*Acreage not known.

Key to Abbreviations Used:

Insect

Cc - Large aspen tortrix
Ce - Pine reproduction weevil
Cf - Spruce budworm
Cw - Cutworms
Db - Western pine beetle
Dj - Jeffrey pine beetle
Dm - Mountain pine beetle
Dp - Douglas-fir beetle
Em - Lodgepole needle miner
Ips - Pine ips
Mc - California flatheaded borer
Md - Flatheaded fir borer
Sv - Fir engraver

Host Tree

CP - Coulter pine
DF - Douglas-fir
IC - Incense-cedar
JP - Jeffrey pine
KP - Knobcone pine
LP - Lodgepole pine
PP - Ponderosa pine
RF - Red fir
SP - Sugar pine
WF - White fir

Fir engraver outbreaks killed many groups of white fir throughout northeastern California.

of the western pine beetle occurred in the Lost Valley, Julian, Palomar Mountain, Agua Tibia, and May Valley areas.

MOUNTAIN PINE BEETLE, Dendroctonus monticolae, was much less destructive to sugar pine this year than last, no unusual activity having been reported. In ponderosa and lodgepole pine, however, the situation changed very little. Stands of these two species in the Warner Mountains continued to sustain heavy beetle infestations. The severe outbreak in pole-sized ponderosa pine in the Joseph Creek drainage persisted. The infestation in lodgepole pine within the Skunk Cabbage Creek drainage showed no signs of abating. Other infestations in lodgepole occurred at Bunchgrass Meadows and Dry Burney Swamp, Lassen County; in the Silver Lake basin, Plumas County; and in the Dingley and Delaney Creek drainages north of Tuolumne Meadows, Yosemite National Park. Attempts to control the infestation in the Tuolumne area, which have been complicated by the concurrent lodgepole needle miner epidemic, began to show signs of producing demonstrable results.

JEFFREY PINE BEETLE, Dendroctonus jeffreyi, caused relatively little damage. Slight increases were noted in the Jeffrey pine stands of eastern Plumas County, and around Blacks Mountain and along the northern boundary of Lassen Volcanic National Park in western Lassen County. None of these infestations reached outbreak proportions, however.

IPS (PINE ENGRAVERS), Ips spp., were associated to varying degrees with most of the western pine beetle outbreaks in pine stands of northern and central California. In several areas ips beetles were also aggressive in their own right. Two infestations showed up in knobcone pine near McCloud; several others, also in knobcone, occurred in the northwestern part of the State. Near Portola, ips originating from Jeffrey pine slash caused considerable mortality to standing trees. Severe infestations in ponderosa pine flared up around West Point, Amador County. And a moderate amount of ips damage to ponderosa pine elsewhere was reported around the Hillhouse burn, Tehama County, and the Nelson Cove burn, Mariposa and Madera Counties. In southern California, knobcone pine and Coulter pine in several localities were hard-hit by these beetles.

FIR ENGRAVER, Scolytus ventralis, was much more abundant than usual and losses caused by this bark beetle increased generally throughout the range of white fir and red fir. Areas in which mortality occurred include the Beaver

Lindane was widely used on western pine beetle and ips control projects. In this field test on the Plumas National Forest it also proved effective against the mountain pine beetle in lodgepole.

Creek drainage, Siskiyou County; the Burney Creek drainage, portions of the Warner Mountains, the eastern part of Plumas County, and various points in the Sierra Nevada as far south as Tulare County. Fir trees in campgrounds and summer home tracts around Lake Tahoe were hard-hit. Losses due to this beetle are not expected to remain for long at a high level. Outbreaks are usually short-lived, as natural factors combine to bring epidemic populations back to tolerable levels.

DOUGLAS-FIR BEETLE, Dendroctonus pseudotsugae. No significant outbreaks of the Douglas-fir beetle occurred in California during the year. A potential buildup of this pest in fire-damaged timber near Willits was averted by logging the infested trees.

DOUGLAS-FIR ENGRAVER, Scolytus unispinosus, a bark beetle responsible for considerable mortality in young-growth Douglas-fir in Humboldt and Mendocino Counties during 1959, caused negligible damage this year. Violent fluctuations in abundance seem to be characteristic of this pest and the behavior of this outbreak was much as expected.

CALIFORNIA FLATHEADED BORER, Melanophila californica, continued to be an important factor contributing to the death of pines in various parts of the state. Some of the heaviest damage was in Jeffrey pine stands of southern California, particularly at Mt. Laguna, Garner Valley, Baldy Mountain and Mountain Center.

LODGEPOLE NEEDLE MINER, Evagora milleri, continued in outbreak in the lodgepole pine forests of the southern Sierra. The most serious infestation was one that has been in progress for more than a decade in the Tuolumne River drainage, Yosemite National Park. Upwards of 60,000 acres remain infested in the park, and tree-killing due to the needle miner alone, and the needle miner in combination with the mountain pine beetle, has been extensive. Additional spraying, an extension of the work done in 1959, is proposed for a portion of this outbreak in 1961. At Sentinel Meadows, Mono County, a needle miner closely related to E. milleri continued to defoliate lodgepole pine. Populations were very heavy, and the trend of this infestation seemed to be upward, although tree mortality has been negligible.

SPRUCE BUDWORM, Choristoneura fumiferana. California's only spruce budworm infestation, which for many years has been active, but relatively innocuous in white fir stands of the Warner Mountains, increased both in area and intensity. Top-killing was observed for the first time in heavily defoliated young trees. Signs of budworm damage also were detected in the Rush Creek drainage, Modoc County, some 25 miles west of the insect's previously known range. The actual presence of the budworm here was not confirmed, however.

OTHER INSECTS. Among the many indigenous pests that continued to take heavy tolls, particularly of the growth potential, were: the lodgepole terminal weevil, Pissodes terminalis, on lodgepole pine; various species of Neodiprion sawflies on young pine and fir; and the black pine-leaf scale, Aspidiotus californicus, on ponderosa and sugar pines. Infestations of the Douglas-fir tussock moth, Hemerocampa pseudotsugata, in white fir remained endemic. The pine reproduction weevil, Cylindrocopturus eatoni, did little damage to planted or naturally established seedlings.

Cone and seed insects severely limited seed production in most commercially important tree species. Cone moths (particularly Dioryctria abietella and to a lesser extent Barbara colfaxiana) and a midge, Contarinia sp., did major damage to the light to moderate crop of Douglas-fir cones. Seed Chalcids, Megastigmus spp., caused moderate to heavy losses in white fir; red fir suffered heavily from seed maggots, Earomyia spp. In ponderosa pine the seed crop was heavy and insect damage, mostly from the ponderosa-pine cone beetle, Conophthorus ponderosae, was light. Damage to sugar pine was variable and the cone crop spotty, but in some localities the sugar-pine cone beetle, C. lambertianae, killed practically all of the cones. In Jeffrey pine, where the cone crop was light to moderate, insects destroyed about a third of the seed.

Of the several new or rarely collected forest insects turned up this year, one was the large aspen tortrix, Choristoneura conflictana. The first recorded outbreak of this pest in California was discovered in aspen stands near Homestead Flat and Long Valley, Modoc County. The tortrix is a destructive defoliator of aspen in other parts of the country, but it has been found only once or twice here previously.

TABLE 2.--INSECT CONTROL PROJECTS ACCOMPLISHED IN 1960, BY AGENCIES AND AREAS

LOCATION	NO. ACRES	NO. TREES	INSECT	HOST	CONTROL METHOD	COST
STATE AGENCIES AND PRIVATE OWNERS[1]						
Blodgett Forest	600	60	Db	PP	Chemical	$ 503
Corte Madera	3,120	49	Mc,Ips	JP,CP	Chemical; peel-burn	912
Cuyamaca Rancho State Park	10,000	138	Mc,Db	JP,CP,PP	Chemical	3,711
Hat Creek	30,000	4,335	Db,Dm,Ips	PP,SP	Chemical	10,760
Miami Creek-Bass Lake	2,000	204	Ips,Db	PP	Chemical	438
San Bernardino	10,000	336	Db,Dm,Dj,Mc,Ips	PP,SP,JP,CP	Chemical	9,796
San Jacinto	14,240	1,449	Db,Mc,Ips	PP,JP,CP	Chemical	11,981
San Jacinto State Park	400	39	Db,Ips	PP,CP	Chemical	980
Kings Canyon-Sequoia	2,900	1,758	Db,Ips	PP	Chemical	2,988
Wrightwood	1,008	101	Mc	JP	Chemical	2,395
Subtotal	74,268	8,469				$ 44,464
NATIONAL PARKS						
Yosemite	57,835	2,196	Db,Dm,Dj,Mc,Ips,Sv	PP,SP,LP,JP,WF	Chemical; peel-burn	$ 30,850
Yosemite	1,200	2,055	Dm	LP	Chemical	40,900
Yosemite	-	-	Em	LP	Chemical	1,622
Lassen	2,100	259	Db,Dm,Dj	PP,SP,JP	Chemical	7,640
Lassen	2,000	347	Dm	LP	Chemical	8,110
Sequoia-Kings	816	359	Db,Dm,Dj	PP,SP,JP	Chemical	8,465
Subtotal	63,951	5,216				$ 97,587
NATIONAL FORESTS						
Angeles	11,765	629	Db,Mc,Dm,Dj	PP,JP,CP,SP	Chemical; logging	$ 5,578
Cleveland	2,310	582	Mc,Ips,Db	JP,CP	Chemical	7,065
Eldorado	4,460	609	Ips,Db	JP,PP	Chemical	2,990
Inyo	3,206	185	Dm,Dj	LP,JP,LP	Chemical	4,283
Klamath	3,000	120	Dp,Dm,Db	DF,PP	Logging	847
Lassen	103,800	64,600	Db,Dj,Ips,Dm	JP,PP,SP	Chemical; logging	36,782
Los Padres	12,500	671	Mc,Ips,Db	CP,JP,PP	Chemical	10,298
Mendocino	380	1,354	Db,Ips,Dm	PP,SP	Chemical; logging	2,782
Modoc	-	60	Db,Ips	PP	Logging	1,700
Plumas	4,001	969	Db,Ips,Dm	PP,SP,WF,LP,RF	Chemical; logging	3,652
San Bernardino	86,261	3,011	Ips,Db,Dm,Dj,Mc	PP,JP,SP,CP	Chemical; logging	44,141
Sequoia	9,940	6,094	Dj,Db,Ips,Dm	PP,SP,JP	Chemical; logging	26,391
Shasta-Trinity	58,586	7,754	Db,Dm,Ips	PP,LP,SP	Chemical; logging	23,100
Sierra	75,240	19,320	Dm,Dj,Ips,Db	PP,JP,SP	Chemical; logging	62,559
Stanislaus	20,940	6,218	Dm,Ce,Db,Ips,Dj	SP,PP,JP	Chemical; logging	11,110
Tahoe	5,850	985	Db,Dm,Ips,Sv	PP,SP,WF	Chemical; logging	5,073
Forest Genetics	8,200	61	Db,Dm	PP,SP	Chemical; logging	838
Subtotal	410,439	113,222				$249,189
Total	548,658	126,907				$391,240

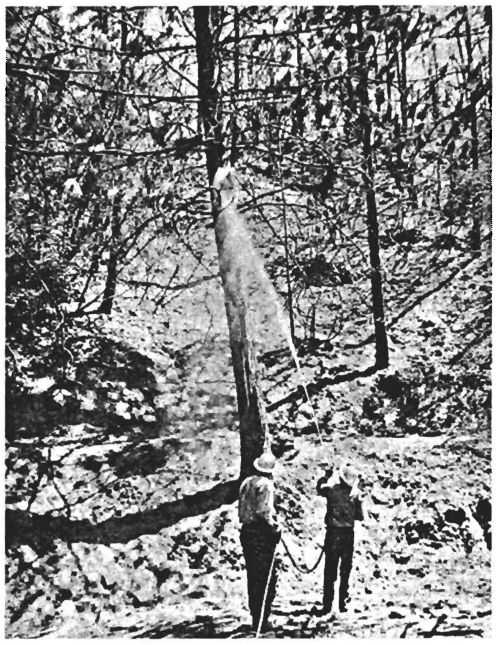
1/ Under the California Forest Insect Control Law.

TABLE 3.--VOLUME OF INSECT-INFESTED OR SUSCEPTIBLE, FIRE-KILLED AND WIND-KILLED TREES LOGGED ON PRIVATE LAND AND NATIONAL FORESTS IN 1960[1/]

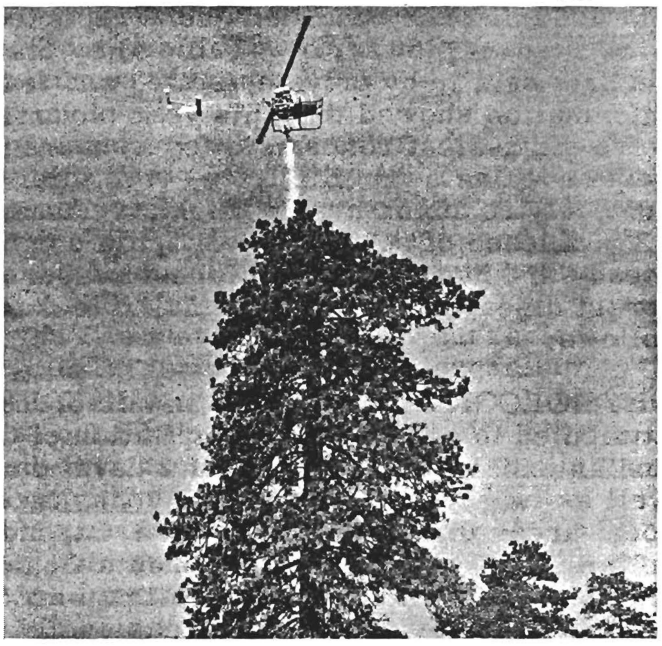
COMPANY	AREA	INSECT INFESTED	INSECT SUSCEPTIBLE	KILLED BY FIRE OR WIND	TREE SPECIES
	Acres	-----Thousand board feet-----			
			PRIVATE LANDS		
J. K. Antonowitsch	-	3	-	-	PP
A. P. Barnes	-	4	-	-	PP
Bear Valley Mutual Water	2,500	110	-	135	PP
Big Bear Timber	600	200	920	-	JP,PP,WF,SP,IC,CP
Collins Pine	-	3,000	-	-	PP,SP
Crane Mills	2,513	100	22,560	50	PP,SP,WF,DF
E. L. Dennis	-	12	-	-	PP
Diamond National	1,600	400	3,200	1,400	SP,PP
Feather River Lumber	-	364	-	22,372	PP,SP,WF,RF,IC
Fruit Growers Supply	8,232	2,856	1,608	1,072	PP,SP
General Box District	40	110	180	-	WF
Glenco Forest Products	2,180	740	4,574	9,678	PP,WF
Grizzly Tree Farm	160	30	-	-	PP
International Paper	1,700	2,000	9,000	5,000	PP,SP,DF
R. W. Irvine	-	20	-	-	PP
Ivory Pine	40	-	200	250	JP,WF
Lake Arrowhead Development	800	50	600	150	PP,JP,WF
B. H. Mace Tree Farm	-	2,400	-	-	PP
McCloud River Lumber	-	4,000	-	-	PP
McLaughton Ranch	200	3	-	-	PP
Michigan-California	-	100	1,000	75,000	SP,PP,WF,IC,DF
Mosquito Tree Farm	800	-	10	-	PP
Pickering Lumber	927	412	5,891	10,265	SP,PP,WF
Forest C. Reed	360	100	600	200	WF,PP,SP,IC
Charles Richardson	-	3,000	-	-	PP
Scott Lumber	7,400	3,000	6,060	300	PP,SP,LP,WF,DF,IC
Shasta Forest	3,500	1,500	5,000	100	PP,SP,DF,WF,IC
Southern California Edison	650	50	200	3,000	SP,WF
Southern Pacific Land	10,100	4,045	14,066	26,482	PP,SP,LP,RF,WF
Stockton Box	2,520	942	314	-	PP,SP,WF,DF,IC
U. S. Plywood	4,200	100	2,000	-	DF,PP
Walker Forest	7,350	650	20,750	2,250	PP,SP,DF,SP,IC
Wetsel Oviatt	200	15,000	5,000	-	PP
Winton Lumber	1,700	240	-	230	PP,SP,DF,WF,RF,IC
Subtotal	60,272	45,541	103,733	157,934	
			NATIONAL FOREST LANDS		
Subtotal		96,512	308,390	320,398	
Total		142,053	412,123	478,332	

1/ Based on the data submitted by companies or agencies reporting, which is not complete for the State as a whole.

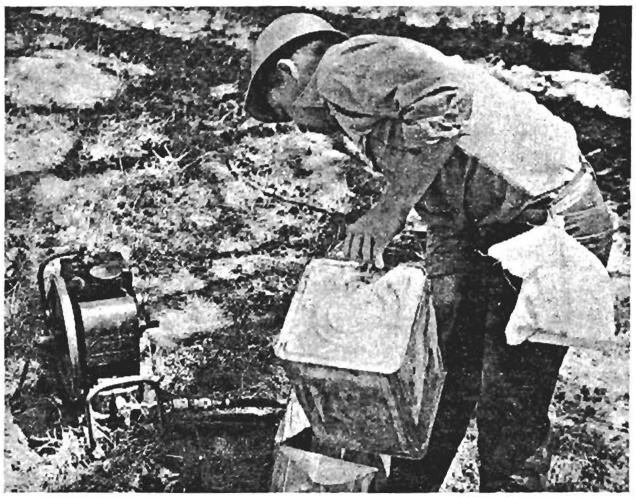
RECENT INNOVATIONS IN BARK BEETLE CONTROL

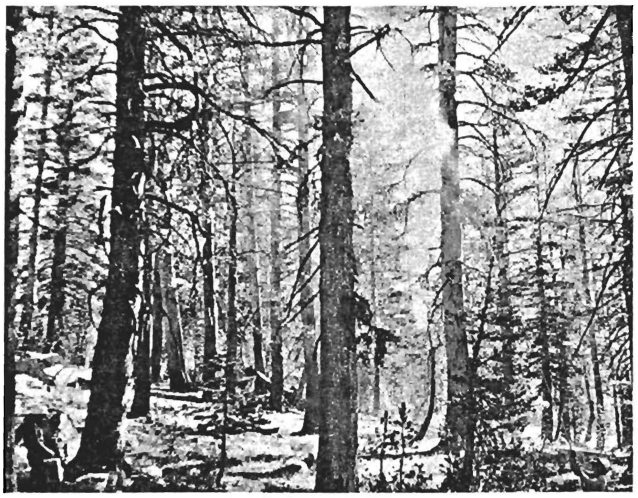


Scorched pines surviving the Johnstone fire were sprayed with lindane emulsion to protect them from bark beetles.



In trials with a helicopter, up to 30 gallons of lindane spray per tree were dropped into the tops of large pines to control bark beetles on the San Dimas Experimental Forest.



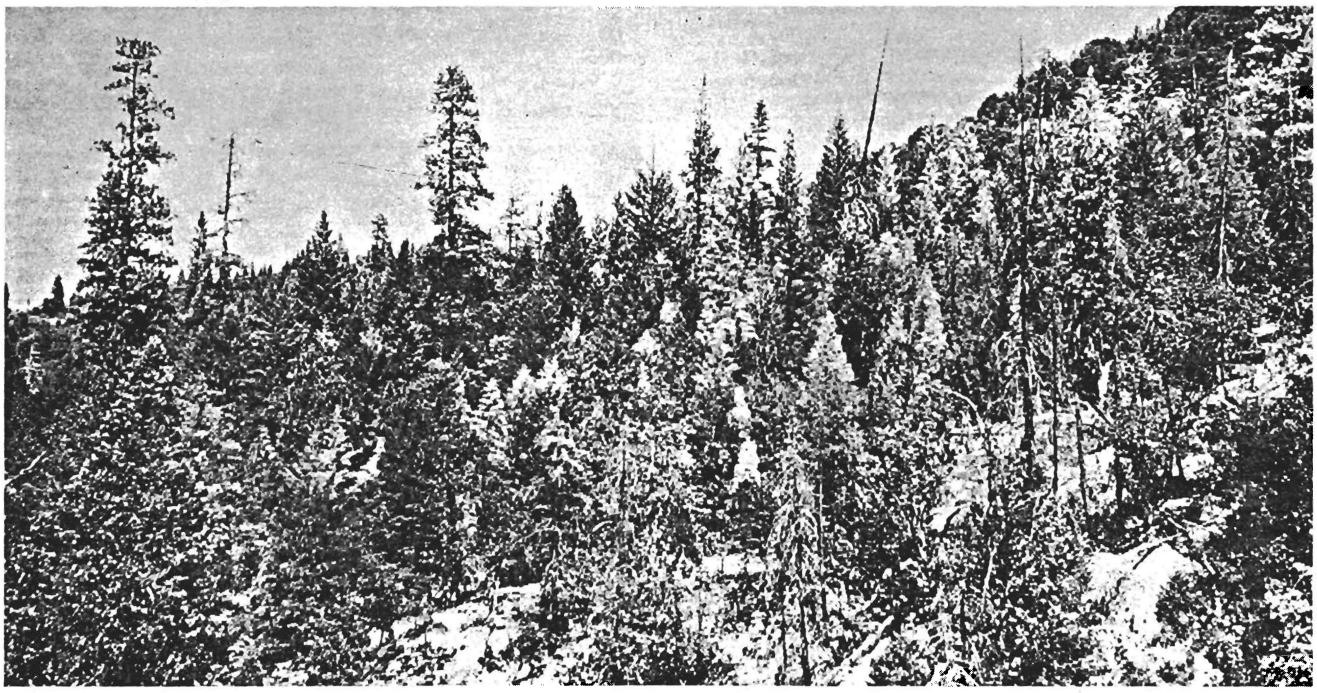


Yosemite National Park developed a portable motor-driven pump for spraying standing lodgepole pines infested with the mountain pine beetle. The pump (A) drafted insecticide (ethylene dibromide) directly from a 5-gallon can. Spray was discharged through a lightweight wand (B) at 3-5 gallons per minute.

FOREST DISEASES

The 1960 disease conditions here reported are based on data from the state-wide random plot survey (Table 4) by Station pathologists and the 107 detection reports sent in by private, state, and federal cooperators. These sources of information showed that this year physiological disorders and nursery diseases were of greatest concern to forest managers and pathologists. Other major pests such as dwarfmistletoe, true mistletoe, heart rots, white pine blister rust, elytroderma needle blight, yellow witches' broom, cytospora canker, and "X" disease of southern California continued to take their unspectacular but steady and huge toll of the forest resource. The status of the more important forest diseases and the accumulative data for 1958-1960 special survey is as follows:

PHYSIOLOGICAL DISEASES and disorders so widespread in the early spring are attributed to subnormal precipitation of the last 2 years, a late hard spring freeze, and an excessive heat wave of 2 days' duration in early June. Heavy mortality, as well as twig and top dieback of young incense-cedar and Douglas-fir occurred at local areas throughout the Sierra-Cascade area and in the northern Coast Range. In the vicinity of Hat Creek, Shasta County, as much as one-half of the young incense-cedar died in areas up to 20 and 30 acres in size. Trees of other species growing on poor sites were occasionally affected. The drought weakened many trees to the point where weak parasitic fungi are beginning to cause considerable damage. In some areas low soil moisture contributed to the early defoliation of broadleaf trees, especially those growing on poor sites. Should 1961 be another dry year, additional mortality can be expected. The late hard freeze experienced in the northeastern portion of the State not only injured much of the new growth



Drought caused the top-dying and mortality of Douglas-fir and incense-cedar, as shown in this view of damage on Klamath National Forest.

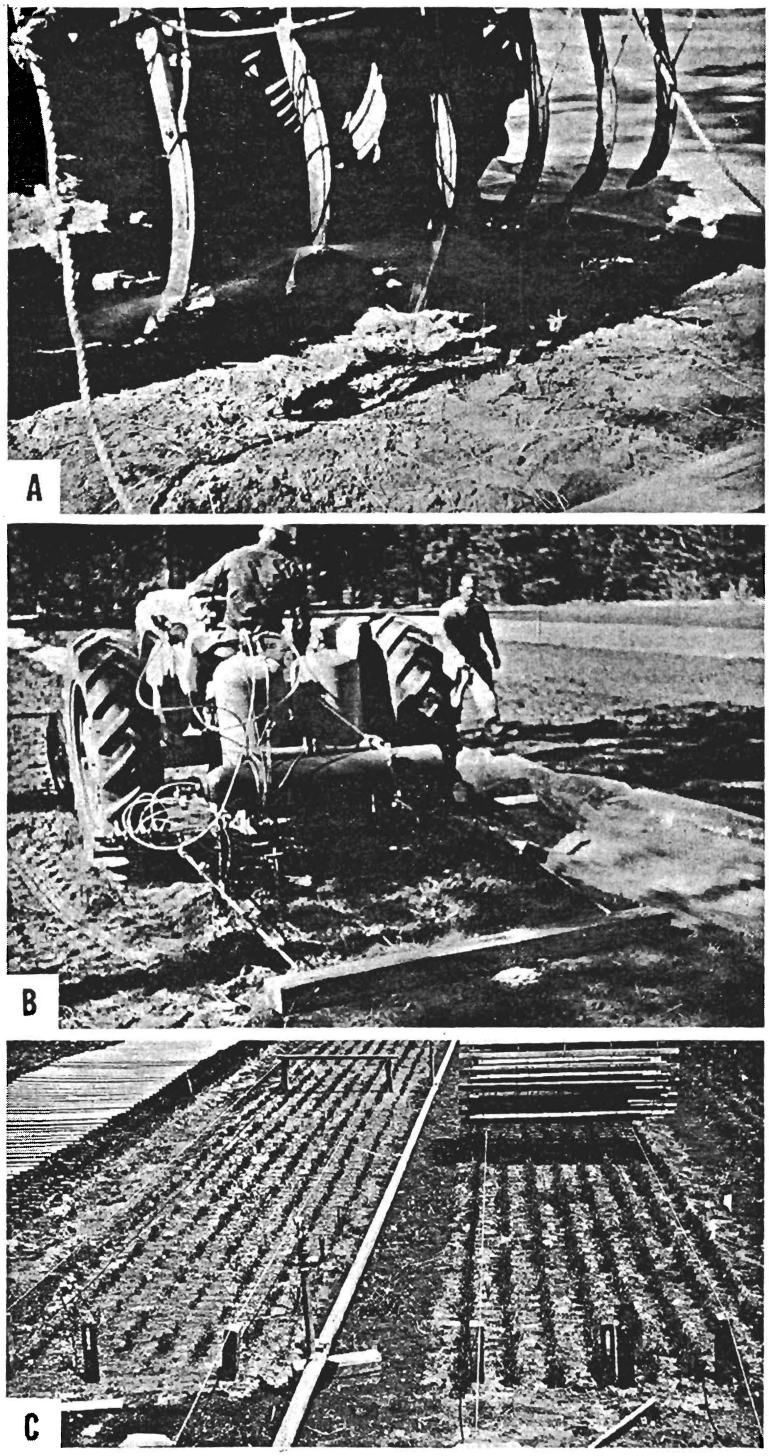
(particularly that of Douglas-fir), but aggravated and worsened the health of the trees affected by the drought. The unusually high temperatures of early June did greatest damage in the north coastal area. High winds along the coast in the northern portion of the State caused considerable salt damage to redwood foliage and to some white fir foliage of trees growing near the ocean.

NURSERY DISEASES, mostly root diseases, caused severe losses of stock in several forest nurseries throughout the State. Heavy mortality in several plantations may have been due in part to root diseases transferred to the forest from the nursery. From nurseries several species of fungi and two species of bacteria were isolated from the diseased roots and adjacent soil. Of the six known pathogens, three caused most of the damage. The charcoal rot caused by Sclerotium bataticola was found at four of the five state and federal nurseries. Another pathogen, Rhizoctonia solani, a typically low-temperature organism, was isolated from damaged seedlings at all five nurseries, namely, Ben Lomond, Parlin Fork, and Magalia of the California Division of Forestry and Mt. Shasta and Placerville of the Forest Service. Both the armillaria root rot, Armillaria mellea, and the phytophthora root rot, Phytophthora cinnamomi, were killing small areas of seedlings at Placerville. A species of Pythium (a possible damping-off disease) was found at all the nurseries. Another species of Phytophthora was isolated from diseased seedlings at two of the nurseries.

In addition to the known pathogens ten suspected pathogens were isolated at one or more of the nurseries. Each of the fungi Cephalosporium acermonium, Fusarium oxysporum, Fusarium solani, and a species of Phoma was isolated from all or all but one of the nurseries. In addition species of Alternaria, Cylindrocarpon, Sclerotinia, and Pyrenochaeta terrestris were found at one or more of the nurseries. The two bacteria Agrobacterium rhizogenes, causing a disease known as hairy root, and A. tumefaciens, causing crown gall, were found at the Placerville nursery.

The greatest losses in the seed beds were to sugar pine, Douglas-fir, and giant sequoia. Besides causing direct losses in seedling or transplant beds, diseases may be responsible for more costly losses in outplantings. When diseased and weakened seedlings die in the field from the infection contracted in the nursery, shipping and planting costs have been incurred. Finally, and most important of all, virulent pathogens can be spread into forested areas by shipment of diseased nursery stock. White pine blister rust on white pines shipped from European nurseries to North America is a good example of this disastrous action. In the Forest Service nursery at Placerville, control of root diseases was undertaken this year by destroying all seedlings within obvious disease centers and the margins thereto and by fumigating certain nursery beds. This and other forest nurseries will be cooperating in further tests of soil fumigants and are considering the need to begin a regular maintenance program of soil fumigation.

DWARFMISTLETOE, Arceuthobium spp., is one of the most serious forest pests of California conifers. This is particularly true for Douglas-fir, the true firs, the hard pines, and sugar pine. Areas supporting a stand composed mostly of a single tree species that is heavily infected with dwarfmistletoe pose a tremendous problem to the forest manager. Most coniferous hosts are attacked either by a single species of dwarfmistletoe or by one form of one species. This singularity of the parasite favors management of mixed stands.



Application and results of soil fumigation for control of root diseases at Placerville. A. Method of injection. Note small tubes clipped to rear edge of cultivator shanks for carrying fumigant into soil. B. Plows lowered and fumigant being applied. Strip in upper right has been treated and sealed with polyethylene cover. C. Comparison of sugar pine seedlings in untreated nursery bed (left) with those on fumigated soil (right). Seedlings on treated soil survived in greater numbers and show increased size and vigor.

Cumulative data from all disease survey plots (1958-1960) show that of the plots supporting white fir 27.8 percent had dwarfmistletoe present and 15.6 percent of the trees of this species were infected, while red fir had 44.7 percent of the plots and 36.1 percent of the trees affected by the parasite. Douglas-fir had 5.2 percent of the plots supporting dwarfmistletoe with 0.7 percent of the trees infected. Of the hard pine group 29.6 percent of the ponderosa plots and 11.7 percent of the trees were infected; Jeffrey pine had 10.7 percent of the plots and 4.0 percent of the trees infected; knobcone pine had 50.0 percent of the plots and 82.2 percent of the trees infected; and Digger pine had 20.0 percent of the plots and 11.1 percent of the trees with dwarfmistletoe. The lodgepole pine dwarfmistletoe was found at 22.2 percent of the plots and on 26.3 percent of the trees. The form of dwarfmistletoe attacking sugar pine occurred on 14.4 percent of the plots and on 9.0 percent of the trees. Dwarfmistletoe was also reported on Coulter, Monterey and Bishop pines.

Research on the parasite and its host relationship as well as on the improvement of practical methods of control is continuing. The search has been stepped up for a chemical compound which will be selective enough to kill the dwarfmistletoe plant without injuring the host tree.

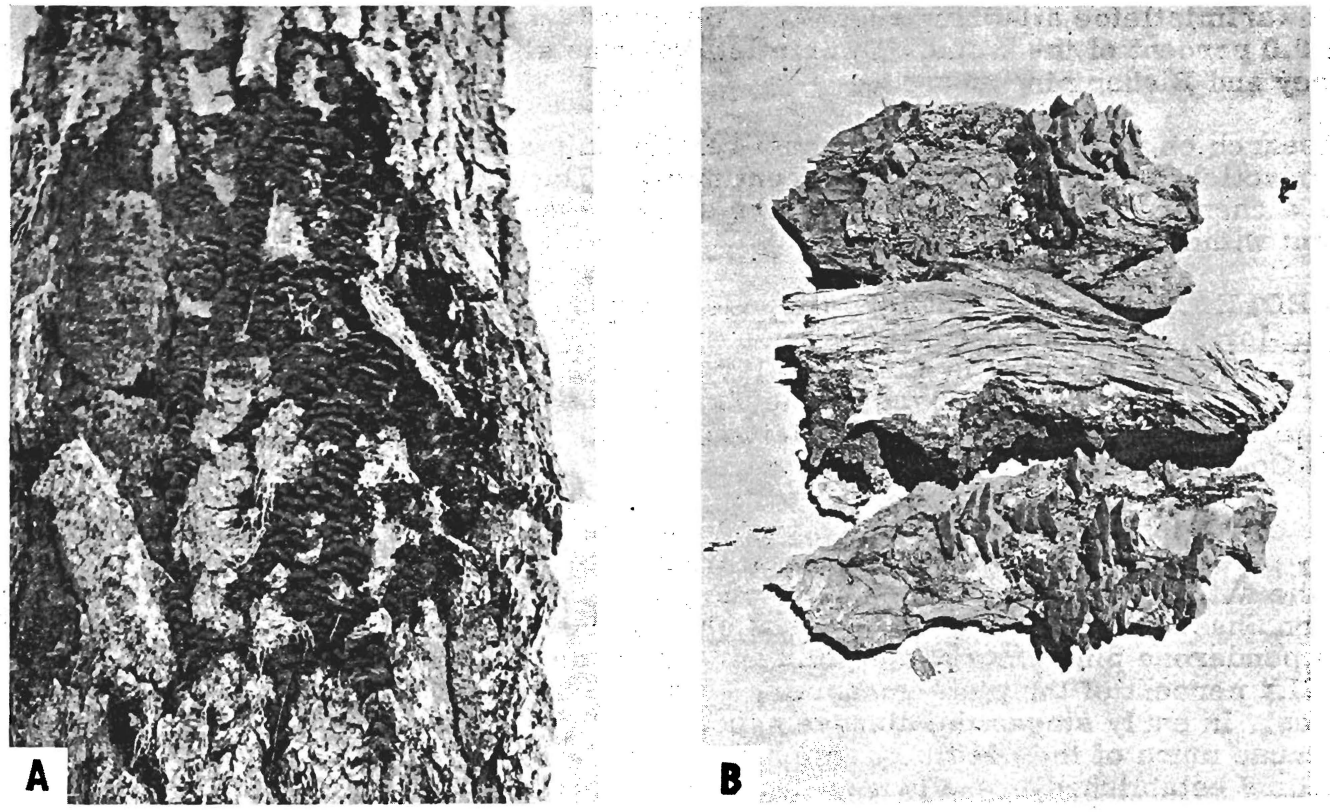
NEEDLE CASTS AND BLIGHTS (Hypoderma robustum, Hypodermella abietis-concoloris, and Phacidium infestans var. abietis) that were so prevalent in past years on true firs subsided to a low level in 1960. The only needle damage worthy of mention was caused by the phacidium needle blight and was confined to white fir. It was observed from Mariposa County northward to Modoc and Siskiyou Counties.

The elytroderma needle blight, Elytroderma deformans, of ponderosa and Jeffrey pines was noted at many areas scattered throughout the State. It was found in the witches' broom stage on knobcone pine near Grizzly Peak Lookout in northern Shasta County. Survey records show it has been found at 29.0 percent of the ponderosa pine plots and on 10.8 percent of the trees. The blight was found at 21.4 percent of the plots supporting Jeffrey pine and on 14.8 percent of the trees. In early stages the disease appears to fluctuate considerably in intensity because much of the needle infection is "cast" before the mycelia of the fungus become established in the twigs. Once it reaches the twig and starts "brooming" there is little change in its status.

RUSTS ON CONIFERS. White pine blister rust continues to build up on white pines (within its present zone of spread) at a rapid rate in those areas harboring conditions highly favorable for its development. This type of intensification is occurring on sugar pine at numerous places in northwestern California. It occurs, but less frequently, in the southern Cascade Range and much less frequently southward into the Sierra Nevada. The intensity of the rust is so heavy in the lower Klamath River country that mature sugar pines are now being killed. This type of killing was observed along the Thompson Creek Ridge for the first time in 1960. Whitebark and western white pine at the higher elevations in northwestern California are becoming heavily infected. No rust has been reported on foxtail pine.

Limb rust, Peridermium filamentosum, on Jeffrey pine was again reported from several places in the southern portion of the State. Stalactiform rust, Peridermium stalactiforme, was again observed on Jeffrey pine at a few locations in

the State. It was found at most lodgepole pine stands examined. Gall rust, Peridermium harknessii, was reported on most species of hard pines. One area where considerable damage had occurred on ponderosa pine was reported from the Los Padres National Forest.



Fomes pini, widely known as the major heart rot in Douglas-fir, also attacks true firs. A. On white fir small conks occur in clusters, as shown here. B. Detail of the conks and decayed face of the tree where conks emerged.

The rust on red and white fir called yellow witches's broom, Melampsorella caryophyllacearum, was detected at several locations in the northern, eastern, and central portions of the State. It was reported to be causing severe damage to red fir in some of the campgrounds in the vicinity of Huntington Lake on the Sierra National Forest. One heavy infection center on red fir was observed near Mt. Aetna on the Plumas National Forest and another center on white fir on the north end of Miller Mtn. on the Klamath National Forest. The large, tight brooms caused by this rust could be identified readily from the air while flying over the heavy infection centers of the white fir stands in the Daggett Creek drainage of the Klamath National Forest.

ROOT DISEASES other than those described for nurseries are widely distributed and are strongly pathogenic in forested areas. The armillaria root rot, Armillaria mellea, frequently a saprophyte on hardwood roots, occasionally breaks out as a parasite on conifers. It was reported doing some damage to small groups of conifers from Fresno County to Shasta County.

Fomes root disease, Fomes annosus, was found on wind-thrown trees at several places in northern California and is believed to be more widely distributed than has heretofore been suspected. This pathogen killed 16 different species of pine in the Eddy Arboretum at the Institute of Forest Genetics. Control through tree removal and soil fumigation was initiated this year at the Institute.

The leptographium root disease continues to spread in the areas where it has become thoroughly established.

MISCELLANEOUS DISEASES. The cytospora canker of true fir, Cytospora abietis, was observed at numerous places in the State during 1960. This pathogen is often found in association with dwarfmistletoe, where it hastens the death of the infected limb. Occasionally young stands are severely damaged by this disease. About one-fourth of the true firs examined in 1960 had one or more limbs infected with this canker disease.

True mistletoe, Phoradendron pauciflorum, on white fir occurs from the southern end of Placer County (found on Ralston Ridge in 1960) southward. True mistletoe on incense-cedar and juniper is common and it was again found on Baker cypress.

In addition to the major disease pests, several other diseases were reported from various parts of the State during the year. These included foliage diseases, rust, mistletoe, etc. of the broadleaf trees as well as needle casts, rusts, and various cankerous diseases of conifers. A species of Cenangium (small cup fungus) as yet unidentified was found on the needles of white fir. This may be a new species; it appears to be the first time this fungus has been collected on the foliage of true fir.

DISEASES OF UNDETERMINED CAUSE. Diseases of unknown cause are found from time to time, but most of these either "run their course" or are of minor importance. The one known as "X" disease in southern California is serious enough to be of major concern. This disease is still prevalent in the Crestline-Lake Arrowhead area of San Bernardino County as well as in the Crystal Lake area of Los Angeles County. Many ponderosa pine in these recreational areas are dying each year. Declining trees at other areas have been reported, but since the characteristics of "X" disease are not clear cut, new locations must be carefully verified. Research on "X" disease is being accelerated.

RESULTS OF RANDOM PLOT SURVEY. Table 4 gives cumulative data for the period 1958-1960 on all temporary, randomly selected disease survey plots now numbering 290. It should be remembered that the data for 290 plots of 25 trees each (a total of 7,250 trees) are still insufficient to warrant predictions of statewide disease conditions. However, the survey is so designed that each succeeding year's data will add to and strengthen previous information about the prevalence of disease in the several commercial timber types of California.

TABLE 4.--FOREST DISEASE SURVEY DATA 1958-1960

Tree species 1/	Total sample		Infection by number of plots and trees																	
	Unit	No.	Dwarfmistletoe	True mistletoes	Elytroderma	Other needle casts	Blue brooms	Unclassified foliage	Cronartium ribicola	Gymnosporangium	Melampsorella	Peridermium harknessii	P. stalactiforme	P. filamentosum	Cytospora	Unclassified limb canker	Echinodontium tinctorium	Fomes pini	Polyporus schweinitzii	Armillaria mellea	Unclassified heart rot
Ponderosa pine	Plots	162	48		47	40		3				4						5			47
	Trees	1933	226		208	102		3				4						6			77
Jeffrey pine	Plots	56	6		12	3		1				1	1	1							11
	Trees	425	17		63	12		1				1	1	2							23
Sugar pine	Plots	103	15			1	5		3									1			25
	Trees	378	34			1	5		3									1			33
Lodgepole pine	Plots	36	8		1	2		2				5	11								9
	Trees	353	93		1	14		8				12	25								27
Incense-cedar	Plots	133		25		1				116											3
	Trees	814		55		2				557											5
White fir	Plots	148	41	7		21		4			1				23	12	6	1	1		103
	Trees	1457	228	12		51		6			1				109	21	11	2	1		395
Red fir	Plots	47	21			2		5			7				8	6	3	31		1	30
	Trees	493	178			2		5			25				25	18	5	96		1	108
Douglas-fir	Plots	97	5			5		6								9			7		52
	Trees	958	7			14		15								29			8		190
Digger pine	Plots	5	1									1									
	Trees	9	1									1									
Juniper	Plots	17				1		4													6
	Trees	93				3		6													12
Knobcone pine	Plots	4	2		1							1						1			
	Trees	28	23		1							7						1			
Western hemlock	Plots	4	1																	1	3
	Trees	21	5																	1	5
Redwood	Plots	12																			7
	Trees	224																			136

1/ Other tree species, apparently free of disease, occurred on the plots in the numbers indicated: western white pine (33), mountain hemlock (20), Sitka spruce (7), white bark pine (2), grand fir (1), Port Orford cedar (1).

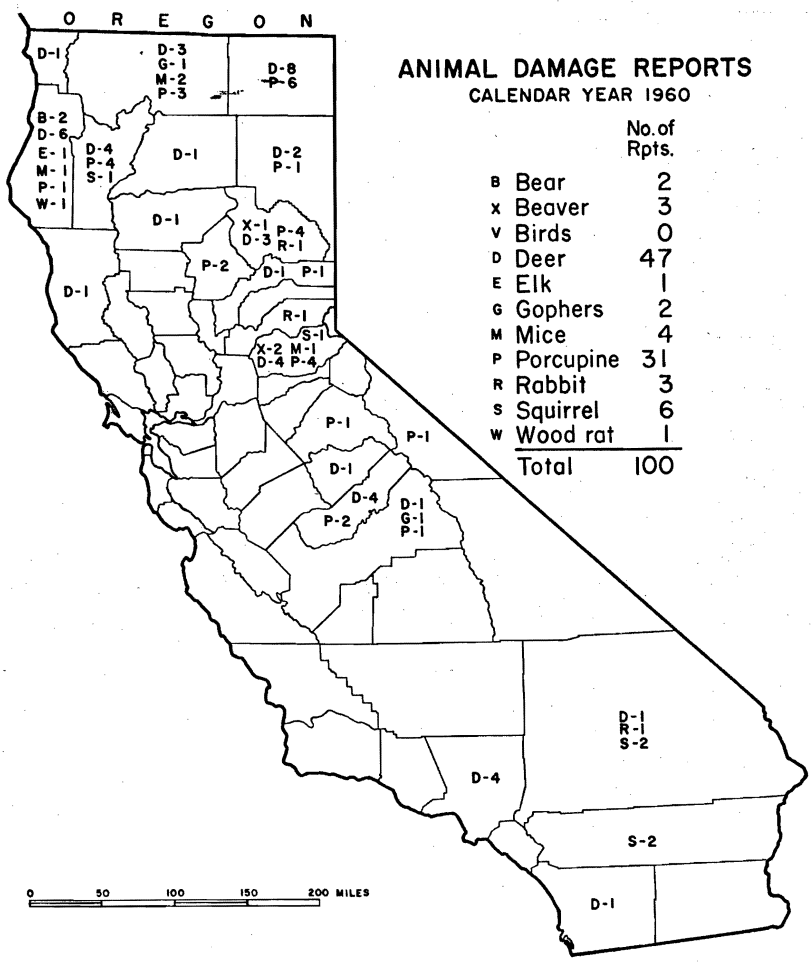
FOREST ANIMALS

Reports of tree damage caused by forest animals increased ten-fold this year. Out of 100 detection reports received, 47 involved deer browse damage to Douglas-fir, redwood and pine reproduction. Thirty-one reports of current porcupine damage were also received. Twenty-three reports listed damage by eight other animals. The increased number of reports reflects an increasing awareness of animal damage by timber producers.

Field observations by Council members indicated animal damage to be more widespread than was indicated by the number of reports received during the year. Shown in Table 5 are the major forest animal damage problems for which some method of control is practicable, and the action recommended on each problem.

BEAR damage to Douglas-fir and young redwood continued on the north coast of the State. The California Redwood Association reported that the trapping of bears must be continued in order to hold bear damage to a tolerable level. When trapping on a study area was discontinued for a year, bear damage increased.

DEER damage to forest regeneration is becoming more noticeable each year. An estimated 130,000 acres of forest regeneration in Humboldt and Mendocino Counties shows serious deer browsing. Pine plantations in the Sierras are also being killed or seriously retarded by deer. Damage is most severe when plantations are small in size and located within or adjacent to good deer habitats. Large cleared areas of 100-200 acres near Mt. Shasta and Lake Almanor have shown no noticeable deer damage to date.



ANIMAL DAMAGE REPORTS
CALENDAR YEAR 1960

		No. of Rpts.
B	Bear	2
X	Beaver	3
V	Birds	0
D	Deer	47
E	Elk	1
G	Gophers	2
M	Mice	4
P	Porcupine	31
R	Rabbit	3
S	Squirrel	6
W	Wood rat	1
	Total	100

The Council approved a resolution at its November meeting which called for "an impartial study of the deer browse problem by public agencies such as the University of California and Humboldt State College, guided by the Animal Committee."

PORCUPINE damage was less prevalent in natural regeneration than last year. This may have resulted from last year's open winter, or it may have been due to a natural fluctuation in porcupine populations. Reports of

porcupine damage were received from the Oregon border, southward to Fresno County. Porcupine damage was also observed in the Mad River and Forks of the Salmon River areas of Siskiyou and Trinity Counties. An ecological study of the porcupine in Modoc County was begun during the year by a graduate student from the University of California.

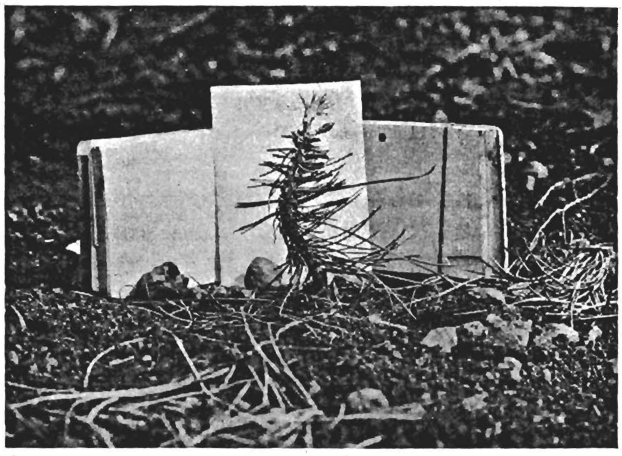
MICE AND SQUIRRELS continued to make heavy inroads on tree seeds and seedlings. Their activity was very noticeable following the late summer forest fires in the Sierra. Seeds that survived the fires were consumed by forest rodents in large quantities until control measures were undertaken. Under normal forest conditions seed depredations usually go unnoticed.

GOPHERS seriously damaged two plantations during the year. Failure of the plantations had been attributed to other causes prior to the field study. These animals may play a more important role in plantation failures than is recognized at this time.

Bush effect in young redwood caused by browsing of deer in the Mad River drainage, Humboldt County. Repeated browsing may retard height growth in young trees 5 to 10 years or more.

TABLE 5. MAJOR FOREST ANIMAL DAMAGE AREAS

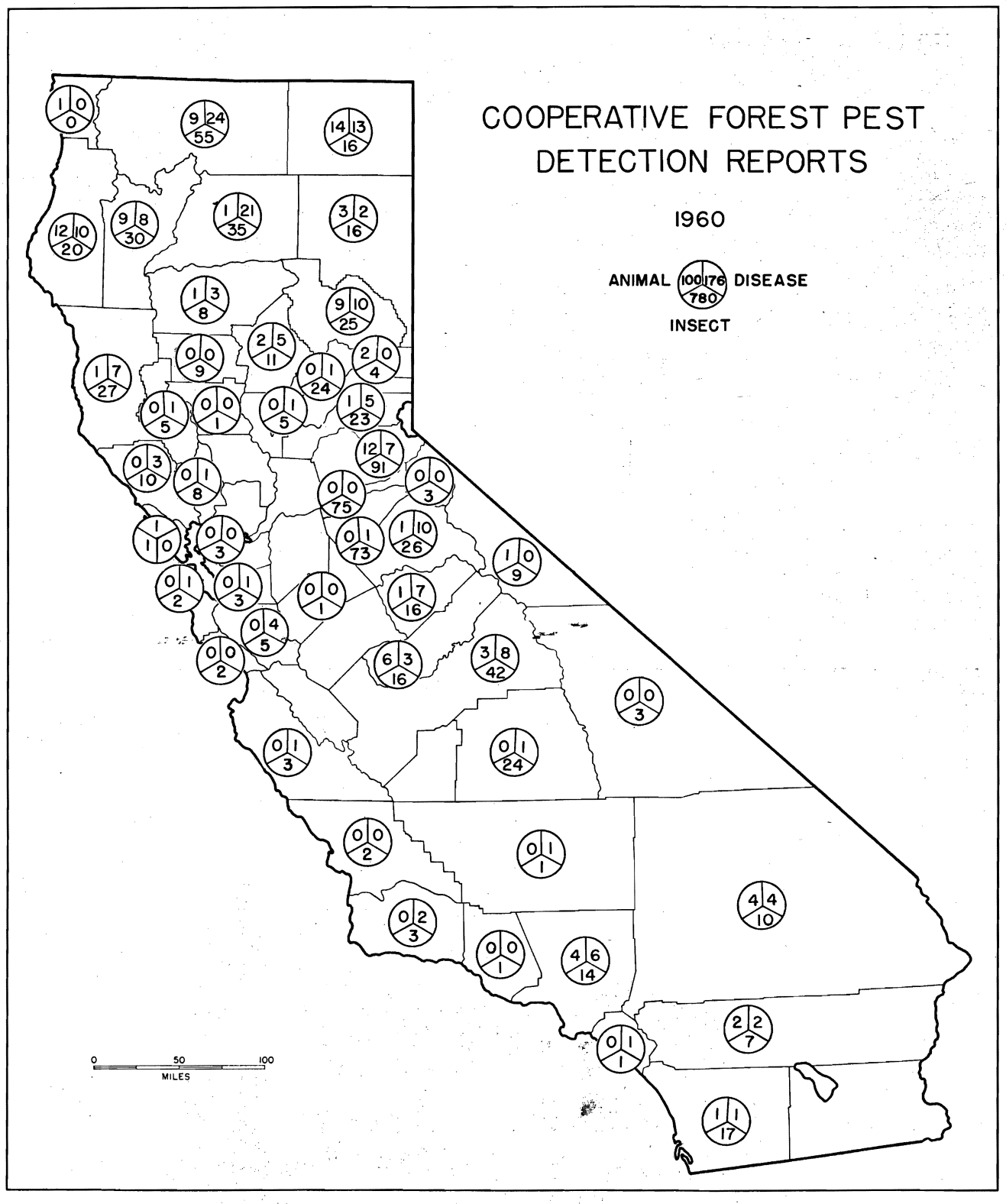
Area	Animal	Host	Action
NW California	Deer	D. F.	Pilot studies to determine type and cost of enclosure fences, interplant forage, effect of site of opening, etc. Improve deer herd management.
NE California	Deer (Oregon-Calif. deer herd)	P. P. Plantations	Stop planting in migration route, or build enclosure fence.
Northern Calif.	Deer	P. P. Plantations	Clear areas larger than 100 acres or use planting stock sprayed with deer repellents. Respray by hand for 2nd year.
Sierra	Deer	P. P. - J. P. Plantations	Same.
Eastside Sierra	Porcupines	P. P. - J. P.	Put strychnine salt bait in dens. Use salt bait boxes. Hunt roads 8:00 p. m. to midnight, August 1 - Sept. 30.
Westside Sierra	Porcupines	Pine Plantations	Use salt bait box. Hunt roads 8:00 p. m. to midnight, Aug. 1 - Sept. 30. On hybrid plantings, use wire cylinder.
NW California	Bear	Poles of D. F. and Redwood	All year hunting season, or trap and remove.
Sierra	Doves and Junco	Pine seed in seed beds and seed spots.	Treat seed with Arasan (and Endrin for rodents).
NE California	Squirrels	Pine cones in seed production area.	Band the seed trees with aluminum, 18" wide, and placed 6 ft. from ground.



Above: Deer or rodents clipped the needles and terminal buds from this newly planted ponderosa pine. Trees of this size often are completely destroyed by browsing.

Left: A 3-year-old ponderosa pine on the Stanislaus National Forest killed by girdling by porcupines.

Below: Boxes housing poison bait were used in controlling porcupines in this plantation. Purpose is to prevent damage like that shown by deformed pine in this picture.


COOPERATIVE FOREST PEST
DETECTION REPORTS
1960
ANIMAL 100 176 DISEASE
780
INSECT
0
50
100
MILES