FOREST PEST CONDITIONS IN CALIFORNIA-1970

A PUBLICATION 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 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 is comprised of members of the following organizations:

Boyce Thompson Institute
California Forest Protective Association
California Redwood Association
State of California: Departments of Agriculture, Conservation, Fish and Game, Parks and Recreation, and the University of California.
U. S. Department of Agriculture, Forest Service
U. S. Department of the Interior, Bureaus of Indian Affairs, Land Management, Sport Fisheries and Wildlife, and the National Park Service
Western Wood Products Association

THIS REPORT, FOREST PEST CONDITIONS IN CALIFORNIA - 1970, is compiled for public and private forest land managers to keep them informed of pest conditions on forested lands in California, and as a historical record of pest trends and occurrences. The report is based largely on information provided by the California Cooperative Forest Pest Detection Survey. In 1970, 511 reports were received: 288 for insects, 200 for diseases, and 23 for animal pest damage.

The report was prepared by the Forest Service and the Bureau of Sport Fisheries and Wildlife in cooperation with other members of the Council. It was duplicated and distributed by the California Division of Forestry.

THE COVER PHOTO: Forest Entomologist checks sticky trap for catch of western pine beetle during the 1970 field evaluation of synthetic pheromones at Bass Lake, California.

Sacramento January 1971

HIGHLIGHTS OF PEST CONDITIONS - 1970

STATUS OF INSECT PESTS. Threatening populations of several forest insects were detected in California during 1970. The Douglas-fir tussock moth occurred in significant numbers for the first time in several years; the Douglas-fir beetle unexpectedly caused considerable localized tree killing on the Plumas and Six Rivers National Forests; the pine resin midge debilitated and deformed young ponderosa pines over much of the State; the lodgepole pine needle miner reached epidemic status in remote locations of Yosemite National Park and continued a serious increasing trend in valuable recreation areas of the Park; and an extremely damaging forest pest, the gypsy moth, was accidently introduced into California. Despite these threatening conditions, observed damage from these and other forest insect pests remained for the most part at a modest or tolerable level.

STATUS OF DISEASE PESTS. Forest disease conditions remained about the same as in previous years. A number of new white pine blister rust infection centers were found. The fall of 1967 was apparently very favorable for white pine blister rust as many infections originating then were found in 1970. All of those in the southern Sierra area were within, or very close to, infection centers that had developed earlier. Because of the number of blister rust infection centers, no direct control will be done in areas north of the Middle Fork of the Stanislaus River. The effectiveness of direct control south of the river will be determined by continued systematic blister rust scouting and survey.

A special survey made on the San Bernardino National Forest indicates that about eight thousand acres of pinyon pine type are seriously infected with the black-stain root disease caused by Verticicladiella wagenerii. There is no known control method.

Damage caused by smog in southern California continues to become more evident. A recently completed survey of the ponderosa-Jeffrey pine type on the Angeles National Forest indicates that about 261,000 trees are affected. Some 20 percent of the affected trees are severely damaged.

STATUS OF ANIMAL PESTS. Depredation by deer continues to be a major animal damage problem in forest regeneration. Damage is high in the northern coastal counties. Porcupine damage seems to be increasing in some areas of the State. Pocket gopher damage was reported in all the timber-producing areas of the State, with the exception of the coastal areas.

a special report -

DOUGLAS-FIR TUSSOCK MOTH *again* THREATENS CALIFORNIA FORESTS

The balance of nature has again unaccountably shifted in favor of a destructive caterpillar which feeds on the needles of white fir trees in California. Commonly known as the Douglas-fir tussock moth, because it is found also attacking Douglas-fir in other regions of the western United States, this insect is highly respected by forest entomologists for its great ability to rapidly build up epidemic populations and cause widespread damage before natural control factors can again regain the upper hand.

Normally, this moth is present in the forest in very low numbers and causes no damage. Low populations of this type have been under surveillance near Hat Creek, California for over two years. In mid- and late-summer of 1970, greater populations of the Douglas-fir tussock moth were discovered at Burney Mountain, Iron Mountain, Strawberry Peak and Mariposa Grove-Raymond Mountain areas in California. While the most serious damage so far has taken place in the Mariposa Grove-Raymond Mountain area, covering portions of Yosemite National Park and the Sierra National Forest, the largest infestation covers several thousand acres of white fir and mixed-conifer forests in the Iron Mountain-Baltic Ridge-Plummer Ridge area of the Eldorado National Forest. There may be other undiscovered infestations present because it is very difficult to detect the early stages of a buildup of this moth.

HISTORY. The Douglas-fir tussock moth is known to scientists as Hemerocampa pseudotsugata McDunnough. It has earned its notorious reputation as a major forest insect enemy in several past epidemics.

The tussock moth killed over 300 million board feet of timber in an epidemic in eastern Washington in 1929 to 1930. It caused severe damage in the form of growth loss and tree mortality on several thousand acres of white fir in Mono County, California in 1934 to 1938 where nearly 30 percent of the infested timber died from the effects of defoliation. This moth was responsible for initiating the first large-scale, forest aerial spraying of DDT when the then new insecticide was employed to halt the devastation of fir timber on 500,000 acres in Idaho, Oregon and Washington in 1946 and 1947. The next serious outbreak was detected in 1954 on the Stanislaus National Forest of California and was terminated by aerial spraying of 10,000 acres of white fir in 1966. Next, serious and widespread epidemics occurred throughout the western United States between 1962 and 1966, involving areas of Montana, Idaho, Washington, Oregon, California and Arizona. Several of these infestations were controlled by aerial spraying of DDT.

ECOLOGY. The Douglas-fir tussock moth is an insect which passes through four life stages in its annual life cycle. The overwintering eggs hatch in the spring when the tender new foliage of fir trees is elongating. The tiny caterpillars are exceedingly hairy and can be dispersed by wind currents like pieces of lint. The small larvae feed on the skin of the new needles of the host tree causing the new growth to shrivel and die. Later, the caterpillars progressively increase several times in size and consume all the needles, both new and old, causing complete defoliation of severely infested trees. In epidemics, one or two severe defoliations will kill many trees outright, top kill many more and leave still others in a lingering unhealthy condition to be killed by other associated pests. In the intervening periods between epidemics, however, only a few tussock moth caterpillars survive and their impact on the health of host trees is insignificant.

The tussock moth is itself host to many natural enemies -- primarily parasites. It also has a high reproductive rate with each surviving female moth producing about 260 eggs per year. This combination of a high reproductive rate and high natural mortality rate, characteristic of the tussock moth, is believed to be the reason for the rapid fluctuations in tussock moth numbers. If some change in the environment tends to reduce parasite activity, permitting even a few more than usual female tussock moths to lay eggs, the increases in tussock moth numbers the following generation can be quite startling. Past experience indicates that on the average there is about a five-fold increase per generation. So far, the subtle change in weather or other environmental factors that release these populations from natural control have gone unrecognized. Once epidemics become established, it is difficult for the parasites to again catch up and effectively suppress the population to their usual insignificant numbers.

Established tussock moth epidemics may persist for two to several years until another natural control agent, a disease, becomes dominant. This disease is a virus which is exceedingly virulent among dense tussock moth populations and usually terminates epidemics within one moth generation after the disease becomes evident in the population. One promising method of biological control that needs to be developed is a means of infecting a tussock moth population with this virus disease much earlier in the epidemic cycle before serious defoliation occurs. Since the virus is a natural control agent which does not attack other insects, animals, or plants, this should be a very safe control procedure.

CURRENT SITUATION. Surveys of known infested areas made in late 1970 revealed the sharp increase in tussock moth numbers this year. However, significant damage has not yet occurred except in one limited area (Mariposa Grove-Raymond Mountain). Evidence of infestation in most areas at this time is recognizable only to the trained observer. Also, the 1970 moth generation suffered severe mortality from parasites which furnishes some hope that natural control forces have not yet been out-stripped by tussock moth reproduction.

Unfortunately, there are some local spots of higher infestation within outbreak areas. Here, the 1971 generation -- currently represented by eggs -- is numerous enough to cause recognizable damage next year. At this point it is not known if these spots will expand or intensify next year. Additional surveys during the caterpillar stage of the tussock moth's life cycle are planned for the spring of 1971 to further clarify the infestation trend.

At the present time, the large infestation on the Eldorado National Forest is under intense study to determine if it is a suitable area for trying the introduction of the tussock moth virus disease for biological control of this species. Survey results and numerous specimens and samples are being analyzed by the Forest Service insect disease laboratory at Corvallis, Oregon. The results of these analyses are expected in January 1971 and the Forest Service will then decide if a virus testing program can be carried out in the area during the 1971 generation. Entomologists and foresters have great hope that artificial introduction of the virus into threatening tussock moth populations will effectively and safely control these sporadic buildups. A successful field testing of the virus in California, therefore, could have beneficial results for California forests in the future as well as providing a safe tool for suppressing this insect throughout the western United States.

LIFE CYCLE OF THE
DOUGLAS-FIR TUSSOCK MOTH

STATUS AND CONTROL OF INSECT PESTS

DOUGLAS-FIR BEETLE, Dendroctonus pseudotsugae. Apparently, spontaneous outbreaks of the Douglas-fir beetle killed an estimated one million board feet of overmature Douglas-fir timber on the Plumas National Forest in Plumas County, and several million board feet on the Six Rivers National Forest in Humboldt County. The Humboldt County infestation is centered on Tish Tang Ridge, where this beetle inflicted devastating losses in the 1966 epidemic. The current outbreak will largely eliminate mature trees from that locality.

Evaluation of these outbreaks indicated increasing trends for next year. Therefore, control has been carried out (Plumas County) or planned for this winter (Humboldt County) by means of logging infested trees.

WESTERN PINE BEETLE, Dendroctonus brevicomis. The western pine beetle continued killing trees in several well-known problem areas and scattered spots around the State such as McCloud Flats, Siskiyou County; Bass Lake, Madera County; and Basket Pass, Kern County. Population trends of this beetle were closely followed in field studies made at Bass Lake and were found to be static at a quite low level. This confirmed the general endemic character of western pine beetle activity in the northern part of the State during the year.

In southern California, this beetle is partly responsible for a high mortality rate of ponderosa pine at Lake Arrowhead and Barton Flats in San Bernardino County. Serious air pollution damage to the trees is probably the main cause of the problem.

Damage from this beetle is expected to increase due to drought suffered by many pines in the late summer and fall of 1970. The first indications of this trend are increased tree fading noticed this fall in the McCloud Flats and Trinity Lake areas. Tree damage caused by the many large fires that occurred in the southern part of the State in the fall of 1970 is also expected to contribute to an upward trend in beetle populations in those areas.

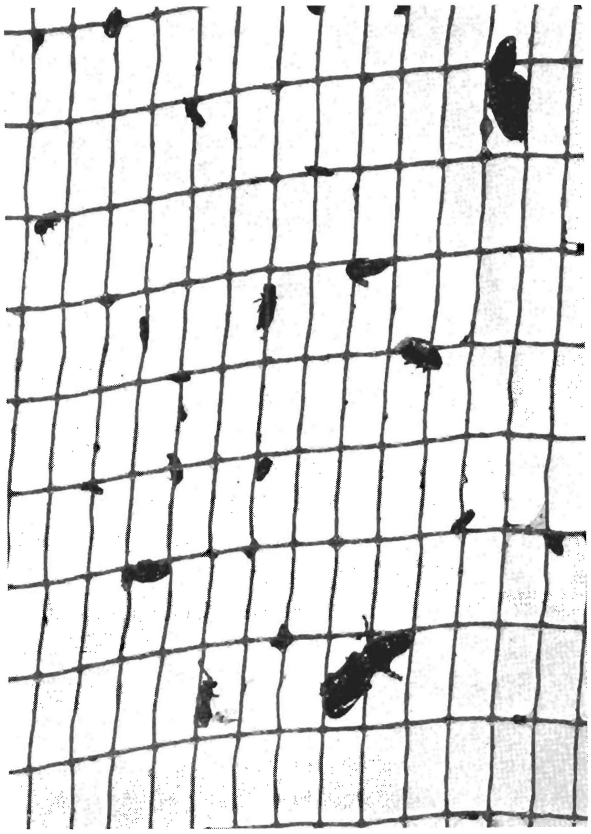
During 1970, an extensive and detailed field test was conducted at Bass Lake to evaluate the newest tools and techniques for the detection, evaluation, and control of the western pine beetle. Involved in the test were the use of traps baited with synthetic attractants (pheromones) recently developed for the beetle. Color-aerial photographs were taken periodically to help locate infested trees for the purpose of monitoring bark beetle populations over the sizable forested area. To reach the goals envisioned in this project, a large amount of field data had to be obtained and analyzed. The task of obtaining this information, in terms of money, materials, and manpower, could only be met through cooperative action, particularly since the time available for various activities

was severely limited by the biology of the insect. California's enviable record for cooperation among agencies and individuals concerned with forest pests, was greatly enhanced by the spirit and cooperation of the people who worked on this project. The agencies involved and responsible for the project are as follows:

Pacific Southwest Forest and Range Experiment Station
University of California
Stanford Research Institute
Forest Service (Regional Office and Sierra National Forest)
California Division of Forestry
Pacific Gas and Electric Company
Pines Civic Council (representing other property owners)

Results of the tests will not be available until additional data are collected and analyzed, but there are indications that attractants may become powerful tools in dealing with bark beetle problems.

At Bass Lake, sticky traps emitting synthetic pheromones were deployed to determine the effectiveness of the pheromones in attracting western pine beetles. In the suppression test, 264 traps were used; in the survey test, 110 traps were located throughout the area on a 40-chain grid.



Western pine beetles as well as some other insects were trapped on the sticky screening. The number of western pine beetles attracted and caught averaged about 2,000 per trap in the area of the suppression test.

MOUNTAIN PINE BEETLE, Dendroctonus ponderosae. Infestations of the mountain pine beetle increased in locations where host vigor was impaired by ecological factors. This impairment occurred in the 38-year-old ponderosa pine plantation at Sugar Hill in Modoc County where an over-crowding of the trees is developing; in an over-age and overstocked lodgepole pine stand near Independence Creek, Sierra County; and among lodgepole pines around urbanized districts in the southern Lake Tahoe area where scale insects have weakened many trees. A persistent, endemic population of these beetles also is killing groups of lodgepole pine in the upper Tuolumne and Merced drainages of Yosemite National Park where mature trees still suffer from the lingering effects of past needle miner defoliations.

In southern California, an increasing infestation is present in ponderosa pines enfeebled by smog damage in San Bernardino County.

Control of these infestations was recommended in those cases where thinning or removal of infested trees was appropriate and chemical control was used only in southern California recreation forests.

OTHER BARK BEETLES. Other bark beetle species causing concern in local areas include Ips spp., reported from most pine areas of the State; Scolytus ventralis reported from Siskiyou, Lassen, Alpine and San Bernardino Counties; Scolytus unispinosus, Siskiyou County; Dendroctonus valens, Siskiyou, Trinity, Placer and Madera Counties; Dendroctonus jeffreyi, San Bernardino, Fresno and Inyo Counties; and various twig beetles reported from pine, juniper and oak from Plumas, Humboldt, Nevada, Tulare and Butte Counties.

CALIFORNIA FLATHEADED BORER, Melanophila californica. The California flatheaded borer continues to be epidemic in the Laguna Mountains of San Diego County. Fire-damaged pine trees in the southern portion of that forested area are expected to be highly susceptible to attack by this beetle. Salvaging these trees is highly recommended to prevent increases in this epidemic.

DOUGLAS-FIR TUSSOCK MOTH, Hemerocampa pseudotsugata. Infestations of the Douglas-fir tussock moth were detected at Burney Mountain, Siskiyou County; Iron Mountain, El Dorado County; Strawberry Peak, Tuolumne County; and Mariposa Grove-Raymond Mountain, Mariposa County. The largest infestation covers several thousand acres on the Eldorado National Forest around Iron Mountain, while the most severe infestation occurs in Mariposa County on a limited area of Yosemite National Park and adjacent Sierra National Forest. Surveys of infested areas made in late 1970 revealed the sharp increase in tussock moth numbers this year, but significant damage has not yet occurred except in the Yosemite National Park area. If these infestations continue to increase, it is not expected that damage will reach a serious level until late in the 1971 season.

Research entomologists and forest insect control specialists are hopeful that a virulent virus disease of the tussock moth can be used as a biological control tool in lieu of chemical insecticide sprays. The largest outbreak area, on the Eldorado National Forest, is under study to determine if a field test of this virus spray can be conducted there in 1971. First indications are that the virus has not yet developed in this area. This will be confirmed or denied in January 1971 when tussock moth egg masses collected in the area hatch in the laboratory, and are examined for virus infection. If the virus is absent or inactive in the infestation, a virus spray test can probably be conducted successfully. For this test, the virus spray must be applied against a healthy population in order to determine if the spread of the disease can be attributed to the artificial introduction of the virus into the infestation.

LODGEPOLE PINE NEEDLE MINER, Coleotechnites milleri. The expected reflourishing of the lodgepole needle miner epidemic in Yosemite National Park was confirmed by 1970 surveys. Serious defoliation of lodgepole pine stands occurred in "back country" locations of Virginia Canyon and Conness Creek. The strong increasing trend of moth numbers in more accessible and heavily used areas also continued. Nearly all population sample plots showed increased numbers of larvae over the previous generation with the increased levels amounting to 200 to 500 percent in several cases. It now appears, that only an abrupt shift in weather patterns or applied control can avert widespread defoliation during the moth generation of 1971-72.

GYPSY MOTH, Porthetria dispar. The California Department of Agriculture, Bureau of Entomology reports the following in connection with a detected importation of the gypsy moth into California:

> "On September 16, 1970, USDA Plant Protection Division Inspector Tom Crowe submitted a viable egg mass from the Ford Philco Testing Facility, 33600 Ortega Highway, San Juan Capistrano. Identification was by D. H. Byers of the Orange County Department of Agriculture, with confirmation by G. T. Okumura in Sacramento.
>
> "Infested material consisted of wood used for pallets and crating which arrived in California in late July. It was being inspected because gypsy moth occurs at the point of origin, Picatinny Arsenal in New Jersey. Such material is usually treated at the source to prevent gypsy moth dispersal. Permission was obtained from the Ford Philco Company to gather and burn all suspect material on the grounds of the San Juan Capistrano facility. The area was then sprayed thoroughly with an oil-carbaryl mixture.

"Gypsy moth has been a serious defoliator of many deciduous host trees in the northeastern states since its introduction from Europe about 100 years ago. It feeds on conifers less readily. There is one annual generation, with adults appearing in July and August. Females, which cannot fly, deposit large egg masses on any convenient objects. Dispersal to new territory is most likely in the egg stage. Larvae hatch in the spring and feed voraciously into early summer.

"Inspection for more egg masses in the area will continue. Neighboring sycamore and oak trees will be closely watched for larvae in the spring. In addition, sex-lure traps to attract adult males will be used next summer."

SAWFLIES, Neodiprion spp. Sawflies of the genus Neodiprion and sawfly damage were relatively common on pines and firs in 1970. Most of the reports of these insects came from Siskiyou and Modoc Counties in the northern part of the State, but sawfly defoliation was also nearly always present in areas where the Douglas-fir tussock moth was active. Surveys planned for this winter will be used to evaluate the sawfly infestation in one or two of the more important locations.

OTHER DEFOLIATORS. Several defoliators of hardwoods were active during the year. The fruit-tree leaf roller, Archips argyrospilus, stripped the leaves from nearly all of the oak trees and some understory Douglas-fir over approximately 100,000 acres of land along the northern shores of Shasta Lake in Shasta County. The fall webworm, Hyphantria cunea, defoliated madrone and alder trees in spots throughout the northern part of the State. The satin moth, Stilpnotia salicis, was again reported from Modoc County feeding on aspen; an ash bug, Neoborus pacificus, severely defoliated shade trees in Camptonville in Yuba County; and the California oakworm, Phryganidia californica damaged oaks in several areas but was particularly noticeable in the Anderson Valley of Mendocino County. The epidemic of brown day moth, Pseudohazis elonterina, that severely damaged sheep range in Inyo County in 1969, collapsed in 1970.

During 1970, no direct control efforts were carried out to combat defoliating forest insects except that reported for the gypsy moth and possibly some spraying by individual landowners to protect shade trees.

SCALE INSECTS. Three established and damaging outbreaks of scale insects have been under observation and study during 1970. The epidemic of pine needle scale, Phenacaspis pinifoliae, present in the town of South Lake Tahoe for the past three years, shows evidence of declining as natural parasites and predators build up in the population. This beneficial increase in natural enemies has resulted from a change in mosquito abatement programs. Spraying is now directed against mosquito larvae in the water, rather than spraying to kill adult mosquitos. The sprays directed against mosquito adults in the past had inadvertently killed most of the natural enemies of the scales.

PINE RESIN MIDGE, Cecidomyia piniinopis. Flagging of branch tips of young ponderosa pine trees in plantations and natural stands by the pine resin midge was the most widespread and conspicuous forest insect damage observed during 1970. Infestations were reported from Fresno County northward to Siskiyou County near the Oregon border. In plantations where severe twig killing occurred, counts of up to 40 larvae in individual twigs were found.

In nearly all cases, affected trees are expected to recover with little permanent damage or growth loss unless the infestation continues and becomes chronic in character. Early field checks of the current overwintering midge generation indicates the infestation is continuing but at a reduced level, at least in the spots checked.

OTHER INSECTS DAMAGING PLANTATIONS AND YOUNG TREES. The grasshopper, Bradynotes obesa again infested newly established plantations in the Mt. Shasta and Doe Peak areas of Siskiyou County. Two hundred and seventy-five acres were treated with Sevin, and 500 acres with malathion by the Agricultural Research Service to control these outbreaks. Another grasshopper, Oedaleonotus tenuipennis, also nearly destroyed a smaller plantation on Frazier Mountain in Ventura County, but control action was not warranted in that instance.

The fir coneworm, Dioryctria abietella, damaged valuable grafted nursery stock despite periodic applications of dimethoate sprays used to prevent such damage. The spray did control several other insect pests on these trees and it seems that protective coverings placed on the trees when grafted are also sheltering the coneworm from the insecticide. A slight change in application technique is expected to correct this problem next year.

A bud moth, Zeiraphera vancouverana, attacking Sitka spruce was identified for the first time in California in 1970. This insect is believed to be a native species which had gone undetected before, due to its cryptic living habits, rather than introduction of a new pest to the State.

TABLE I

INSECT CONTROL ACTION RECOMMENDED BY THE COUNCIL - 1970

NORTHERN CALIFORNIA COMMERCIAL AND RECREATIONAL FORESTS

INFESTATION AREA	ESTIMATED ACREAGE	COUNTY	INSECT	HOST	RECOMMENDED ACTION
BARK BEETLES					
McCloud Flats	7,000	Siskiyou	Db	PP	Salvage and spray, thin and research
Plumas	1,000	Plumas	Dp	DF	Salvage
Tish Tang Ridge	600	Humboldt	Dp	DF	Salvage
South Shore Lake Tahoe	320	El Dorado	Sv,Dm,Mc	WF,LP,JP	Evaluate
DEFOLIATORS					
Callahan	600	Siskiyou	Ma	SP	Surveillance
Hat Creek and Latour State Forest	3,000	Shasta	Hp	WF	Surveillance
Iron Mountain, Baltic & Plummer Ridges	30,000	El Dorado	Hp	WF	Evaluate
Strawberry Peak	1,000	Tuolumne	Hp	WF	Evaluate
Burney Mt.	1,000	Shasta	Hp	WF	Evaluate
Raymond Mt.	500	Mariposa	Hp	WF	Evaluate
Knox Mt.-Hilton		Modoc	Na	WF	Evaluate
Northern California	Unknown	Northern California	Cp	PP	Surveillance
Sentinel, Crooked and Wet Meadows	2,200	Mono	Cm	LP	Surveillance and research
South Shore Lake Tahoe	1,280	El Dorado	Pp	JP,LP	Surveillance, research and conserve natural enemies

PLANTATIONS AND EXPERIMENTAL AREAS

Plantations	4,000	Siskiyou	Gh	PP,JP	Detection, evaluate and control as needed
Seed Production Areas		Northern California	C&S	PP	Surveillance and research
Established Seed Orchards	100	Northern California	Da	PP,JP,SP,DF	Spray grafts five times a year

STATE AND NATIONAL PARKS

Anza Borrego	500	San Diego	Db,Mc	CP	Maintenance control
Cuyamaca Rancho State Park	8,000	San Diego	Mc,Db	JP,PP	Maintenance control
Heart Bar	1,300	San Bernardino	Dj	JP	Maintenance control
Lassen Volcanic National Park	3,000	Shasta, Lassen	Dj,Db,Dm	JP,PP,SP,LP	Presuppression survey
Palomar State Park	1,500	San Diego	Db,Ips,Sv,Mc	CP,PP,WF	Surveillance
San Jacinto State Park	11,000	Riverside	Mc,Db	JP,CP,PP	Maintenance control
Sequoia and Kings Canyon	8,500	Fresno	Db,Dm	PP,SP	Limited maintenance control
Sequoia and Kings Canyon	400	Tulare	Cm	LP	Surveillance
Yosemite National Park	57,700	Mariposa, Tuolumne	Db,Dm,Dj	PP,SP,JP,LP	Limited maintenance control
Yosemite National Park	9,000	Tuolumne	Cm	LP	Surveillance and research
Yosemite National Park	1,000	Mariposa	Hp	WF	Evaluate

SOUTHERN CALIFORNIA RECREATION FORESTS

Arrowhead-Crestline	47,000	San Bernardino	Dm,Db,Ips,Dj	PP,CP,JP	San.-treatment and maintenance control
Arroyo-Seco District	3,000	Los Angeles	Db,Ips,Mc	PP,CP,JP	San.-treatment and maintenance control
Big Bear Valley	8,800	San Bernardino	Dj,Ips,Mc,Sv	JP,WF	San.-treatment and maintenance control
Corte Madera	1,600	San Diego	Db,Ips,Mc,Dv	CP,JP,PP	Evaluate and salvage
Idyllwild-San Jacinto	37,000	Riverside	Mc,Db,Ips,Dm	PP,CP,JP	San.-treatment and maintenance control
Julian-Pine Hills	12,000	San Diego	Db,Ips	CP	Evaluate
Laguna Mtn.	9,700	San Diego	Db,Mc	CP,JP	Maint. control
Lost Valley	4,000	San Diego	Db,Ips	CP	Maint. control
Mt. Baldy District	1,500	Los Angeles	Ips,Dj,Dm,Mc,Db	PP,JP,CP	San.-treatment and maintenance control
Mt. Pinos-Cuyuma	24,000	Ventura	Ma	Pe	Surveillance--spray high use areas
Mt. Pinos District	7,900	Ventura, Kern	Mc,Ips	JP	San.-treatment and maintenance control
Palomar Mt.	6,600	San Diego	Db,Sv	CP,WF	Maintenance control
Ranger Peak-Figueroa Mt.	700	Santa Barbara	Db,Ips,Dv	PP,CP	Maintenance control
San Gorgonio District	25,000	San Bernardino	Db,Dj,Ips	PP,JP,CP	San.-treatment and maintenance control
Snow Valley	125	San Bernardino	C sp.	JP	Surveillance
Valyermo District	14,600	Los Angeles	Mc,Ips	JP,WF	San.-treatment and maintenance control
Wrightwood	2,000	San Bernardino	Mc,Ips	JP	Maintenance control

Abbreviations Used in Tables I and II

INSECTS

C sp. - Jeffrey pine needle miner	Dm - Mountain pine beetle	Na - White-fir sawfly
Cm - Lodgepole needle miner	Dp - Douglas-fir beetle	Pp - White pine scale
Cp - Pine resin midge	Gh - Grasshoppers	Sv - Fir engraver
C&S - Cone and seed insects	Hp - Douglas-fir tussock moth	
Da - Fir coneworm	Ips - Pine ips	
Db - Western pine beetle	Ma - Matsucoccus sp.	
Dj - Jeffrey pine beetle	Mc - California flatheaded borer	

HOST

CP - Coulter pine	MP - Monterey pine
DF - Douglas-fir	Pe - Pinyon pine
GS - Giant sequoia	PP - Ponderosa pine
IC - Incense cedar	RF - Red fir
JP - Jeffrey pine	SP - Sugar pine
Ju - Juniper	WF - White fir
LP - Lodgepole pine	

STATUS AND CONTROL OF DISEASES

SIGNIFICANT CONDITIONS

With few exceptions there is little change in overall forest disease conditions within California from year to year. Forest tree diseases as reported by host and county for the year 1970 are listed in Table II. The following diseases were of special interest.

ELYTRODERMA. The only disease that appeared much more prevalent this year was elytroderma disease caused by Elytroderma deformans. The characteristic red, infected second-year needles were abundant in many localities during the spring and early summer of 1970. Many of these infections will not become systemic because of early needle drop.

RED BAND NEEDLE BLIGHT. The red band needle blight caused by Scirrhia pini (Dothistroma pini) continued to damage planted Monterey pine on the Jackson State Forest and other north coastal areas. It was found in one new area seriously affecting a Monterey pine farm planting near Fort Dick. The disease was also found for the first time on bishop pine in a Christmas tree plantation south of Fortuna, Humboldt County. It was not causing serious damage to this species. Since the discovery of this disease in 1965, many Monterey and Monterey X knobcone hybrids have died in several areas. All seriously affected areas are within about 15 miles of the coast. Because of this disease, it may not be possible to grow Monterey pine successfully in this coastal area without attempting to control the red band needle blight. Bordeaux mixture applied as a preventative treatment has been the only direct control measure that so far offers promise of success in California.

NURSERY DISEASES. Several nursery disorders including root pathogens, nematodes and foliage diseases were reported from the Forest Service Nursery, Humboldt County. A number of control methods are currently being tested in cooperation with the University of California and the Pacific Southwest Forest and Range Experiment Station.

SURVEYS

SMOG DAMAGE. The ponderosa and Jeffrey pine type on the Angeles National Forest was surveyed this year for air pollution damage, using the same two-stage color aerial photography and randomly-selected ground-plot examination system that was used on the San Bernardino National Forest in 1969.

Of the 40,600 total acres of ponderosa and Jeffrey pine type about 16,500 acres are severely or moderately affected; on 3,300 acres damage was severe and on 13,200 acres damage was moderate.

Preliminary survey results indicated that within the affected areas about 261,000 trees are severely or moderately affected; 20 percent of which are severely affected and 80 percent are moderately affected. An additional unestimated number of trees are lightly affected.

TABLE II
FOREST DISEASES REPORTED - 1970

CAUSAL AGENT	HOST	COUNTY
RUSTS		
Cronartium comandrae	PP	Butte
	PP	Shasta
Cronartium ribicola	SP	Butte
	SP	El Dorado
	SP	Fresno
	SP	Humboldt
	SP	Lassen
	SP	Nevada
	SP	Placer
	SP	Tulare
Gymnosporanium libocedri	IC	Modoc
	IC	Plumas
Melampsorella caryophyllacearum	WF	Fresno
Peridermium harknessii	LP	Butte
	LP	El Dorado
	PP	Lake
	MP	Monterey
	LP	Placer
Peridermium stalactiforme	JP	Alpine
	LP	El Dorado
	LP	Fresno
	JP	Kern
	JP	San Bernardino
Pucciniastrum goeppertianum	WF	El Dorado (2)*
FOLIAGE DISEASES		
Colletotrichum gloesporioides	CL	Marin
Coryneum cinereum	PP	Siskiyou
Davisomycella medusa	PP	Lassen
Davisomycella montana	LP	Fresno (2)*
Elytroderma deformans	JP	El Dorado
	PP	El Dorado
	PP	Humboldt
	JP	Lassen
	PP	Siskiyou
	PP	Trinity (2)*
Lophidermium autumnale	WF	Modoc
Lophidermium pinastri	MP	Del Norte
	PP	El Dorado
	PP	Siskiyou
Macrophoma pinea	PP	Sierra
Marssonina populi	QA	Modoc
Mycosphaerella arbuticola	Ma	Humboldt
Myxosporium marchandianum	CBO	Butte
Naemacycleus niveus	MP	Del Norte
Neopeckia coulteri	LP	Fresno
Pestalotia funera	MP	Del Norte
Phyllosticta amicta	Mz	Madera
Rhizospheria pini	WF	Sonoma
Scirrhia (Dothistroma) pini	MP	Del Norte
Venturia tremulae	QA	Fresno
Virgella robusta	WF	Modoc
MISTLETOES		
Dwarf Mistletoe	LP	El Dorado
	LP	Fresno
	RF	Fresno
	WF	Fresno
	WF	Modoc
	MP	Monterey
	DF	Plumas
	WF	Plumas
	Pe	San Bernardino (2)*
True Mistletoe	Ju	Alpine
	WF	El Dorado (3)*
HEART ROTS		
Daldinia concentrica	CBO	Butte
Echinodontium tinctorium	RF	El Dorado (2)*
	WF	El Dorado (9)*
	WF	Riverside
	WF	San Diego
Fomes officinalis	WF	Riverside
Fomes pini	DF	El Dorado
	MP	Monterey
Fomes pinicola	WF	San Bernardino
Polyporus schweinitzii	MP	Monterey
	LP	Riverside

CAUSAL AGENT	HOST	COUNTY
ROOT DISEASES		
Armillaria mellea	CBO	El Dorado (2)*
	LP	El Dorado (2)*
	PP	El Dorado
	RF	El Dorado
	WF	El Dorado (2)*
	LP	Fresno
	DF	Placer
	LP	Riverside
	PP	San Bernardino
	JP	Shasta
Fomes annosus	CBO	El Dorado
	IC	El Dorado
	JP	El Dorado
	PP	El Dorado (2)*
	RF	El Dorado
	WF	El Dorado (5)*
	JP	Fresno
	JP	Lassen
	LP	Lassen
	PP	Lassen (2)*
	PP	Los Angeles
	Ma	Mendocino
	Mz	Mendocino
	PP	Mendocino
	IC	Modoc
	JP	Modoc (2)*
	Ju	Modoc (3)*
	PP	Modoc (8)*
	PP	San Bernardino
	WF	San Bernardino
	JP	San Diego
	JP	Shasta (3)*
	JP	Ventura
Macrophomina phaseoli	MP	Sacramento
Verticicladiella wagenerii	PP	El Dorado
	JP	San Bernardino
TWIG AND STEM DISEASES		
Atropellis pinicola	SP	Yuba
Cenangium ferruginosum	PP	El Dorado
Cytospora abietis	WF	Siskiyou
Dermea pseudotsugae	DF	Siskiyou
Phoma pinicola	MP	Mendocino
NURSERY DISEASES		
Ascochyta piniperda	PP	Humboldt (2)*
Botrytis cinerea	DF	Humboldt
	DF	Siskiyou
Chemical	DF	Humboldt
Excessive Heat	DF	Humboldt
Fusarium spp.	DF	Humboldt
Pestalotia funerea	DF	Humboldt
Pythium spp.	DF	Humboldt
	PP	Humboldt
Rosellinia herpotrichoides	DF	Humboldt
Xiphinema bakeri	DF	Humboldt
MISCELLANEOUS		
Chemical (borate)	JP	Angeles
	JP	Kern
	WF	Tehama
Drought	MP	Alameda
	IC	El Dorado
	PP	El Dorado
	PP	Humboldt
	JP	Kern
	PP	Lassen
	IC	Madera
	JP	Shasta (2)*
	PP	Shasta (2)*
	PP	Trinity
	GS	Tulare
Excessive Heat	MP	Butte
	DF	Humboldt
Frost or Freezing	GS	El Dorado
	MP	El Dorado
	WF	El Dorado
	DF	Humboldt
	PP	Modoc (2)*
	WF	Shasta
	JP	Tulare
Hail	DF	Siskiyou

HOST ABBREVIATIONS

Conifer Hosts: Refer to Table I.

Other Hosts:

CBO - California black oak
CL - California laurel
Ma - Madrone
Mz - Manzanita
QA - Quaking aspen

* Number of reports received.

Because smog damage in this area appears to be increasing, surveys of this type will be continued. The San Bernardino areas will be resurveyed in 1971. Other apparently affected areas near San Diego, Santa Cruz and Fresno will be surveyed.

BLACK STAIN ROOT DISEASE. Pinyon pine areas on the San Bernardino National Forest infected by the black stain root disease caused by Verticicladiella wagenerii were aerially surveyed during October. The survey revealed several centers of dead and dying pinyon pine scattered throughout the pinyon pine type. Most of these centers are about one-fourth up to an acre in size. About eight thousand acres of pinyon are infected by this disease. Where small spots occurred within about 20 chains of each other, the whole area was mapped and counted as being affected.

A number of areas recorded from the air as having infected trees were also examined on the ground: in only one case was the damage due to another cause, indicating that the aerial observations made were reliable.

The largest observed infection center, with almost complete pinyon pine kill, is about 100 acres. In many centers up to 75 percent of the pinyon pine is dead or dying. A number of green, and otherwise healthy appearing trees, were found infected around the edge of most of the spots examined. Based only on root collar examinations, the additional area infected appeared to be limited to within a 30-foot radius of dead or dying trees.

During the past two to three years, the rate of tree killing appears to have accelerated in most infection centers: there are more recently-dead trees than older-dead trees; many centers had no older-dead trees.

A significant portion of the area surveyed is almost pure pinyon pine type. Mixed in with the pinyon on the rest of the area is a scattering of juniper, which so far is not affected by the disease. There are also a few Jeffrey pine on some of the areas, but to date only one has been found that was killed by V. wagenerii. In other more northern areas of California, however, this disease has killed a number of both Jeffrey and ponderosa pine.

STATE-WIDE DISEASE SURVEY. All data collected since this survey started in 1958 is being summarized and analyzed. The survey design and objectives are also being reviewed, and if necessary, revised procedures will be developed prior to beginning again to collect additional data. Occurrence and impact information for nearly all forest diseases in California is presently insufficient to establish research and control program priorities.

CONTROL

BLISTER RUST CONTROL. Several small white pine blister rust infection centers were found on the Calaveras District of the Stanislaus

National Forest in 1969; all were sanitized that fall. In the spring of 1970 many 1967-origin cankers, which were not detectable in 1969, were found near these centers. As a result, centers that earlier totalled a few acres now occupy several hundred acres. In the light of this condition the northern boundary of the area in which control is being attempted by eradicating infection centers was shifted to the Middle Fork of the Stanislaus River.

Elsewhere in Zone-3, scouting and sanitation work continued. Although some new centers were found -- notably the first one ever found on the Sierra National Forest -- all originated earlier than 1967. The Sierra center followed the same pattern of origin and intensification as those at Mountain Home State Forest: 1961 origin, 1964 and 1967 buildup.

DWARF MISTLETOE CONTROL. In recent years dwarf mistletoe control on recreation lands has stressed coordination of the disease effort with other forest management measures, especially thinning on the semi-arid sites in southern California. A reexamination in 1970 of many of the earliest projects revealed that this approach has been quite successful.

NEW DISEASES

The following pathogens were found for the first time in California:

Dermea pseudotsugae. A disease causing twig and stem cankers on Douglas-fir was found in a small plantation on the Klamath River near Happy Camp, Siskiyou County. About 100 trees are affected and several have died. The area will be examined periodically to appraise the damage potential of this new disease.

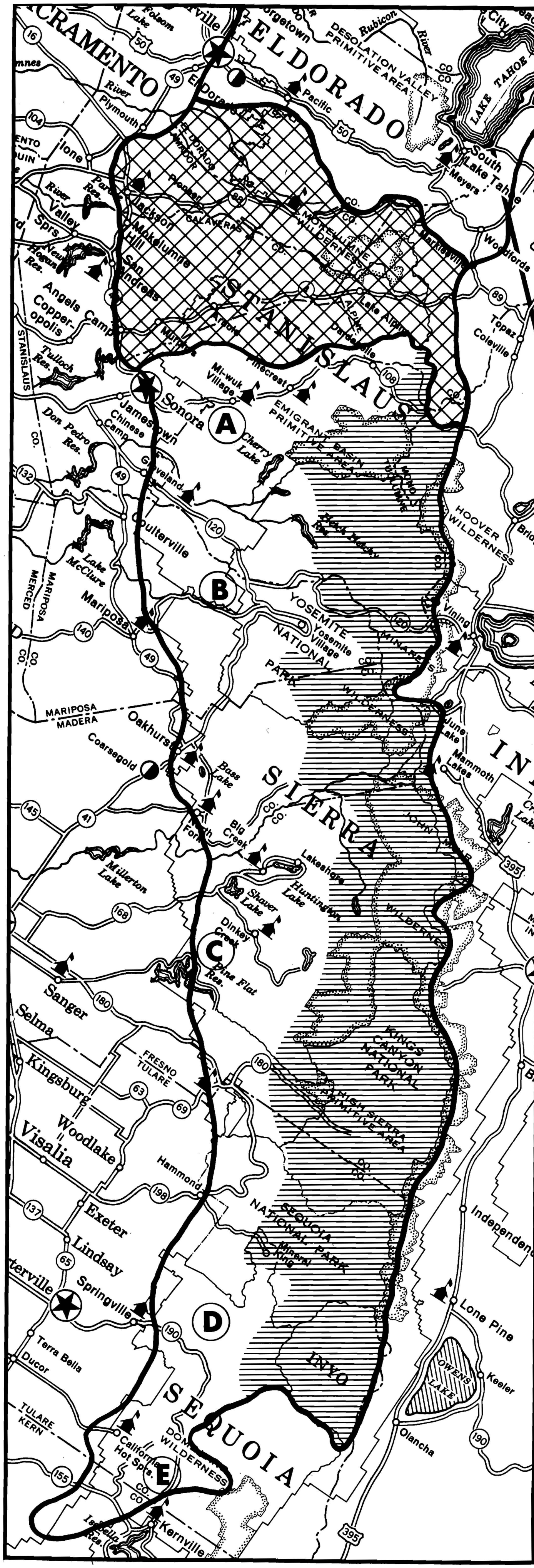
Xiphinema bakeri. An ectoparasitic dagger nematode was found causing severe damage to 2-0 Douglas-fir seedlings at the Forest Service Nursery, Humboldt County.

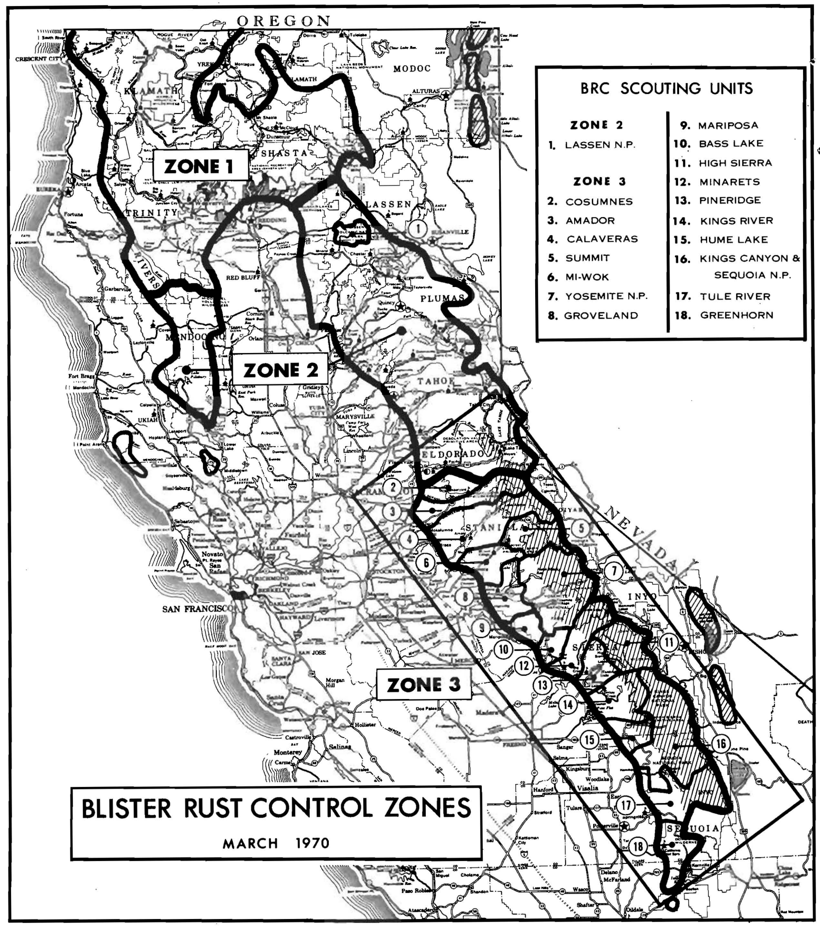
Myxosporium marchandianum. Apparently a weak parasite causing a twig dieback on California black oak was reported in Butte County.

NEEDLE DISEASE NAME CHANGES

In 1966, Dr. G. D. Darker revised and rearranged the fungi family Hypodermataceae that cause needle cast diseases. Originally, this family had five genera with 47 species. These five genera have been divided and others added until there are now 22 genera. A few species have been left in the original genera but most have been rearranged. Of these, 24 species in nine genera are found in California.

Since these new names have now been accepted, a list that has been prepared for field use is included in this report. Table III lists the species for the old genera and gives the new name for each fungus. For example, Hypodermella medusa is now Davisomycella medusa. The host tree species on which each needle cast is found in California is also given.





White Pine Blister Rust Control. Recent surveys show that, although blister rust occurs throughout Zones 1 and 2, Zone 3 is largely rust free. Accordingly, in Zone 3 all known infection centers are being sanitized in an attempt to delay—or even prevent—the disease from becoming permanently established there. In 1970 the boundary between Zones 2 and 3 was shifted south to the middle fork of the Stanislaus River (see page 14). (The exterior boundary of these zones follows the botanical range of white pines; sugar pine is found in all but the shaded portion.)

Scouting, the systematic search for infected pines and ribes in stream-side sites, is an important part of the continuing control program in Zone 3. Scouting here is done only in the sugar pine type, and all scouting units are resurveyed on a 3-year schedule.

All sugar pine units in Zone 3 were scouted in 1967, 1968, and 1969. Units 5, 6, 9, 10, and 15, as well as portions of Yosemite and Kings Canyon National Parks, were scouted again in 1970. The remaining sugar pine units will be scouted for the second time in 1971 and 1972.

To date infected pines have been found at only five locations in Zone 3:

A. Several large and few small infection centers near Hull Creek and Reynolds Creek on the Stanislaus National Forest.

B. One small center on Neds Gulch near the west boundary of Yosemite National Park.

C. One small center near Dinkey Creek on the Sierra National Forest.

D. Several large and many small centers in the area between Garfield Grove in Sequoia National Park and Camp Nelson.

E. Three small centers in the Greenhorn Mountains, Sequoia National Forest.

Dwarf Mistletoe Control. The most productive forest lands in California are those developed especially for use as campgrounds and picnic areas; also, these are the forest lands requiring the greatest investment, often thousands of dollars per acre. Special management measures are needed in such high-use sites to ensure that the forest cover remains healthy, vigorous, and attractive.

Increasingly, where dwarf mistletoe is present in recreation sites, control of this disease is accomplished as one part of a coordinated landscape management project in which the stand is thinned and sanitized to provide optimum growing conditions for carefully selected leave trees, and to enhance both the natural beauty and recreational utility of the remaining stand.

Figures A and B (Laguna Mountain Recreation Area, Cleveland National Forest) show typical before and after views of a landscape management project completed in 1970; note the open, more pleasing appearance of the thinned stand. All trees with dwarf mistletoe were cut or pruned.

Figures C, D, and E show several early dwarf mistletoe control projects in California: Figure C is in McGill Campground, Los Padres National Forest; Figures D and E respectively are Hanna Flats Campground and Barton Flats Recreation Site, San Bernardino National Forest.

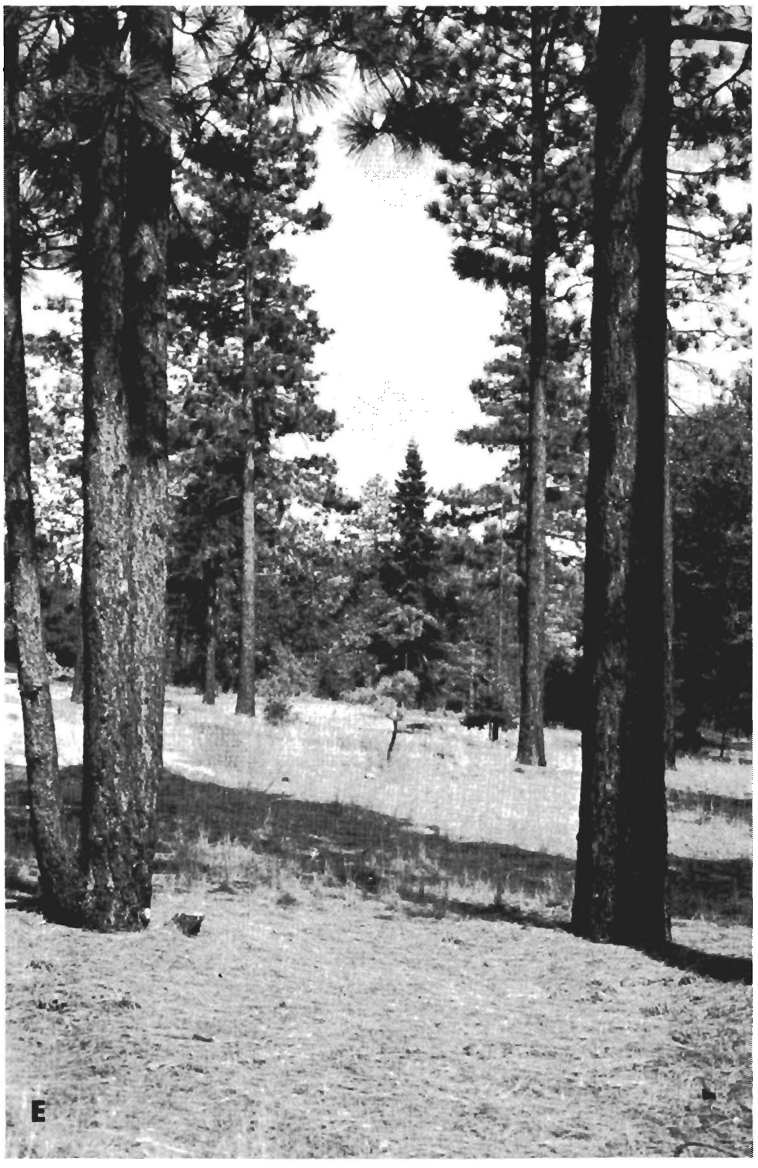


TABLE III

CALIFORNIA NEEDLE CAST FUNGI LISTED UNDER FORMER NAMES WITH THE CORRESPONDING NEW NAMES

Former Name	New Name	Host Trees
Bifusella		
linearis	Same	Whitebark, limber pine
striiformis	Soleella striiformis	Digger, Torrey and Cluster pine (Pinus pinaster in Golden Gate Park)
Hypoderma		
robustum	Virgella robusta	White, red and shasta fir
pedatum	Ploioderma pedatum	Monterey pine
pini	Bifusella pini	Pinyon pine
new variety	Lirula nervisequia var conspicua	Bristlecone fir
Hypodermella		
limitata	Davisomycella limitata	Monterey pine
lacrimiformis	D. lacrimiformis	Knobcone & Monterey pine
medusa	D. medusa	Jeffrey & ponderosa pine
montana	D. montana	Lodgepole pine
punctata	Lirula punctata	White fir
abietis-concoloris	L. abietis-concoloris	White fir
montivaga	Lophodermella montivaga	Lodgepole pine
arcuata	L. arcuata	Sugar pine
cerina	L. cerina	Ponderosa & Lodgepole pine
Elytroderma		
deformans	Same	Ponderosa, Jeffrey, knobcone, and lodgepole pine
Lophodermium		
juniperinum	Lophodermium juniperi	Juniper, incense-cedar
pinastri	Same	Jeffrey, ponderosa, sugar, Coulter, Monterey, Digger, lodgepole, western white, Japanese white and white-bark pine
nitens	Same	Sugar, western white, whitebark pine
autumnale	Same	White fir
durilabrum	Same	Foxtail pine
piceae	Same	Sitka spruce
crassum	Same	Brewers spruce
decorum	Same	Bristlecone fir

KNOW YOUR FOREST DISEASES*

FOMES ANNOSUS ROOT ROT

Fomes annosus root rot is caused by a native pathogen, Fomes annosus, that can be found almost everywhere conifers grow in this country. F. annosus is prevalent throughout the North Temperate Zone of the world and has also been found in some tropical and subtropical areas. F. annosus was first reported in California in 1909 by Meinecke and has now been found in 28 of the 58 counties in California, including all National Forests and Yosemite and Kings Canyon National Parks.

IMPACT. In the East, F. annosus has killed loblolly, longleaf, pitch red, slash, shortleaf, Virginia and white pines. The disease has been reported on several hardwood species in Europe, but in general, deciduous trees are more resistant than conifers.

In California, all commercial conifers are susceptible and pines of all sizes can be killed. In other species, the disease is most damaging as a heart rot, but young true firs are also killed. Only one hardwood (madrone) has been found infected in California. A few brush species have also been found infected, including manzanita and sagebrush.

Most current loss data is from other areas, particularly the Southeast. The most serious potential disease impact is the apparent ability of this pathogen to take land out of production. Infection centers continue to enlarge actively in the southeastern States up to about five years. Very little quantitative loss data has been collected in California.

In 1942, it was reported that on the Cleveland National Forest, 70 percent of 10,000 Jeffrey pine treated in a bark beetle control job had F. annosus. In 1962, severe losses were reported in the Placerville arboretum where 26 species of pine were killed. As of 1970, 24 of the reserve trees in the Cal Mountain Seed Production area have been killed by this pathogen.

Pines will sometimes die within two to three years of adjacent tree cutting, but generally it takes 10 to 15 years for an infection center to develop to its most obvious damage peak. Sometimes all trees in the area surrounding an infected stump are not killed. So far, only a few infection centers have been found in precommercial thinning areas. Most of the significant centers appear to have resulted from the colonization of larger stumps created by commercial harvest.

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*Each year a different California forest disease will be described in enough detail so that field-going people can more readily recognize it. This information will be repeated every three or four years as necessary.

The length of time an area may be out of production due to Fomes annosus is unknown but in some cases it appears that it could be a significant portion of a rotation period. The appraisal of both current and potential damage in California is continuing.

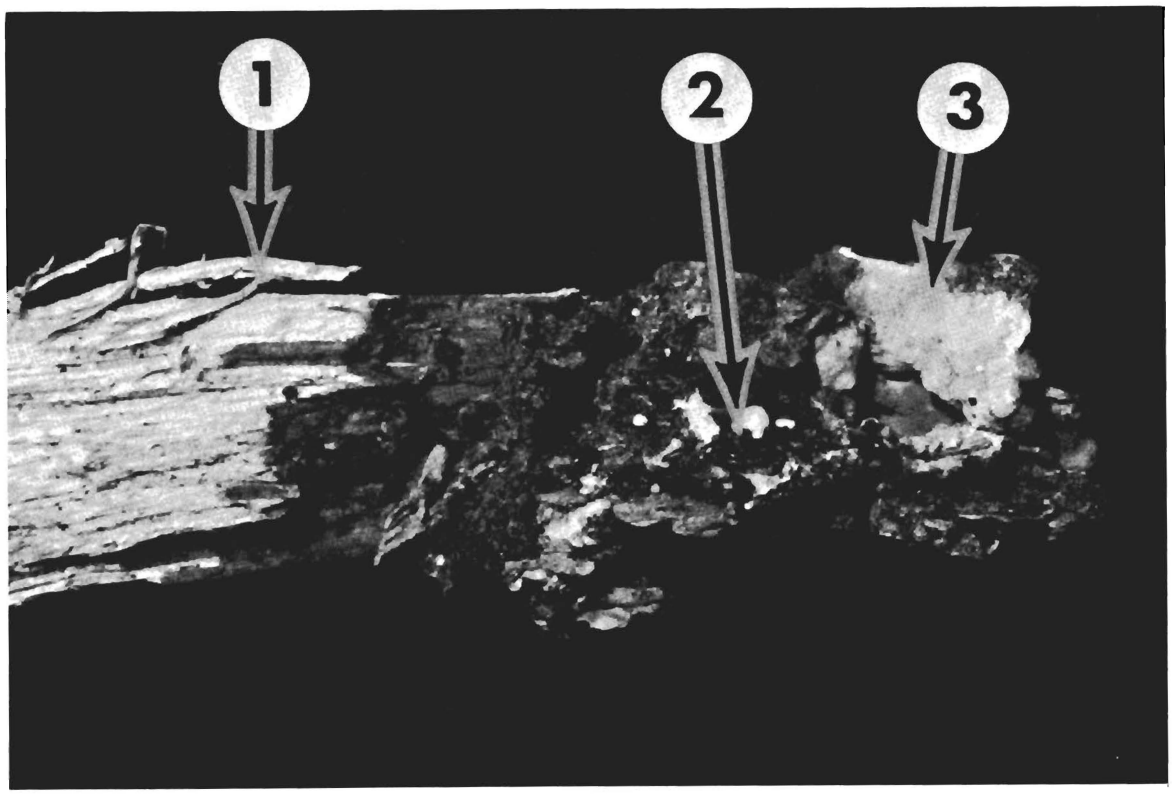
A Fomes annosus infection center on the Los Padres National Forest. Note the pattern of dead trees around the large Jeffrey pine stump.

LIFE CYCLE. F. annosus is a root infecting pathogenic fungus which is both parasitic (attacks living plants) and saprophytic (can live on dead plant material). It has both a perfect stage (perennial conks) and an imperfect stage (fragile conidiophores) and is spread by spores from both. The number of spores in the atmosphere from one stage or the other is probably high throughout the year in most California areas. The major court of initial stand infection is freshly-cut stumps. Injured or severed roots may also be important, particularly in timber sale areas. Stumps are susceptible immediately after cutting and up to three or four weeks after cutting.

Spores probably germinate on stumps year-round, although reports from the southeastern States indicate that temperatures below freezing or above 70°F. may limit germination. Once established, the fungus penetrates the stump rapidly and spreads into the roots. From there it spreads to uninfected roots of living trees at natural grafts or root contacts.

SYMPTOMS. Fomes annosus produces conks with a light gray to dark-grayish brown upper surface. The spore-producing under-surface is creamy white, with small pores which darken with age. Conks are perennial; however, under some conditions they may be destroyed after a relatively short time and therefore seem to be annual. Conks are irregular in shape and range in size from miniature buttons to tough-textured sporophores several inches across. They are formed on stumps, slash, and dead trees, as well as around the root collar and on roots of living infected trees.

F. annosus fruiting bodies may be abundant in some stands and absent or scarce in others. They can be easily overlooked because of their inconspicuous color and obscure location.



A section from a large pine stump colonized by Fomes annosus. Note stringy type rot (1) button-type sporophores (2) and the large, older sporophore (3). These symptoms are commonly found inside large stumps.

Symptoms of severely infected trees include a sparse crown, short needles, short twig internodes and a general reduction in tree vigor.

Trees killed by F. annosus usually are associated with a nearby cut stump and dead trees very often form a pattern similar to that caused by bark beetles: the oldest dead trees occur near the center of concentric rings of dead and dying trees with the most recent kills farthest from the center.

F. annosus causes a light-yellowish stringy rot. The advanced stage is typified by narrow, elongated, whitish pockets which when run together, reduce the wood to a spongy or stringy mass. Black spots or flecks sometimes occur in the rot pockets. The characteristics of annosus-rotted wood are seen best in broken roots of windthrown trees. Decayed roots are shredded and stringy at the break in contrast to the sharp, firmly splintered breaks of sound roots. Small whitish pits are usually found on the inside of the bark of infected roots.

CONTROL. Control efforts have included attempted eradication by pulling all stumps and roots and then fumigating with methyl bromide. Digging a barrier trench to isolate uninfected trees has also been used. Both methods are very costly (up to $1,000 per acre), impractical under most forest conditions, and not necessarily successful. There are several biological control possibilities but none show immediate promise under California conditions.

It may be possible to limit infection by restricting tree cutting to days with a mean temperature above 70°F. or below freezing. Clear fellings of all trees 30 to 50 feet around small, early infection centers may also prevent spread but both of these techniques require additional research.

Prevention measures by chemical treatment of freshly-cut stumps seem to offer the most promise. Borax (technical grade sodium tetraborate decahydrate) which is toxic to the annosus spores gives the best level of prevention. Urea, ammate, and several other high nitrogen compounds that stimulate competing fungi, have also been used but without as much success. Borax is sprinked on pine stumps in dry form. It is applied at the rate of one pound per 50-square feet of stump surface and must be applied very soon after cutting -- probably within one hour.

The Forest Service, Region 5, Division of Timber Management and the Pacific Southwest Forest and Range Experiment Station, Section of Disease Research, have recently completed two tests in California using borax treatments as a method of preventing F. annosus infection of freshly-cut stumps. In the Region 5 tests, borax was found to be effective in preventing F. annosus colonization of ponderosa and Jeffrey pine stumps. Similar tests on white fir by the Experiment Station show that borax is equally effective in preventing stump infection in true firs. In both tests, less than four percent of the borax-treated stumps and over 60 percent of the nontreated stumps became infected. These data are currently being used to secure the registration of borax for use on western pines and true firs. When registration is obtained, borax treatment will be recommended for treating pine and fir stumps in areas where it is needed.

STATUS AND CONTROL OF ANIMAL PESTS

DEER. Heavy to moderate browsing of seedlings and saplings by deer occurred Statewide. Serious damage was inflicted on plantations of Douglas-fir, white fir, red fir, ponderosa pine and Jeffrey pine. Eight thousand acres of Douglas-fir and ponderosa pine were damaged on one plantation in Humboldt County. Deer browsing is greatest in the northern coastal forests. However, it is increasing at a rapid pace on some areas of the northeastern and central forests. Efforts directed towards special deer hunts as a damage control tool have not met with much success. Z.I.P. applications are being tried in some areas in an attempt to reduce damage at the time it is normally incurred. The Olympia Research Center of the Bureau of Sport Fisheries and Wildlife is currently working with deer repellents in an effort to find a desirable control tool.

PORCUPINE. Damage by porcupines was scattered across the inland northern forests, southward through the Sierra range to Inyo County. The Haystack Burn in Siskiyou County and the Sugar Hill Plantation in Modoc County are the areas where the most serious damage occurred. Overall damage seems to have increased over that of last year. Increasing damage is reported in the northern coastal areas of Del Norte and Humboldt Counties. Control was conducted in some areas using standard strychnine-salt blocks. The Olympia Research Center is currently conducting studies with the salt block, using a built-in attractant. The work looks promising, but additional research is required. The Division of Wildlife Services of the Bureau of Sport Fisheries and Wildlife will conduct a porcupine control program on the Klamath National Forest starting in late 1970.

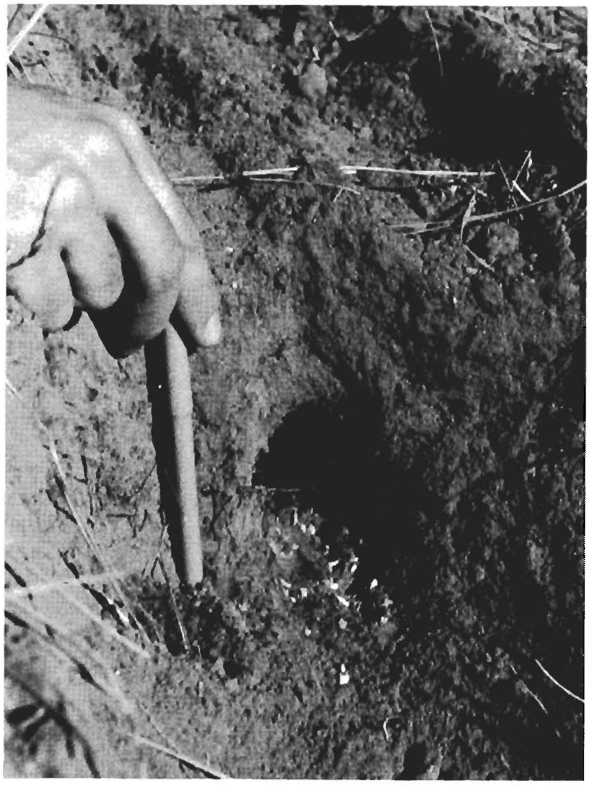
POCKET GOPHER. Damage to plantations by pocket gophers was reported in all the timber producing areas of the State with the exception of the coastal areas. Ponderosa pine was the species most seriously damaged. Pocket gopher damage has been reported from static to increasing. The most serious damage occurred in Siskiyou and Modoc Counties. Successful control efforts have been made with the new "forest-land" burrow builder. Results of work conducted in the spring and fall of 1969 show that adequate control can be obtained with this machine.

SEED EATING RODENTS. In order for some direct seeding-type reforestation projects to be successful, high population levels of seed eating rodents, principally the white footed deer mouse, had to be suppressed. Suppression efforts using 1080-treated oats, were conducted on 1,255 acres of National Forest land as well as on public lands under the jurisdiction of the Bureau of Land Management and on lands belonging to several private companies. Control was achieved on the majority of the treated areas.

MINOR SPECIES. The species listed below caused minor damage in the counties noted. Although treated here as minor, the damage was severe and heavy in many areas, but it was more localized and not widely scattered.

Species	Counties
1. Beaver	Inyo, Mono
2. Black Bear	Shasta, Trinity
3. Deer Mouse	El Dorado, Shasta, Trinity
4. Domestic Stock	Siskiyou, Tulare
5. Ground Squirrels	Los Angeles
6. Rabbits	Glenn, Mendocino, Tehama, Fresno
7. Meadow Mouse	San Bernardino
8. Tree Squirrels	Riverside, San Bernardino

The "forest-land" burrow builder has been successful in pocket gopher control. It is pictured here in operation.



Artificial burrow made by machine. Pocket gophers readily utilize the burrow and lethal bait.

A BRIEF OF RESOLUTIONS ADOPTED BY THE CALIFORNIA PEST CONTROL ACTION COUNCIL AT ITS ANNUAL MEETING, NOVEMBER 1970

1. Commended the Forest Service for their action in proposing a coordinated westwide program of research and development on dwarf mistletoes and urged that the program be approved, funded, and implemented at once. The Council further urged that region-station efforts be strengthened before establishing a new research unit for basic studies.

2. Urged all efforts by Federal and State agencies to immediately initiate and support survey and impact studies on disease losses and the development of necessary techniques for such work.

3. Urged the Congress, the Secretary of Agriculture, and the Chief of the Forest Service to make every effort to fund a new virus test in a biological control effort to suppress the Douglas-fir tussock moth. Substitutes for DDT are urgently needed to protect timber resources from insect pests and the use of natural insect virus appears to be a safe, efficient alternative.

4. Urged all governmental agencies, landowners, and others, to take every feasible step leading to and encouraging a reduction of the bark beetle threat resulting from over 12,000 acres of coniferous forest lands that were severely damaged by forest fires in Southern California in 1970.