



FOREST PEST CONDITIONS IN CALIFORNIA-1967

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 comprises 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 - 1967, was based largely on information provided by the California Cooperative Forest Pest Detection Survey. In 1967 there were 602 reports submitted: 305 for insects, 275 for diseases, and 22 for animal pest damage.

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

THE COVER PHOTO: A mountain beaver, commonly called a "boomer." Mountain beaver cause three types of injuries to trees in young forest stands: topping or removal of terminal shoots, clipping lateral branches, and debarking. Boomer damage was serious on localized areas in Del Norte County in 1967.

HIGHLIGHTS OF PEST CONDITIONS-1967

STATUS OF INSECT PESTS. Tree killing of ponderosa and sugar pine by bark beetles increased in several areas of California in 1967. This increase resulted from many scattered outbreaks of western pine beetle and mountain pine beetle in the north end of the State. The lack of a measurable amount of rainfall from early spring through October in 1966 may have been a contributing factor in the development of these outbreaks. The red turpentine beetle and the fir engraver beetle were also more abundant than in 1966.

Despite increased bark beetle damage to pine and white fir, the overall forest insect condition picture improved with the waning of the Douglas-fir beetle epidemic in California's north-coastal Douglas-fir forests. This catastrophic epidemic, that killed an estimated gross volume of 796 million board feet of old-growth Douglas-fir trees on 1.6 million acres in 1966, subsided in 1967.

Damage by ips beetles in pine declined to a low level this year.

Tip killing of young ponderosa pine by the resin midge (Cecidomyia piniinopis) increased and caused conspicuous flagging throughout the ponderosa pine type in central and northern California. Defoliation of shade and ornamental trees caused concern in some locations.

STATUS OF DISEASE PESTS. Forest disease conditions changed but slightly during 1967. Some foliage diseases showed a slight increase in intensity. Cytospora canker, particularly on red fir, was common in some areas, and three needle fungi, new to California, were found in 1967.

Several new areas of root diseases involving from 1 to over 100 centers each were found. Fomes annosus was the most common, but new centers of Verticicladiella wagnerii and Armillaria mellea were found.

Intensified scouting revealed a number of new centers of white pine blister rust. Seven new centers were located in Tuolumne County, extending the known sugar pine infection zone about 10 miles southward.

The long, dry period extending from about February 7 to November 3, 1966 weakened many small trees to the point beyond which they could recover. Singly and in small groups, many smaller trees so affected were killed. Top and branch killing resulting from the 1966 drought was common in trees of all ages. All commercial conifer species in northern California were locally affected.

STATUS OF ANIMAL PESTS. The problem of deer depredation continues as the State's primary animal damage problem in recently established plantations and young natural stands. Porcupine populations have been reported on the increase for the past three years. Mountain beaver and dusky-footed woodrats caused considerable damage to redwood and Douglas-fir reproduction in several areas of the north-coastal region.

FOREST PEST CONTROL IN 1967. The Forest Service and the California Division of Forestry began a comprehensive review of the blister rust control program in the State, and initiated a systematic, continuing blister rust control detection survey on several National Forests.

Lassen Park completed such a survey of the entire Park, locating blister rust infection centers only in the southeastern portion where infected trees had been found before.

Five-year results of a test of several herbicides for the control of dwarf-mistletoe gave promise that an operational procedure can be developed.

Bark beetle suppression projects were conducted in several limited areas in northern California. Suppression work on the Jeffrey pine beetle outbreak in Lassen and Plumas Counties will be completed the winter of 1967-1968. Losses in Jeffrey pine should be reduced to an endemic level. Cooperative maintenance suppression projects continued on a small scale in southern California.

A rodent control program was conducted on approximately 4,700 acres in northern California in preparation for several tree seeding projects. Areas were either hand or aerial baited with 1080 (sodium fluoracetate). Post control trapping indicated 93 to 100 percent reduction of the white-footed deer mouse (peromyscus) population in the areas treated.

Browsing trend plots were established in current year reforested areas of Douglas-fir type in the north coast area to document the amount of browsing damage that occurs each year. Those who make decisions on deer herd management will have a factual history of browsing in these plantations.

STATUS OF INSECT PESTS

WESTERN PINE BEETLE, Dendroctonus brevicomis. Tree killing by the western pine beetle reached outbreak proportions over 133,000 acres of ponderosa pine forest immediately west of Trinity Lake in Trinity County. Precipitation in this area was approximately 50 percent below normal between February and October 1966 and moisture stress of the trees probably triggered this outbreak. Ground surveys in 1967 indicated tree mortality reached a peak in midsummer and then declined in late summer and fall. X-ray analysis of bark samples showed the population density of the pest had declined to a low level.

Another outbreak of western pine beetle occurred on approximately 5,000 acres of dense 60- to 80-year-old ponderosa pine stands on the McCloud Flats, Siskiyou County. During midsummer, large groups of trees were killed. The overwintering bark beetle population remains high and tree killing will probably increase in 1968.

On the Mendocino National Forest, an infestation is centered in the Indian Dick and Keller Lake areas. An evaluation made in October shows a decline in the number of infested trees but bark samples that were X-rayed show high populations of overwintering broods. Elsewhere on the Forest, many scattered large ponderosa pines were found which contain abundant overwintering broods.

Scattered spots of fading ponderosa pines are evident in Shasta County near Snow Camp and Bald Mountain and other locations in northern California.

The southern Sierra Nevada Range, where serious storm damage occurred during the winter of 1966-1967, also suffered from western pine beetle outbreaks in Evans Flat, Kern County; Camp Nelson and Starvation Creek, Tulare County; and Cherry Flat, Fresno County. Beetle populations in the bark were high and direct control work is planned. Further north, infestations at Miami Creek and South Fork of Willow Creek, Madera County, subsided after direct control treatment.

In southern California, the activity of the western pine beetle was the lowest in recent years. Protected areas suffered only endemic losses in 1967.

DOUGLAS-FIR BEETLE, Dendroctonus pseudotsugae. The Douglas-fir beetle epidemic in northwestern California declined sharply in 1967 after killing 249,000 mature trees containing a gross volume of 796 million board feet of timber in 1966. The first indications of this

decline were revealed by population trend surveys conducted in late fall of 1966. In July of 1967, a more comprehensive evaluation survey was made. The ground phase of this survey indicated at that time a 95 percent reduction in trees killed in 1967 compared to 1966 losses. Detection flights and ground observations made since show some tree mortality in 1967, but less than in the previous year. Surveillance is continuing in the affected stands. Some group killing of Douglas-fir by this pest was also detected in northeastern California at Nelson Creek, Shasta County, and in scattered spots on the Plumas National Forest.

MOUNTAIN PINE BEETLE, Dendroctonus ponderosae (formerly D. monticolae). Killing of sugar pine, by the mountain pine beetle, noticeable in recent years, increased in 1967. In some locations, such as Middle Fork of the Feather River in Plumas County, the killing of groups of advanced reproduction and individual mature trees was epidemic. The loss of mature trees and groups of small trees is also serious near Snow Camp and Bald Mountain, Shasta County. Other centers of loss occurred at Colby Mountain, Tehama County; Hatchet Mountain and Buckhorn Reservoir, Shasta County; Sterling City, Butte County; Trinity Lake, Trinity County, and at Quartz Mountain and Scott Hill, Placer County. Sugar pine mortality increased in numerous other locations from the Sequoia National Forest northward.

Mountain pine beetle activity in lodgepole pine declined in 1967 but a few infestations persist. In the Medicine Lake Recreation Area, Siskiyou County, and Warner Valley, Plumas County, there were continuing but less severe problems than in 1966. A continuing and possibly increasing infestation exists near South Shore of Lake Tahoe.

FIR ENGRAVER BEETLE, Scolytus ventralis. After two years of inactivity by the fir engraver beetle, an increase in tree killing by this insect was conspicuous in white fir stands during 1967. Increased losses in stands defoliated by the Douglas-fir tussock moth in 1964 and 1965 were reported at Knox Mountain and Cedar Pass, Modoc County. In other areas group-killing occurred at Bryant Springs and Camp Creek, El Dorado County; the Tahoe Valley Basin; Bear Valley, Placer and Nevada Counties, and Sardine Lookout, Sierra County.

RED TURPENTINE BEETLE, Dendroctonus valens. Following a period of relative scarcity, this beetle is again commonly associated with other bark beetles in attacks on pine trees.

JEFFREY PINE BEETLE, Dendroctonus ponderosae (formerly D. jeffreyi). Losses from the Jeffrey pine beetles declined in 1967. Dwindling populations still remain at scattered locations in Shasta, Lassen and Plumas

Counties. These include Butte Creek, Raker Bench, Warner Creek, Willow Creek, Rock Creek and Mountain Meadows Reservoir in and adjacent to the Lassen National Forest, and Indian Creek on the Plumas National Forest. These infestations show a several fold decrease in tree killing compared to losses in the past two years.

The cooperative control project at Big Bear, San Bernardino County, reduced tree killing to an endemic level.

PINE ENGRAVER BEETLE, Ips spp. Pine engraver beetles caused only minor damage in 1967. Although abundant populations were present in green slash in several locations, the beetles were, for the most part, unable to successfully attack green standing trees. The lack of beetle success in living trees is attributed to increased tree vigor resulting from abundant moisture in the spring of 1967. This situation is a marked contrast to the condition in 1966 when the trees were under a drought stress and serious ips damage resulted.

The most serious infestations of ips in standing trees occurred at Smoky Cabin in the Hat Creek Rim country, Shasta County; and Snow Lake, Plumas County. Both were areas where thinning work generated large accumulations of fresh slash. Ips emarginatus were associated with the Jeffrey pine beetle at Mountain Meadows Reservoir.

CALIFORNIA FLATHEADED BORER, Melanophila californica. The California flatheaded borer continues to be the most serious insect tree killer in southern California but infestations of this beetle are waning as a result of direct control efforts and increased rainfall. The severest outbreak remaining was in Jeffrey pine at Laguna Mountains, San Diego County.

OTHER BARK BEETLES AND WOOD BORERS. Twig beetles, principally Pityophthorus spp., in various species of pine, increased in 1967. The damage was not serious and the condition was a symptom of drought injury to the host in most cases but also occurred in trees that had been flooded and trees poisoned by herbicides in thinning operations.

Damage by wood borers became more noticeable as the salvage programs to harvest fire- and beetle-killed timber accelerated. Fire-damaged trees in the Round Mountain Burn on the Mendocino National Forest now contain dense populations of roundheaded and flatheaded borer larvae which are penetrating deep enough into the wood to degrade lumber manufactured from the trees. In some cases, these borers have apparently contributed to the death of fire-injured trees by constructing galleries into green portions of the cambium as well as deadened areas. An increasing volume

of salvage Douglas-fir from the 1966 beetle epidemic now contain ambrosia beetles. The pin holes and stain caused by these beetles were of increasing concern to mill operators.

DEFOLIATING INSECTS. Damage caused by insect defoliators of conifers was quite limited in 1967. The lodgepole needle miner, Coleotechnites milleri, infestation at Tuolumne Meadows, Yosemite National Park, declined to the lowest level known in twenty years. The smaller infestations on Woods Creek, Sequoia and Kings Canyon National Parks, and Sentinel Meadows, Mono County, continue at a generally light population level.

The persistent, localized outbreak of the Jeffrey pine needle miner, Coleotechnites sp., at Snow Valley, San Bernardino County, expanded slightly in 1967. No tree mortality was reported.

The fir needle miner, Epinotia meritana, continued to defoliate red fir on the Yosemite and Sequoia and Kings Canyon National Parks and the Sierra National Forest. Thinning of the crown in affected trees was noticeable but the trees have maintained good vigor.

Unusual numbers of flying adults of the pine butterfly, Neophasis menapia, were reported from both pine and Douglas-fir areas but no defoliation was apparent. Likewise, numerous phantom hemlock looper, Nepytia sp. near phantasmaria, adults were collected south of McCloud in Shasta County, but only slight defoliation was observed. A matsucoccus scale, probably Matsucoccus paucicicatrices, was found seriously depressing the growth of sugar pine in a localized area along the Calaham-Cecilville Highway in Siskiyou County. M. fasciculensis damaged Jeffrey pine on 200 acres on Casa Diablo Ridge, Mono County.

Insect defoliators of hardwood trees caused concern in several areas, mainly due to the damage inflicted on ornamental and shade trees. The most widespread and damaging one, the California oakworm, Phryganidia californica, declined in 1967 but continued defoliating oak in numerous areas. Oak trees also suffered from the attacks of the fruit tree leaf roller, Archips argyrospilus. The elm leaf beetle, Pyrrhalta luteola, was unusually abundant in many parts of the State. The red-humped caterpillar, Schizura concinna, was widespread and damaging to fruit and shade trees particularly sweet gum, maple, apple, prune and walnuts. The alder flea beetle, Altica ambiens, stripped alder trees in the Hat Creek and Cow Creek drainages of Shasta County, and at Lake Arrowhead in San Bernardino County.

INSECTS OF YOUNG TREES. A pine resin midge, Cecidomyia piniinopis, was widespread and damaging in most northern California pine areas in 1967. Reports on this general outbreak were received from Tuolumne, El Dorado, Mariposa, Shasta, Butte, Nevada, Placer and Modoc Counties. A Douglas-fir gall midge, Contarinia sp., was very common in the Red Cap Creek and Ti Creek drainages of Siskiyou County.

STATUS OF DISEASES

ROOT DISEASES. The reports of 1967, as those of the past few years, indicate that root diseases of conifers are a very important forest problem. There were 83 new reports submitted concerning the root diseases caused by Fomes annosus, Verticicladiella wagnerii, Armillaria mellea, and Polyporus schweinitzii.

Fomes annosus. The root disease caused by F. annosus has been reported from all National Forests and National Parks of California, and 28 of the State's 58 counties. It has been found on all the major and many minor forest tree species. The widespread distribution of this fungus, the increasing frequency of its detection in infected areas, and our inability to control this disease once established, indicates that this is a very important forest pest.

In 1967, 50 new reports of F. annosus were received. F. annosus was found in four campgrounds, and in Yosemite Valley. It was found in the Hackamore area (Modoc N.F.), Manuel Mill (Stanislaus N.F.), and Cal Mtn. (Lassen N.F.) seed production areas as well as in five plantations. New centers were also discovered on the Challenge and Stanislaus Experimental Forests. In one report, for Alamo Mountain, Ventura County, 111 separate infection centers were found.

Verticicladiella wagnerii. The root disease caused by V. wagnerii has been very damaging to infected pinyon pine stands in southern California. Recently, this fungus was found with increasing frequency on pines and Douglas-fir in the forests of northern California.

In 1967 a group of 11 new infection centers was found in the Modoc National Forest. The intensity of V. wagnerii in this small area appears to be quite high. Eight new centers were found in the Georgetown Divide area, El Dorado County.

Armillaria mellea. The root disease caused by A. mellea is widespread throughout California and often damaging. It is particularly damaging to young plantations in the oak foothills of California.

In 1967 there were 21 new reports of Armillaria root disease. In these reports the fungus was found killing ponderosa pine, red and white fir, giant sequoia, and Douglas-fir.

Polyporus schweinitzii. This fungus causes a root disease which is widespread but of unknown importance. This year there were three reports of this fungus killing Douglas-fir and ponderosa pine.

NEEDLE DISEASES. One new infection center of Scirrhia pini (Dothistroma pini) was located in residential planting in Ferndale, California. Two other centers, one in a nursery in Eureka and one on native western white pine near Smith River, Del Norte County, were reported, but foliage samples submitted had only immature spores so that positive identification could not be made.

During the late winter and early spring, this disease seemed generally to be intensifying in all the infection centers in the State. However, by the time the new needles appeared, weather conditions favorable for infection had practically ended. In midsummer most of the older infected needles had dropped, and few new needles had become infected. As a result, there was less infection than had previously been seen. Many formerly infected trees appeared to be free of the disease at the midsummer inspection.

The deep snow and heavy precipitation favored the two brown-felt blights or snow molds caused by Herpotrichia nigra (generally on conifers other than pine) and Neopeckia coulteri (confined to the genus Pinus). These fungi were quite common both in the Coast Range and Sierra Nevada Mountains.

Numerous needle diseases were reported and identified during 1967:

- * Those found on either red or white fir or both were Hypodermella abietis-concoloris, Hypoderma robustum, Stegopezizella balsameae, and Phacidium infestans var. abietis.
- * Needle diseases found on pines were: Hypodermella medusa, H. montana, H. arcuata, Naemacyclus niveus, Dothichiza pithyophila, Lophodermium pinicolium, Diplodia pinea and Elytroderma deformans.
- * In addition, Hypodermella lacrimiformis was found on knobcone and Monterey pine and may be a "first time" find on the latter species. Bifusella linearis was found on limber pine at Mount Pinos, Ventura County, and on whitebark pine in the Warner Mountains, Lassen County. This may be the first time this fungus has been found on either of these tree species as well as in California. Trichosperma griseo-candidum was found in Modoc County on needles of ponderosa pine cut in a thinning area in midwinter. This appears to be the first time this fungus has been reported in North America.

- * Another needle disease, *Septoria pinicola*, was found with *Hypodermella lacrimiformis* on both Monterey and knobcone pine.
- * A needle cast on Douglas-fir caused by *Rhabdochline pseudot-sugae* was again reported from several areas.
- * *Marssonina populi* caused some premature defoliation of trembling aspen in the Modoc area, as well as several other areas of the State.

DWARFMISTLETOE. In California, dwarfmistletoe occurs only on species of the Pinaceae family. The parasite with its several species and many forms is one of the most serious diseases of the State. The following statistics on dwarfmistletoe are taken from the Forest Disease Survey conducted by the Forest Service on a Statewide basis from 1958 through 1966.

- * Ponderosa Pine: 4,394 trees were examined on 409 plots; dwarfmistletoe occurred on 23 percent of the plots and 10 percent of the trees were infected.
- * Sugar Pine: 968 trees were examined on 274 plots; dwarfmistletoe occurred on 22 percent of the plots and 15 percent of the trees were infected.
- * Lodgepole Pine: 834 trees were examined on 71 plots, dwarfmistletoe occurred on 28 percent of the plots and 26 percent of the trees were infected.
- * White Fir: 3,868 trees were examined on 376 plots, dwarfmistletoe occurred on 29 percent of the plots and 17 percent of the trees were infected.
- * Jeffrey Pine: 1,578 trees were examined on 168 plots, dwarfmistletoe occurred on 15 percent of the plots and 7 percent of the trees were infected.
- * Red Fir: 1,136 trees were examined on 103 plots, dwarfmistletoe occurred on 46 percent of the plots and 36 percent of the trees were infected.
- * Douglas-fir: Which ranges along the Coast from the Oregon line to the Santa Lucia Mountains and from eastern Siskiyou County southward to Stevenson Creek near Shaver Lake in Fresno County, has a host specific dwarfmistletoe, *Arceuthobium douglasii*. The parasite does not occur in the stands of Douglas-fir

growing along the Coast, nor south of Tehama County in the Coast Range and mid-Shasta County in the Cascade Range.

Within the range of this dwarfmistletoe, 1,282 Douglas-fir trees were examined on 104 plots; dwarfmistletoe occurred on 11 percent of the plots and 3 percent of the trees were infected.

- * Other: Dwarfmistletoe is found on all the other species within the Pinaceae family in California except bristlecone fir, Sitka spruce, bristlecone pine, Torrey pine, and big-cone Douglas-fir.

RUSTS ON CONIFERS. Weather conditions during the spring and summer were not favorable for the spread of most rusts. Ribes were infected with white pine blister rust at many areas.

Intensified scouting for blister rust resulted in the discovery of many previously unknown infection centers. Some of the centers showed a rather rapid buildup during the last 10 years and many have only recently become operationally detectable. The centers vary in area from a few acres to nearly 300 acres.

One of the seven centers in Tuolumne County was of 1944 origin; the others there may be of the same age. The southernmost of these centers extended the known limits of rust on pine about 10 miles southward.

Pinyon rust on ribes was as scarce as it was in 1966. Specimens of all the rusts reported in 1966 were reported again in 1967. In addition, a needle rust of white fir caused by the fungus Pucciniastrum geoppertianum was reported, as well as a needle rust Caeoma torreyae on California torreya.

CYTOSPORA CANKER. This disease of red and white fir, caused by the fungus Cytospora abietis, is commonly associated with dwarfmistletoe branch infections. However, trees or limbs weakened from other causes are also susceptible. The 9-month period between soaking rains in 1966 predisposed numerous red and white fir trees, both free of and infected with dwarfmistletoe, to infection by C. abietis. As a result, the disease was particularly heavy in 1967. Not only limbs and tops, but entire trees of all ages, were killed by the parasite at one area in El Dorado County. Severe damage was noted elsewhere in the State, particularly on red fir in Siskiyou County. Because of the abundant cytospora infection and subsequent killing of branches infected with dwarfmistletoe, a noticeable reduction in dwarfmistletoe populations at some areas was observed in both firs but to a greater extent in red fir.

NONINFECTIOUS DISEASES. Damage caused by noninfectious diseases, although considerable, varied little from 1966, although the source of damage did vary widely. The 9-month interval between soaking rains (February 7 to November 3) in 1966 allowed the soil to dry out to the point where insufficient water was available to meet the minimum requirements of some trees. As a result, many trees, particularly the smaller ones, singly and in small groups, died of drought.

On other trees that had lost feeder roots, crowns were partially destroyed when transpiration was accelerated by wind and high temperatures. This reaction was slower in the old and mature trees, but when the loss of some feeder roots was coupled with the excessively hot weather that occurred in July and August 1967, even these were affected. Top dying in mature sugar pine, ponderosa pine, Douglas-fir, incense-cedar, and white fir began in early summer and continued into early fall. In some areas foliage and top killing was accelerated by strong, hot, dry winds. These winds caused some damage to trees that had escaped drought injury.

Other types of noninfectious damage reported were: hail at three widely separated areas; spray damage in Christmas tree farms and in forest plantations; winter damage (extreme cold with an occasional period of warm weather which started transpiration), late spring frost; and air pollution. None of these was very serious.

MISCELLANEOUS DISEASES. Most of the miscellaneous diseases reported in 1966 were again submitted for identification in 1967.

- * Atropellis pinicola was fairly common particularly on limbs of suppressed sugar pine.
- * Bacterial galls on Douglas-fir were common at local areas along the Coast and occurred elsewhere.
- * A Myxomycete, Lamroderma sauteri was found on needles and twigs of western white pine, sugar pine, white fir, etc., in the northern end of the State.
- * Another Myxomycete, Trichia varia occurred as small brown cushions on the needles and twigs of western white pine in Lassen Volcanic National Park.
- * Dibotryon morbosum on twigs of bitter cherry and snow brush (Ceanothus velutinum) was found near McCloud.



In California, dwarfmistletoe occurs on all species of the Pinaceae family. It is one of the most serious diseases of commercial forest trees in the State. The large "witches'-brooms" in the sugar pine are typical of an old, severe infection of dwarfmistletoe.



DISEASES

The root disease Fomes annosus has been found on all major forest trees in California. The illustration shows the typical circular, patch-type pattern of killing caused by this fungus. Spores entered through the stump, progressed down through its roots infecting and killing other trees whenever there was a root contact.



ANIMAL PESTS



A ⇨

Damage by the mountain beaver or "boomer" was prevalent at a number of locations in Del Norte County in 1967. The illustrations show two types of damage, (A) removal of a terminal shoot of a young Douglas-fir, and (B) clipping of the lateral branches followed by clipping of the top.

⇨ B

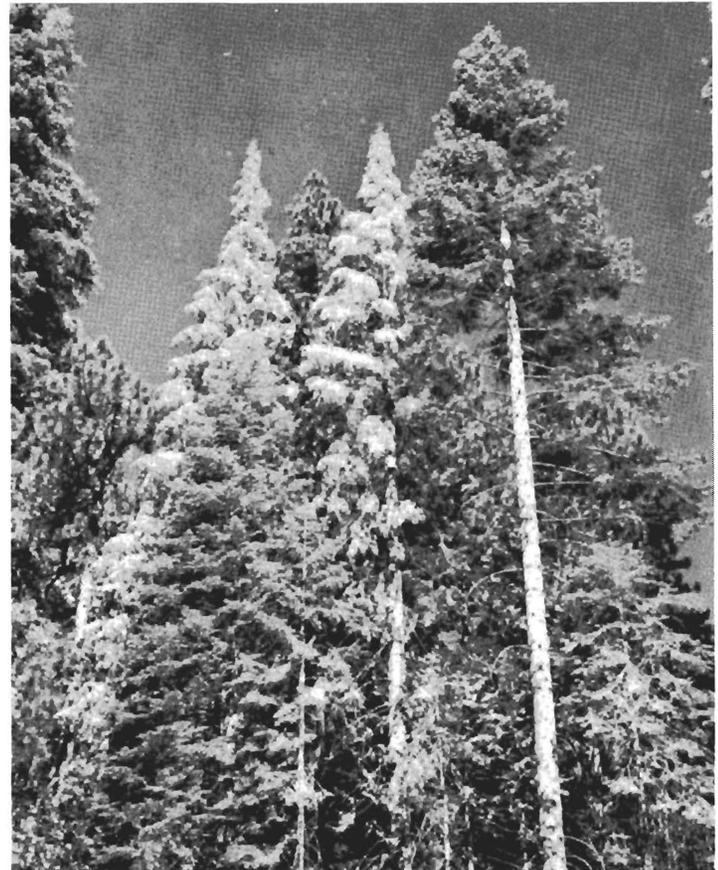


INSECT PESTS

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A pine resin midge was widespread and damaging in most northern California pine stands in 1967. The illustration shows the conspicuous flagging caused by this small insect. After two years of relative inactivity by the fir engraver beetle, an increase in tree killing by this insect was evident in white fir. Killing of white fir in small groups occurred throughout northern California.

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- * A brown resupinate fungus growing on the bark near ground level on white and red fir was identified as Corticium arida.
- * Again, most of the common heart rots were reported. Some like Echinodontium tinctorium, the Indian paint fungus, was reported from many localities on both red and white fir.
- * One unusual report of casual interest was of dodder Cuscuta subinclusa parasitising to small white fir trees in the Grays Peak area in north Tehama County.

NURSERY DISEASES. Seedling damage increased in at least one nursery (Placerville) in 1967 over that reported in 1966. There was more or less continuous precipitation during the spring and early summer of 1967, preventing fumigation of some of the seedbeds before they were seeded. As a result, soil pathogens killed as much as 10 percent of the trees in some nursery beds.

STATUS OF ANIMAL PESTS

DEER. There were twenty-four reports of deer damage. Nearly every tree species was attacked. Douglas-fir, Jeffrey pine and ponderosa pine were the species hit most severely. The reports indicated that deer damage was not limited to just the north-coastal areas as several of the pine plantations in Modoc and Lassen Counties also were severely hit by migrating herds of mule deer. The rate of deer damage is remaining high and static in most areas.

PORCUPINE. Twenty-one incidents of porcupine damage were reported. In nearly every case, the porcupine population was reported to be increasing and as a result more damage occurred in 1967 than in 1966. Damage was particularly noticeable in many young pine plantations. The Denver Research Center is at the present time in the process of perfecting an improved porcupine bait block which may prove a beneficial tool in the control of these animals.

POCKET GOPHER. As indicated by the eight reports of pocket gopher damage, this animal continues to do considerable damage to young pine plantations.

RABBITS. Rabbit damage was reported in seven areas. Damage occurred on nearly all species of plantation stock with heaviest damage being experienced in the one- to three-year-age class. The use of ZIP in some of the plantations in the southern portion of the State has helped in reducing clipping injuries.

MOUNTAIN BEAVER. Two incidents of damage by mountain beaver were reported from the coastal area of Humboldt and Del Norte Counties. Damage was reported occurring to redwood, Douglas-fir and hemlock of the one- to twenty-year-age class. Heavy concentrations of these animals are usually restricted to slopes bordering streams. The most ideal situation for these species appears to be old logging sites that have been burned and then grown back to a dense cover of brush. Present control methods are slow, expensive, and generally impractical. Currently, Weyerhaeuser Timber Company is field testing a toxic foam and applicator; early field tests indicate considerable promise for this control technique.

SMALL SEED-EATING RODENTS. These rodents eat a considerable quantity of conifer seed annually. To prevent possible seed loss to these animals, approximately 4,700 acres of Bureau of Land Management and Forest Service land in California were baited in 1967 with 1080 treated grain prior to the direct seeding of conifer seed.

DUSKY-FOOTED WOODRATS. Three reports of woodrat damage to Douglas-fir, white fir, hemlock and redwood were received from the north-coastal area of the State. In all cases, damage occurred in natural stands in the one- to twenty-year-age class. Of the three reports, two indicated that damage was increasing; one reported the damage to be static.

MEADOW MICE. Meadow mouse damage to pine stock of the one-year-age class was reported from two areas. This animal prefers a grassy condition. Where such a situation persists, a large population of meadow mice may occur. To prevent population buildups, cultural practices aimed at grass removal may be necessary.

TREE SQUIRRELS. Bark stripping by tree squirrels, primarily grey squirrels, continues to be a problem in the coastal redwoods and in the pine region of southern California. Damage in 1967 appeared to be on the increase over 1966.

GROUND SQUIRRELS. Ground squirrels inflicted considerable clipping damage to a recently established Coulter, Jeffrey and ponderosa pine plantation located on the San Bernardino National Forest. Their clipping resulted in the destruction of over two thousand seedlings on a 40-acre plantation.

BEAVER. Six incidents of beaver damage were reported. Tree species being attacked were: alder, aspen, cottonwood, Jeffrey pine, redwood and willow. Beaver damage has been local and is usually not extensive enough to warrant reductional measures.

BLACK BEAR. Black bear damage was reported from four localities in the coastal areas of Humboldt and Del Norte Counties. Damage occurred on Douglas-fir, redwood, bishop pine, and hemlock. Bear damage appears static and similar to conditions of 1966.

ELK. Two incidents of elk damage were reported in Humboldt and Del Norte Counties. Damage occurred in Douglas-fir, redwood and Monterey pine of the one- to fifteen-year-age class. The degree of damage appears to be static or decreasing. One special elk hunt was authorized in northern Humboldt County to reduce herd populations.

BIRDS. No reports of bird damage were received.

SHEEP AND CATTLE. On several plantation sites, livestock have been reported causing damage to conifer seedlings. In all but one instance, the problem has been rectified and further damage eliminated.

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SUMMARY OF ANIMAL DAMAGE REPORTS
FISCAL YEAR 1966-67

ANIMAL	TREE SPECIES	AGE CLASS	NO. OF TREES	ACRES DAMAGED	PLANTATION OTHER	DAMAGE INCREASING OR DECREASING
<u>Beaver</u>	Willow Cottonwood Alder Aspen Ponderosa Pine Redwood	All Classes	475	81	Other	Static
<u>Birds</u>		No Damage Reported.				
<u>Black Bear</u>	Redwood Bishop Pine Hemlock Douglas-Fir	15-45	5,000	200	Other	Static
<u>Deer</u>	Douglas-Fir White Fir Red Fir Hemlock Knobcone Pine Ponderosa Pine Jeffrey Pine Coulter Pine Redwood Cedar	1-15	496,910	14,677	Plantation Other	Static-Severe
<u>Dusky-Footed Woodrat</u>	Douglas-Fir White Fir Hemlock Redwood	1-17	--	300	Other	Increasing
<u>Elk</u>	Douglas-Fir Redwood Monterey Pine	1-15	1,500	5,000	Other	Static
<u>Meadow Mice</u>	Coulter Pine Jeffrey Pine Ponderosa Pine	0-15	8,660	40	Plantation	Decreasing
<u>Mountain Beaver</u>	Douglas-Fir Redwood Hemlock	0-17	--	1,000	Other	Increasing
<u>Pocket Gophers</u>	Jeffrey Pine Ponderosa Pine Douglas-Fir	1-7	33,000	342	Plantation	Increasing
<u>Porcupine</u>	Ponderosa Pine Jeffrey Pine Sugar Pine	All age classes	11,555	2,313	Plantation Other	Increasing
<u>Rabbits</u>	Douglas-Fir White Fir Coulter Pine Knobcone Pine Jeffrey Pine Ponderosa Pine Sequoia	1-15	8,670	789	Plantation	Static
<u>Ground Squirrel</u>	Coulter Pine Jeffrey Pine Ponderosa Pine	0-1	2,170	40	Plantation	No trend
<u>Tree Squirrel</u>	White Fir Jeffrey Pine Ponderosa Pine Sugar Pine Redwood	30-100	No Estimate			Increasing
<u>Seed Eating Rodents</u>	All Species	Seed	<u>Accurate determination of seed lost to these rodents is impossible to determine.</u>			
<u>Sheep and Cattle</u>	Jeffrey Pine Ponderosa Pine Sugar Pine	1-5	2,075	85	Plantation	Decreasing

* From data on approximately 39 questionnaires received from land managers throughout the State.

PEST CONTROL IN CALIFORNIA

Forest pest control in California involves detection, evaluation, and prevention as well as suppression. In 1967 there were important developments in each category.

INSECT DETECTION AND EVALUATION. To evaluate the impact of the Douglas-fir beetle epidemic, an extensive aerial photo sampling survey, supplemented by ground examination of 53 statistically selected plots, was conducted in July to measure the quantity of Douglas-fir timber killed by the beetle in 1966. Within the 1.6-million-acre epidemic the survey revealed that 249,000 (+13.7 percent) trees had been killed. This mortality amounted to 796 million board feet (+14.7 percent) gross volume. By the end of the 1968 field season, the Forest Service hopes to recover 470 million board feet of the loss through salvage timber sales. The survey was a joint undertaking involving foresters and entomologists from the California Division of Forestry and the Forest Service.

The trend of western pine beetle outbreaks was assessed by ground surveys to determine the number of trees killed by successive generation of the beetle and X-rays of bark samples to determine beetle population density. Much work still needs to be done this fall, after the beetles are in overwintering trees, to evaluate the several western pine beetle problems throughout the State. The combined use of aerial photos, limited ground sampling, and X-ray analysis of bark samples may be necessary to accomplish the job.

INSECT SUPPRESSION. A minor amount of suppression work was needed in the fall of 1967 to back up previous efforts to suppress the Jeffrey pine beetle outbreak which occurred in Lassen, Plumas, and southeastern Shasta Counties in 1965 and 1966. The California Division of Forestry, in cooperation with the Forest Service and affected landowners, will complete Jeffrey pine beetle suppression work on private lands surrounding Mountain Meadows Reservoir in early 1968.

Little bark beetle suppression work was necessary in the rest of northern California except for minor local outbreaks. In southern California maintenance suppression projects continued through cooperative efforts of the California Division of Forestry, Forest Service, and private landowners. Except for areas around Big Bear Lake, bark beetle populations in southern California remain at an endemic level.

BRC PROGRAM REVIEWED. Since work was begun in the early 1930's, the blister rust program in California has been revised continuously as changing conditions required. During the past 10 years, as it became increasingly apparent that the disease in much of California would not

follow the same spread and intensification pattern that it has elsewhere, ribes suppression gradually was deferred in the central Sierra Nevada and in the Coast Range.

Early in 1967, the Forest Service and California Division of Forestry began a new and comprehensive review of the entire control program in California. The review has four broad objectives: to determine the present status of the disease throughout the State; to determine where control efforts can be relaxed further; to develop guidelines for blister rust control and sugar pine management in areas where the disease is present, but where ribes eradication is not needed; and to review cooperative features of the program. During 1967, progress was made toward each of these objectives:

- * Status of the Disease. The Forest Service developed and is coordinating an intensified, continuing Statewide detection program: a handbook of instructions was prepared, a two-day training meeting for the affected National Forests and Parks was held, and procedures were field tested. The BRC detection program is discussed at greater length in the annual report Forest Disease Control in California issued by the California Region of the Forest Service in September 1967.
- * Sugar Pine Management Guidelines. Although no ribes eradication or sugar pine management policies have yet been revised, the direction in which the revision may take place was outlined tentatively. As a convenience in developing blister rust and sugar pine management guidelines, the Forest Service tentatively established five blister rust control zones on National Forests in northern California.
- * Economics. The economic basis of young-growth sugar pine management was reviewed in the light of recent developments in blister rust control and silviculture. A preliminary review of the main elements of the problem was prepared and exploratory discussions between the Forest Service's California Region and the Pacific Southwest Forest and Range Experiment Station were held.
- * Cooperative Projects. The Forest Service held preliminary discussions with the California Division of Forestry officials regarding ribes eradication work on private lands.

BRC DETECTION SURVEYS. The National Park Service made a complete detection survey of Lassen Volcanic National Park as well as of Yosemite National Park.

The Lassen Park survey, which covered high-hazard stream type along 161 miles of streams, revealed that nearly all of the Park is rust-free, even though ribes have been eradicated only from selected control units. All of the infected trees were in the Warner Valley area where rust has been found in the past; nearly all were outside control units. No infected trees were found in Yosemite Park.

The Lassen, Plumas, Eldorado and Stanislaus National Forests, made surveys in selected portions of those Forests. The Klamath National Forest made a strip survey of the Beaver Creek Sugar Pine Management Unit. Results are summarized briefly under Status of Diseases, and more fully in the 1967 Forest Disease Control in California.

DWARFMISTLETOE CONTROL. Dwarfmistletoe control projects were carried out on most of the National Forests in California. A sizable acreage of rework in previously treated stands was reported for the first time. Suppression work continued in the Cedar Grove area of Kings Canyon National Park, where the first National Park Service control operation in California has been in progress for several years.

The Forest Service conducted three work conferences in dwarfmistletoe control that were attended by foresters from all of the National Forests and Parks in the State, and by representatives of the California Division of Forestry. Throughout the meetings the theme of multiple-treatment silviculture was stressed with specialists in disease control, silviculture and recreation management repeatedly showing the need for full silvicultural treatment of the stand, and calling attention to the importance of coordinated planning.

The Forest Service has been testing herbicides for the control of dwarfmistletoe on ponderosa and Jeffrey pine since 1962. At present there are two series of tests. The first series, begun in 1962, is a secondary screening of three herbicides (2,4-DA, 2,4-DP, and 4-CPA) previously tested by Clarence Quick at the Pacific Southwest Forest and Range Experiment Station. Although further development work is needed, it seems likely that an operational chemical-control procedure employing these herbicides can be developed.

The second series of tests, begun in 1966, is a secondary screening of two additional herbicides; 2,4,5-TB applied directly to the dwarfmistletoe in oil spray, and 2,4,5-TP applied indirectly in an oil-water emulsion and requiring translocation. Preliminary results are reported in the 1967 Forest Disease Control in California.

ANIMAL CONTROL. The Lassen and Plumas National Forests and the Bureau of Land Management conducted a rodent control program on

approximately 4,700 acres in the preparation for direct tree seeding. The primary target was the white-footed deer mouse (peromyscus). Areas were baited with preparation of 1080 (sodium fluoracetate) either by air using 2 and 5 ounces formulation of 1080 per hundred pounds of wheat or by hand using 2 ounces 1080 per hundred pounds of rolled oats. The control projects were based on the successful germination in seeding projects the past two seasons which involved rodent control. In earlier seeding trials without rodent control, there was virtually no germination even from Endrin treated pine seed. The projects were conducted through the cooperation of the Bureau of Sport Fisheries and Wildlife and the California Department of Fish and Game.

California's major problem of deer browsing on young conifers is centered in the north coast Douglas-fir forests. Logging is conducive to deer habitat improvement. Deer are in the increase in these cutover areas. Some control of deer numbers is needed when reforested areas cannot make normal growth because of continuous and excessive deer browsing. The Forest Service is in the process of establishing a Tree Plantation Browsing Trend Record. Basically, the system is to document the amount of browsing damage that occurs in any one year. Transects are being established in current year reforested areas. It is not planned to establish them in the older planted areas. Through this method, a complete history of browsing in the plantation will be documented. Such factual information will be a meaningful aid to those who will make decisions on deer herd management.

RESOLUTIONS ADOPTED BY THE CALIFORNIA FOREST
PEST CONTROL ACTION COUNCIL - 1967

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

1. Recommended that the Pacific Southwest Forest and Range Experiment Station be funded to (1) reactivate the entomologist position used in past years to cover insect problems in the north end of the State and now currently vacant through transfer of personnel to Pacific Northwest Forest and Range Experiment Station, and (2) the Pacific Southwest Forest and Range Experiment Station retain and maintain the Hat Creek Insect Laboratory.
2. Approved the action taken by the California Division of Forestry to review all zones of infestations as to their need, and to dissolve the following zones of infestation: Lake-Napa, Mill Potrero and Haystack.
3. Recommend to those forest owners and managers interested in control of Fomes annosus, especially in high-value areas, that the stumps of all conifer species resulting from felling of green trees be treated with powdered borax (technical grade sodium tetraborate decahydrate) with safranine dye; such treatment to be made immediately after felling to prevent stump infection by spores.
4. Recognized the seriousness of inadequate support for research on forest diseases at the University of California and requested that the State of California and the timber industry give more realistic support to the forest disease research program at the University.
5. Recommended that the four pathologist positions lost from the PSW Station since 1965 be reactivated with adequate support funds to maintain disease research at the level obtained before these positions were lost.
6. Recommended that from a forest pest standpoint no action against the parasite, Viscum album (European mistletoe) is warranted beyond periodic surveillance.
7. Recommended that the wildlife biologist position with the Bureau of Sport Fisheries and Wildlife, Division of Wildlife Services, Sacramento, be upgraded to secure qualified personnel and induce longer tenure.

8. Recommended for the second successive year that the Senate Committee on Fish and Game and the Assembly Committee on Conservation and Wildlife take action to clear away the obstacles and support immediate implementation of Fish and Game Commission's deer management policy, and further, to revise the big game depredation laws to permit issuance of depredation permits for sufficiently long periods and sufficiently far in advance of actual damage to permit practical conduct of hunting programs.
9. Opposed any action to change the status of tree squirrels from game animals to fully protected mammals.
10. Recommended that additional funds be made available to the California Division of Forestry for a much expanded contract research program on the control of forest rodents by means of safer and more effective toxicants, the use of antifertility agents, and the development of seed repellents and bait attractants.

TABLE 1

INSECT CONTROL ACTIONS RECOMMENDED BY THE COUNCIL

INFESTATION AREA	ESTIMATED ACREAGE	COUNTY	INSECT	HOST	RECOMMENDED ACTION
BARK BEETLES					
Bass Lake	9,000	Madera	Db, Ips, Dm	PP, SP	Control as warranted
Evans Flat, Camp Nelson, Cherry Flat	1,000	Kern, Tulare, Fresno	Db	PP	Spray infested trees
Indian, Pierce and Lights Creek	2,000	Plumas	Dj	JP	Log and spray where warranted
Indian Dick	500	Trinity	Db	PP	Log and spray where warranted
Manzanita, Bond Valley and Ruffa	5,000	Plumas	Dj	JP	Surveillance
McCloud	11,000	Siskiyou	Db	PP	Log and spray where warranted
Medicine Lake	500	Siskiyou	Dm	LP	Surveillance
Middle Fork Feather River	2,000	Plumas	Dm	SP	Evaluate
Mountain Meadow Reservoir	1,000	Plumas	Dj	JP	Control
Northern California	10,000	Modoc, Placer, El Dorado	Sv	WF	Evaluate
"	1	Shasta	Db, Dm	PP, SP	Evaluate
Snow Camp and Bald Mt.	10,000	El Dorado	Dm	LP	Evaluate
South Shore Lake Tahoe	1,000	Trinity	Db	PP	Salvage
Trinity Lake	133,000	N.W. California	Dp	DF	Salvage and surveillance
N.W. California	1,600,000				
DEFOLIATORS					
Julian	25,000	San Diego	Pc, M sp.	O	Surveillance and research
Sentinel, Crooked and Wet Meadows	2,200	Mono	Cm	LP	Surveillance and research
Sierra N.F., Yosemite N.P. and Sequoia and Kings N.P.	55,000	Madera, Mariposa	Em	RF	Surveillance and research
Snow Valley	100	San Bernardino	C sp.	JP	Evaluate
PLANTATIONS AND EXPERIMENTAL AREAS					
Institute of Forest Genetics Plantations	2,000	El Dorado	Db, Ips	PP	Treat infested trees
Seed Production Areas		Statewide Northern California	Ce, Misc. C&S	PP, JP, SP, DF	Detection and evaluation as needed
				PP	Evaluation, research
STATE AND NATIONAL PARKS					
Cuyamaca Rancho State Park	8,000	San Diego	Mc, Db	JP, PP	Maintenance control
Lassen Volcanic National Park	3,000	Shasta, Lassen	Dj, Db, Dm	JP, PP, SP, LP	Maintenance control
Sequoia and Kings Canyon	8,500	Fresno	Db, Dm	PP, SP	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	Maintenance control
Yosemite National Park	5,000	Tuolumne	Cm	LP	Surveillance and research
Anza Borrego	500	San Diego	Db, Mc	CP	Maintenance control
SOUTHERN CALIFORNIA FOREST RECREATION AREAS					
Arrowhead-Crestline	47,000	San Bernardino	Dm, Db, Ips, Dj	PP, DP, 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	Log and maint. control according to plan
Corte Madera	1,600	San Diego	Db, Ips, Mc, Dv	CP, JP, PP	Maint. control according to plan
Cuyamaca	12,000	San Diego	Db, Ips, Mc	CP	Maintenance control
Idyllwild-San Jacinto	37,000	Riverside	Mc, Db, Ips, Dm	PP, CP, JP	San.-treatment and maintenance control
Laguna Mt.	9,700	San Diego	Db, Mc	CP, JP	Maint. control according to plan
Lost Valley	4,000	San Diego	Db, Ips	CP	Maint. control according to plan
Mt. Baldy District	1,500	Los Angeles	Ips, Dj, Dm, Mc, Db	PP, JP, CP	San.-treatment and maintenance control
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
San Geronimo District	25,000	San Bernardino	Db, Dj, Ips	PP, JP, CP	San.-treatment and maintenance control
Ranger Peak-Figueroa Mt.	700	Santa Barbara	Db, Ips, Dv	PP, CP	Maintenance control according to plan
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
Julian and Pine Hills	7,500	San Diego	Db, Ips, Mc	CP	Maintenance control. Evaluate

Abbreviations Used in Tables

INSECTS			HOST	
C sp. - Jeffrey pine needle miner	Dm - Mountain pine beetle	Mc - California flatheaded borer	CP - Coulter pine	PP - Ponderosa pine
Ce - Pine reproduction weevil	Dp - Douglas-fir beetle	Pc - California oakworm	DF - Douglas-fir	RF - Red fir
Cm - Lodgepole needle miner	Dv - Red turpentine beetle	Sv - Fir engraver	JP - Jeffrey pine	SP - Sugar pine
C&S - Cone and seed insects	Em - Fir needle miner		LP - Lodgepole pine	WF - White fir
Db - Western pine beetle	Ips - Pine ips		O - Oaks	
Dj - Jeffrey pine beetle	M sp. - Tent caterpillar			