

Douglas-fir on the Kaniksu National Forest. *Poria weirii* Murr. infected Douglas-fir, grand fir, western redcedar, ponderosa pine, and western white pine on the Coeur d'Alene, Kaniksu, and St. Joe National Forests. *Fomes annosus* (Fr.) Cke. was found as a root rot in young ponderosa pine plantations on the Colville National Forest and in young western redcedar on the Clearwater National Forest. The fungus was found as a butt rot in subalpine fir on the Coeur d'Alene National Forest and in grand fir on the Clearwater National Forest. *Polyporus schweinitzii* Fr. decay was found in abundance in mature white pine and Douglas-fir on the St. Joe and Clearwater National Forests. A brown to black stain possibly caused by a *Verticicladdella* sp. was found in grand fir on the St. Joe National Forest.

Stem diseases. *Fomes pini* (Thore ex Fr.) Karst. is common and attacks all coniferous species. *Echinodontium tinctorium* (E. and E.) E. and E. is causing a high degree of cull in mature and overmature grand fir and western hemlock.

Cankers and galls. Cankers caused by *Atropellis* spp. were common in lodgepole pine, ponderosa pine, and western white pine. *Cronartium ribicola* Fisch. continues to cause western white pine mortality throughout the western white pine type. *Peridermium harknessii* Moore was widespread on ponderosa pine. *Cronartium comandrae* Pk. was locally heavy on lodgepole pine. *Tubercularia* sp. and *Cytospora* sp. were found causing cankers and dieback in willow, white poplar, Siberian elm, Russian olive, and box elder in North Dakota shelterbelt plantings.

Dwarf mistletoes. *Arceuthobium* spp. were controlled on approximately 4,000 acres. One crossover infection of the lodgepole pine dwarf mistletoe, *A. americanum* Nutt. ex. Engel., was found on the Beaverhead National Forest. *A. americanum* on lodgepole pine was found for the first time in the Bearpaw Mountains in eastern Montana on the Rocky Boy's Indian Reservation.

Needle cast diseases. *Elytroderma deformans* (Weir) Darker, in conjunction with the pine

butterfly, caused some mortality in polesized ponderosa pine in the Bitterroot Valley of western Montana. *Lophodermella arcuata* (Darker) Darker was frequently found causing defoliation of western white pine in northern Idaho. *Rhabdocline pseudotsugae* Syd. was locally severe on Douglas-fir in northern Idaho and western Montana. *Dothistroma pini* Hulb. caused defoliation of young ponderosa pine on the Clearwater and Kaniksu National Forests.

Needle rusts. *Pucciniastrum goeppertianum* (Kuehn.) Kleb and/or *P. epilobii* Otth. were found on grand fir seedlings on west side forests.

Air pollution. Fluoride pollution from an aluminum reduction plant at Columbia Falls, Mont., continued at about the same level in 1972 as in 1971. Damage was still occurring up to 5 air miles from the plant. Fluoride damage to vegetation also occurred up to 6 air miles from a chemical plant producing phosphorous near Butte, Mont. Smelters at Anaconda, Mont., and Kellogg, Idaho, are emitting excessive amounts of sulfur oxides and causing acute and chronic injury to vegetation (fig. 14).

CENTRAL ROCKY MOUNTAINS (R-2)³

by

DONN B. CAHILL, C. KENDALL LISTER, AND
DONALD H. BROWN
Division of Timber Management
Denver, Colo.

Conditions in Brief

Bark beetles were again the most important insect pests in the Central Rocky Mountains. Mountain pine beetle populations increased in ponderosa pine stands in the Black Hills of South Dakota and along the Colorado Front Range. Populations also increased in lodgepole pine in the Arapaho and Routt National Forests in Colorado and the Medicine Bow and

³Included forested lands in Colorado, Kansas, Nebraska, South Dakota, and eastern Wyoming.



F-521869

Figure 14.—Depletion of soil and vegetation resulting from sulfur dioxide and other pollutants from lead and zinc smelters.

Shoshone National Forests in Wyoming, as well as adjacent State, BLM, and private lands in both States.

Spruce beetle activity has declined considerably, especially in the Gunnison National Forest, where winter mortality and woodpecker predation significantly reduced the overwintering larval population. The most persistent spruce beetle infestation in the Region continues in the Medicine Bow National Forest.

Western spruce budworm defoliation decreased to 90,500 acres in 1972. Defoliation by tent caterpillar made a definite upswing at several locations in the Region. The lodgepole

terminal weevil continues to kill terminals in lodgepole pine sapling stands on the Routt, Roosevelt, and Medicine Bow National Forests.

Dwarf mistletoe of lodgepole pine is gradually being brought under control on an increasing acreage of commercial forest stands in Wyoming and Colorado through a coordinated dwarf mistletoe control and timber management program. The impact of the disease can be reduced in proportion to intensity of management applied. Removal of dwarf mistletoe-infected overstory trees was reported for 1,500 acres of commercial forest lands in Colorado and Wyoming in 1972. The disease will con-

tinue to cause deformity and slow growth in untreated commercial and noncommercial stands.

Western gall rust was found killing 4- to 6-year-old ponderosa pine seedlings in the Pine Ridge area near Chadron, Neb. The disease, found on lodgepole and ponderosa pine in the Rocky Mountains and the northwestern United States, is capable of causing extensive seedling mortality.

New root disease centers have been detected in the pinyon pine-juniper type in central and southern Colorado. Two root disease pathogens—*Armillaria mellea* and *Verticicladiella wagneri*—have been identified with the problem, which is causing tree mortality and esthetic and economic impact in some housing subdivisions.

Dutch elm disease continues to kill American elm trees at the Bessey Ranger District in central Nebraska. The remaining high value elm trees will be replaced with other tree species as mortality occurs.

Status of Insects

Mountain pine beetle, *Dendroctonus ponderosae* Hopk. Mountain pine beetle continues to increase in lodgepole and ponderosa pine stands in the Region. In the Black Hills, the beetle is concentrated in the overstocked second-growth ponderosa pine stands which are stagnating. Tree mortality due to the beetles increased 33 percent over that reported in 1971. For 1972, the loss was estimated at 402,000 trees on all land ownerships in the Black Hills in South Dakota and Wyoming.

During the past decade, the beetles have been most active in the northern Black Hills around the Lead-Deadwood exemption area and west to include Spearfish Canyon. Now the infestation has spread to the south with intense activity as far south as Custer, S.Dak. Scattered infestations in single trees and small groups occur throughout the Black Hills.

Direct control by application of ethylene dibromide or by felling and burning of infested trees has been practiced every year since 1967. Despite the direct control effort, the beetles have increased and intensified within the old

persistent areas, and have spread throughout the Black Hills.

Thinned second-growth ponderosa pine stands remain free of epidemic mountain pine beetle populations (fig. 15). Recognition of these benefits of stocking reduction has resulted in accelerated offerings of roundwood sales on both Federal and private lands in an effort to thin stands and also salvage the beetle-infested trees. In 1972, an estimated 50,000 infested trees were salvage logged, and 30,000 trees were either chemically treated or felled and burned.

Along the Colorado Front Range, the mountain pine beetle increased greatly during 1972. The total number of infested trees was estimated to be about 240,000. The problem is in ponderosa pine on intermingled ownerships of Federal, State, and private lands from Colorado Springs on the south to the Wyoming State line on the north. Overstocked small diameter stands and some mature stands suffer most of the attacks. To a lesser extent, the



F-521870

Figure 15.—Groups of mountain pine beetle killed trees in unthinned stands in contrast to thinned stands near Lead, S. Dak.

beetles are successfully attacking many trees heavily infested with dwarf mistletoe. Urban expansion is complicating the mountain pine beetle problem in the Front Range. Tree susceptibility to beetle attack is increased by physical damage or disturbance during construction. Frequently, the new homeowners complain about their trees being killed by the beetles. Suppression in 1973 will be attempted only in a few key areas where there is sufficient interest and support by the local residents.

Mountain pine beetle continued to spread in lodgepole pine in Middle Park near Granby and Hot Sulphur Springs, and at Owl Mountain in North Park, Colo. A "hot spot" at Buffalo Peak on BLM and private lands was salvage-logged prior to beetle flight.

In Wyoming, an infestation in South Spring Creek of the Medicine Bow National Forest killed 12,000 lodgepole pine which were first attacked in 1971. This infestation has increased and has now spread into North Spring Creek. The persistent infestation near South Pass City and Atlantic City, Wyo., on private, BLM, and Shoshone National Forest lands increased in 1972, and about 20,000 trees were killed.

Spruce beetle, *Dendroctonus rufipennis* (Kby.). Spruce beetle activity has greatly decreased in all outbreak areas. On the Gunnison National Forest, timely salvage logging of the infested spruce, coupled with a natural population decline, brought the outbreak losses to a low level. The West Elk Wilderness infestation declined to a few small scattered groups in 1972. The most persistent infestation, in the Medicine Bow National Forest, has greatly decreased and is expected to continue at a lower level.

The greatest threat for spruce beetle buildup remains in the San Juan and Rio Grande National Forests, where considerable windthrow occurred during October 1971 and is still susceptible to the beetles.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. This insect continues to cause mortality of Douglas-fir in small scattered groups almost exclusively in steep, rocky drainages throughout the Region. One infestation in-

creased considerably in 1972 on the South Platte River drainage in the Pike National Forest and another was found on the Bighorn National Forest in northern Wyoming near the Tyrell Ranger Station.

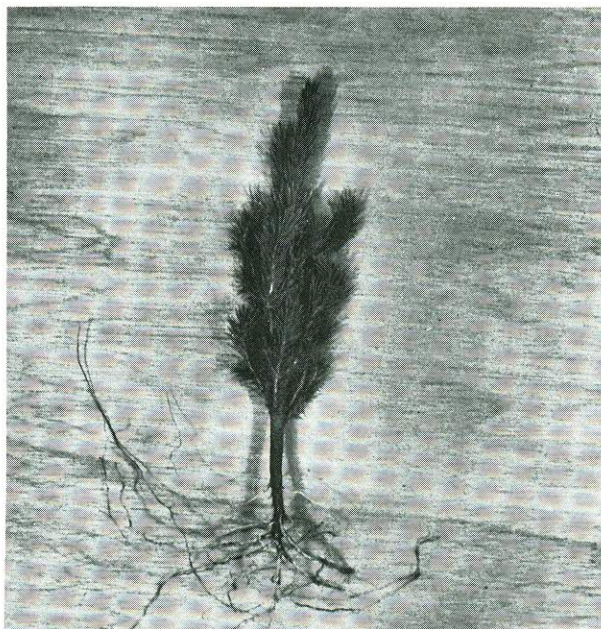
Western spruce budworm, *Choristoneura occidentalis* Freeman. Budworm defoliation dropped from 113,000 acres in 1971 to 90,500 acres in 1972. In the San Isabel National Forest, defoliation decreased by 50,000 acres with the intensity of defoliation remaining about the same, mostly moderate. Some moderate defoliation is expected in 1973 along the Sangre de Cristo Range, with light feeding in the Wet Mountain Range. A new infestation area was discovered near Bear Creek north of the Spanish Peaks, primarily on private lands and extending into the San Isabel National Forest. Light defoliation occurred on 10,000 acres of the Roosevelt National Forest and adjacent lands west of Boulder, Colo. Increased defoliation of 7,500 acres was observed in the Rio Grande National Forest along the Conejos River.

Lodgepole terminal weevil, *Pissodes terminalis* Hopp. The lodgepole terminal weevil has caused considerable damage in lodgepole sapling stands. Not all affected areas are known. Damage by the weevil has been observed in the Roosevelt National Forest in the Buckhorn drainage and near Twin Sisters Lookout; in the Routt National Forest in various areas along the Michigan River; and in the Medicine Bow Division of the Medicine Bow National Forest. Four different stands—all within 3 miles of each other—in the Michigan River drainage, Routt National Forest, were evaluated for terminal weevil damage. Two of the four stands, which average 26 years of age, have been thinned within the last 5 years. For the thinned stands, 33 and 72 percent of the sample trees, respectively, showed recent terminal damage. In both of the other two stands (which had not been thinned) 36 percent of the sample trees showed either recent or older evidence of terminal damage. Periodic evaluations of these and other stands will be useful in determining interactions between terminal

weevil infestation and stand improvement practices.

Strawberry root weevil, *Otiorhynchus ovatus* (L.). This insect was discovered in the Mt. Sopris Tree Nursery, White River National Forest, during the spring lifting of Engelmann spruce. Extensive damage was caused primarily by the immature beetles feeding on the bark of the root systems (fig. 16). Their feeding resulted in the loss of 400,000 spruce seedlings. The seedling beds were fumigated immediately after lifting for control, supplemented by baiting around each infested bed for any migrating adults that survived fumigation.

Pine butterfly, *Neophasia menapia* (Feld. & Feld.). Light defoliation of ponderosa pine by the pine butterfly was observed in the vicinity of Mount Rushmore National Memorial in the Black Hills and a low population of pine but-



F-521871

Figure 16.—Engelmann spruce seedling with root damage (white areas) caused by larval feeding of the strawberry root weevil (Mt. Sopris Tree Nursery, White River National Forest, Colorado).

terfly was observed during the aerial survey of the Pike National Forest near Woodland Park, Colo.

Other insects. Ornamental Colorado blue spruce were defoliated at the Ft. Carson military base by the Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD. Defoliation on a few trees had been about 80 percent during 1971 and when evaluated, sufficient first instar larvae were emerging to merit control. Consequently, most of the trees were treated with Zectran, resulting in decreased defoliation. Since all infested trees were not found in time, it is possible that limited treatment will be necessary in 1973.

Fall webworm, *Hyphantria cunea* (Drury), caused light defoliation of cottonwood along portions of the Arkansas River near Canon City, the Colorado River near Grand Junction, Clear Creek Canyon, Buckhorn Creek, St. Vrain River, and Cache la Poudre River in Colorado. Feeding was also observed on chokecherry, willow, and wildrose.

Western pine tip moth, *Rhyacionia bushnelli* Busck, and Southwestern pine tip moth, *R. neomexicana* Dyar, continue to infest pines in windbreaks in Nebraska. Southwestern pine tip moth caused severe damage in a 1958 plantation at Bull Creek, San Juan National Forest, in southwestern Colorado. Apparently the infestation has been building for the past several years. In 1971 and 1972, 90 percent of the terminals were infested as well as some laterals. Elsewhere on the forest, the tip moth problem varies and is apparently widespread throughout the pine type. Turkey Creek is particularly hard hit, natural regeneration being only one-half to two-thirds its normal height.

Pandora moth, *Coloradia pandora* Blake, larvae were discovered on Christmas trees cut on Pine Ridge at Chadron, Neb. (fig. 17). Ground checking of the area revealed a light larval population and light defoliation. The trend was not determined, but a rapid increase is not expected.



F-521872

Figure 17.—Pandora moth larva feeding on ponderosa pine (western Nebraska).

A **needle miner**, *Coleotechnites* sp. Infestation by this insect in ponderosa pine west of Golden and Boulder, Colo., caused severe defoliation of one-third of the trees in the affected area. Older needles were consumed while current growth was not. The infestation involved about 4,000 acres in an altitudinally restricted belt of 200–300 feet around the 6,000 foot contour level. The infestation is expected to decline without extensive damage. Another needle miner, tentatively identified as white fir needle miner, *Epinotia meritana* Hein., was discovered causing moderate defoliation in white fir on 20,000 acres around Sheep and Iron Mountains south of Gardner, Colo.

A **tent caterpillar**, *Malacosoma* sp. Populations of tent caterpillar increased throughout the Region. The greatest damage was at Cumbres Pass, where heavy defoliation of aspens occurred on 3,000 acres. Fruit tree leafrollers, *Archips argyrospilus* (Walk.), caused moderate defoliation on mountain mahogany, and light defoliation on chokecherry, skunkbrush, and wildrose on 3,000 acres in Boles Canyon, Black Hills National Forest.

The **elm leaf beetle**, *Pyrrhalta luteola* (Muller). This beetle skeletonized elm leaves in South Dakota, Nebraska, Kansas, and eastern Colorado. Feeding on individual trees was less severe in Nebraska during 1972, skeletonizing about 50 percent of the crowns as compared to 90 percent in 1971. Feeding damage was more evenly distributed in 1972, in contrast to intensive centers observed in 1971.

Status of Diseases

Dwarf mistletoes, *Arceuthobium* spp. Lodgepole pine dwarf mistletoe, *A. americanum* Nutt. ex Engelm., was controlled on 1,500 acres in Colorado and Wyoming. Evaluation surveys were completed on 4,000 acres.

The computerized LPMIST program for simulating yields of lodgepole pine stands⁴ was utilized by National Forest personnel for making management decisions in at least 50 stands. The printouts provide information on growth impact from dwarf mistletoe and aid the land manager in setting priorities in timber stand improvement work.

Additional survey data were collected in 1972 for comparison with the 1971 study of dwarf mistletoe survey methods. The study will continue until a survey method is found that satisfactorily yields the data needed for the LPMIST program.

Data collected from 20 ponderosa pine stands in the San Juan National Forest are being analyzed to determine the mortality factor associated with southwestern dwarf mistletoe *A. vaginatum* subsp. *cryptopodum* (Engelm.) Hawks. & Wiens. Dr. Frank Hawksworth, from the Rocky Mountain Forest and Range Experiment Station, is cooperating in the study to determine if the simulated yield program for southwestern ponderosa pine⁵ needs to be adapted for the San Juan National Forest.

⁴ C. A. Meyers, F. G. Hawksworth, and J. L. Stewart. Simulating yields of managed dwarf mistletoe-infested lodgepole pine stands. USDA Forest Serv. Res. Pap. RM-72, 15 pp., illus. June 1971.

⁵ C. A. Meyers, F. G. Hawksworth, and P. C. Lightle. Simulating yields of southwestern ponderosa pine stands, including effects of dwarf mistletoe. USDA Forest Serv. Res. Pap. RM-87, 15 pp., illus. April 1972.

A study on the feasibility of pruning lodgepole pine for dwarf mistletoe control established in 1966 was evaluated in 1972. The 20-acre study area, which contains unpruned trees that were visually classified mistletoe-free in 1966 and pruned trees that were infected in 1966, now show 26.3 percent of the unpruned and 51.2 percent of the pruned trees are infected with dwarf mistletoe. A complete description and results of the study will be published elsewhere.

Western gall rust, *Peridermium harknessii*
V. P. Moore. Gall rust was found killing 4- to 6-year-old ponderosa pine in one stand in the

Pine Ridge area near Chadron, Neb. About 50 percent of the seedlings examined were infected with the rust (fig. 18). Multiple infections occurred on some trees. If this type of damage is typical for other stands in the Pine Ridge area, it could be one of the major reasons for the scarcity of young reproduction. A timber survey of the Pine Ridge area conducted by staff personnel of the Nebraska State Extension Forester in 1967 showed 22 percent of the trees were infected by the rust. Twelve percent of the trees had stem cankers that resulted in a loss in merchantable volume.

A 500-acre stand of 25-year-old lodgepole pine in the Buffalo Ranger District of the



F-521873

Figure 18.—Western gall rust infection on ponderosa pine seedlings. Seedling on the left has several stem galls; seedling on the right has recently died (western Nebraska).

Bighorn National Forest was surveyed for western gall rust as well as dwarf mistletoe. The survey showed 16 percent and 11 percent of the trees were infected with dwarf mistletoe and western gall rust, respectively. The incidence of both diseases will be reduced in a proposed thinning contract, and the progress of both diseases will be measured in future evaluations.

Root diseases. Symptoms typical of the root and vascular disease *Verticicladiella wagneri* Kend. were observed on pinyon pine near Durango and Cortez, Colo., and in Mesa Verde National Park. Pinyon pine in housing subdivisions near Durango were being killed, causing a loss in the esthetic values of the property (fig. 19).

Several dead and dying pinyon pines in typical root rot centers were found infected with *Armillaria mellea* Vahl. ex Fr. near the San Isabel National Forest southeast of Poncha

Springs. The trees are located on a dry rocky site readily visible from the highway. Samples of both diseases were collected for laboratory isolation and identification.

Dutch elm disease, *Ceratocystis ulmi* (Buism.) C. Mor. The disease continues to kill valuable shade trees in the Bessey Ranger District of the Nebraska National Forest near Halsey, Neb. Several suspect trees were verified by cultural isolations made by Dr. Glenn Peterson of the Rocky Mountain Forest and Range Experiment Station in Lincoln, Nebr. Dying elms will be replaced by other tree species.

Other diseases. Winter killing or injury was frequently detected in the ponderosa pine type in Colorado. The dead, bright red colored needles were particularly noticeable before the new growth emerged. The unusually prolonged



F-521874

Figure 19.—Recently dead pinyon pine killed by the root disease, *Verticicladiella wagneri*. Inset—typical stain that occurs in roots of infected trees (Colorado).

dry winds during the winter months have been blamed for much of this damage. Winter injury to lodgepole pine regeneration in older large cutovers in Colorado and Wyoming is quite noticeable in the spring of the year. Damage to terminals can result in a deformed crown. The overall impact of this disease or its duration is not yet known.

Serious dieback of whitebark pine was found in the Wind River Ranger District of the Shoshone National Forest. Partial to complete killing of the tree crowns was seen in small cutovers and in undisturbed stands. Fruiting bodies typical of a *Discomycete* were collected which have not yet been identified. Usually damage was greatest to that portion of the crown exposed above the snow.

SOUTHWESTERN STATES (R-3)⁶

by
CHARLES J. GERMAIN, MELVYN J. WEISS,
AND ROBERT C. LOOMIS
Division of Timber Management
Albuquerque, N. Mex.

Conditions in Brief

Drought, windstorms, and hail damage were major environmental factors affecting the insect situation in the Southwest. Forest stands of all types were severely drought-stressed. Both bark beetles and defoliators, responding to reduced tree vigor and declining biotic restraints, showed increased activity. Fall windstorms on the Fort Apache Indian Reservation and Kaibab National Forest, in the Douglas-fir and Engelmann spruce types, provided an ample food supply for bark beetles. Numerous areas of severe hail damage were noted throughout the Region this year. Many trees were completely stripped of their foliage (fig. 20). These areas are being closely watched for a possible bark beetle buildup.

Douglas-fir beetle damage has increased noticeably on National Forest and Park Serv-

⁶ Includes all forested lands in Arizona and New Mexico and National Park Service land in western Texas.



F-521875

Figure 20.—Ponderosa pine trees stripped of foliage by hail during a severe storm (Ft. Apache Indian Reservation, Ariz.).

ice land in Arizona, and on the Navajo Indian Reservation in New Mexico. The roundheaded pine beetle epidemic in New Mexico (on the Lincoln National Forest and Mescalero-Apache Indian Reservation) is spreading northward into the Capitan Mountains. Spruce beetle populations on the Fort Apache Indian Reservation in Arizona are static. Populations in New Mexico remained at a low level.

Activity of defoliators is significant this year throughout the Region. White fir needle miner has become active at two locations in Arizona. Defoliation by the western tent caterpillar continued on National Forest and private lands in northern New Mexico, but the infestation by this pest near Tucson, Ariz., has declined. Douglas-fir tussock moth activity in Arizona is low. Defoliation by this pest occurred on ornamental spruce and fir trees at Los Alamos, N. Mex. The southwestern pine tip moth continued to damage ponderosa pine reproduction in Arizona. Populations of the western spruce budworm are low.

The most important disease agents were the dwarf mistletoes. Emphasis was given to application of dwarf mistletoe preventive meas-