tinued to cause damage to Douglas-fir and ponderosa pine. Although the damage was not as severe in 1974 as in 1972–73, vegetation on more than 2,000 acres of private, State, and Federal land showed symptoms of sulfur damage.

Fluorides continued to be a serious problem near an aluminum reduction plant at Columbia Falls, Mont. Injury to current-year plant tissue was found on lodgepole pine, western larch, and herbaceous indicator plants up to 5 air miles from the aluminum plant. An epidemic insect infestation of a needle sheath miner, *Zellaria haimbachi* (Busck) and a needle miner, *Ocnerostoma strobivorum* (Zeller) was statistically related to ambient and foliar fluoride concentrations in lodgepole pine in the polluted area.

Analysis of vegetation near a small antimony smelter south of Thompson Falls, Mont., revealed substantial amounts of heavy metal deposits on conifer foliage. Antimony is very similar to arsenic in toxicological properties and could pose a serious threat to animal life in the fallout area.

Other diseases. Drought injury to ornamental Engelmann spruce was noticed in several locations throughout the Region. Cottonwood, spp., and maple, *Acer* spp., defoliation soula, Mont., was found to be caused by se of the herbicide Atrazine. Spruce st, *Chrysomyxa arctostaphyli* Diet, and gall rust, *Endocronartium harknessii* ore) Hirtasuka, were noticeable in several areas in the Region.

Start

CENTRAL ROCKY MOUNTAINS (R–2) [6]

by

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Conditions in Brief

Bark beetles continued to be the most destructive insect pest in this Region. The mountain pine beetle epidemic in ponderosa and lodgepole pine stands in Colorado killed more than 470,000 ponderosa pines in the Black Hills of South Dakota this year. This trend is expected to continue. Integrated suppression programs are being conducted against these forest pests. Moderate defoliation activity occurred in widely scattered areas of the Region. The degree of defoliation is predicted to continue at the same level in 1975 as in past years.

Lodgepole pine dwarf mistletoe infestations in the residual overstory resulted in new infections in the regeneration of cutover stands. Overstory removal and stand sanitation were recommended as the best suppression measures. The relative impact of southwestern dwarf mistletoe on ponderosa pine increased because of the urbanization of the Colorado Front Range. Comandra rust in lodgepole pine forests continued to cause losses in Wyoming, and new centers of white pine blister rust on limber pine were discovered in southeastern Wyoming. Dutch elm disease continued to spread in the Region, whereas oak wilt appeared to have reached a state of equilibrium.

Shoestring root rot and black strain rot were major causes of mortality in pine stands. Needle blight caused foliage damage in Christmas tree plantations and windbreaks.

Status of Insects

Mountain pine beetle, *Dendroctonus ponderosae* (Hopk.). This beetle continued to be the most destructive pest in the Region, killing both ponderosa pine and lodgepole pine. The heaviest losses were in the Black Hills of South Dakota and Wyoming and along the Front Range in Colorado.

Losses in the Black Hills (fig. 13) have been occurring for more than a decade with no immediate decrease foreseen. Tree losses in 1974 were in excess of 470,000 trees, with most losses in second-growth stands where the basal area was 150 square feet or more. The major effort of suppression was of an accelerated program of timber sales; close to 400,000 infested trees were removed from the forest in 1974.

Large scale losses of ponderosa pine occurred along the Front Range of Colorado from Colorado Springs to the Wyoming border. Losses also occurred near Buena Vista and Wet Mountain Valley in the Pike-San Isabel National Forest. The Front Range stands were characterized by poor

[6] The following organizations contributed information for this report: Cooperative Extension Services of Kansas, Nebraska, and South Dakota; South Dakota State Division of Forestry; Wyoming State Department of Agriculture; Colorado State Forest Service; and the Rocky Mountain Forest and Range Experiment Station.

F-523631

Figure 13.—Mountain pine beetle infested trees in unthinned stands, compared to a noninfested thinned stand (South Dakota).

sites, dwarf mistletoe, and overstocking. Urban development and intermingled ownership have complicated suppression effects.

Lodgepole pine losses continued in the Middle Park area of Colorado and in the Medicine Bow National Forest in southern Wyoming. Infested trees were on National Forest, Bureau of Land Management, Rocky Mountain National Park, and private lands. Accelerated tree harvest on Bureau of Land Management land and Medicine Bow National Forest reduced these losses.

Spruce beetle, *Dendroctonus rufipennis* (Kby.). Spruce beetle activity was down throughout the region in 1974. A potential spruce beetle problem on the Dolores District of the San Juan National Forest existed where approximately 3 million board feet of spruce windthrow

occurred in May 1974. A salvage sale program was initiated to remove much of the windthrow.

Douglas-fir beetle, *Dendroctonus pseudotsugae* (Hopk.). Minor losses due to this beetle occurred in scattered areas throughout the Region, Generally, mortality occurred in small groups on steep, rocky drainages.

Western spruce budworm, *Choristoneura occidentalis* (Freeman). Budworm, a perennial defoliator of fir and spruce in Colorado, caused generally light defoliation in 1974. Moderate defoliation occurred on less than 10,000 acres, a slight increase over 1973. Light defoliation is predicted for 1975. Some damage to Christmas tree plantations was reported.

Pine tortrix, *Choristoneura lambertiana ponderosana* (Obraztsou). This insect continued to defoliate ponderosa pine along the St. Vrain and Big Thompson Canyons of the Arapaho-Roosevelt National Forest, and on the San Juan National Forest.

Douglas-fir tussock moth, *Orgyia pseudotsugata* (McD.). This moth continued to be a problem on ornamental plantings of blue spruce along the Front Range from Denver to Colorado Springs. Plantings at Lowry Air Force Base, Denver, suffered severe top defoliation, and some top mortality is expected in 1975.

Lodgepole terminal weevil, *Pissodes terminalis* (Hopp.). This weevil, present in the Routt, Arapaho-Roosevelt, and Medicine Bow National Forests, attacks lodgepole pine saplings. Damage was down from the past 2 years.

Tip moths, *Rhyacionia* spp. *R. frustrana* (Comst.), *R. bushnelli* (Busck), and *R. neomexicana* (Dyer) continued to plague shelterbelt plantings on the Plains. Pine planted on severely disturbed soils showed the greatest susceptibility to attack. Surveys in several ponderosa pine provenance studies indicated that the low elevation eastern plains seed sources are less susceptible to attack by tip moths than the other ecotypes of ponderosa pine.

Zimmerman pine moth, *Dioryctria zimmermani* (Grote). This moth is causing an increasing amount of damage to hard pines in north-central Nebraska. Girdling of stems in several windbreaks may prevent an effective wind barrier for the current plantings. Other infested plantings are of such high tree density that some tree loss would probably be beneficial in the long run. At Sioux Falls, S. Dak., another *Dioryctria* sp. is attacking Black Hills spruce planted in landfill.

Needle miners. *Epinotia meritana* (Hein.), continues to infest about 6,500 acres in the North LaVeta Pass area of Colorado (fig. 14), but defoliation in 1974–75 will probably be light. The spruce needle miner *Taniva albolineana* (Kft.) caused light damage in Natrona County, Wyo. Damage from this insect also occurred in the Kansas counties of Douglas, Franklin, Johnson, and Brown.

Aspen leaf miner, *Phyllocnistis populiella* (Chamb.). High populations were present for the second year on aspen in the Black Hills. Long-term damage is believed to be negligible.

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Figure 14.—White fir stand showing the typical bleached foliage caused by the white needle miner (Colorado).

Other insects. The outbreak of red-humped oakworm, *Symmerista canicosta* (Franc.), in the Newton Hills State Park, S. Dak., collapsed in the spring. Egg density was low, and egg parasitism was about 90 percent. Light populations of the walnut caterpillar, *Dantana integerrima* (G&R), were present on walnut in the Newton Hills State Park, and also occurred in light numbers in eastern Kansas on black walnut plantings. Populations of spring cankerworm, *Paleacrita vernata* (Peck), and fall cankerworm, *Alsophila pometaria* (Harr), infested many shelterbelts on the Plains. This insect was common in the southern half of South Dakota. Severe defoliation occurred in the Kansas counties of Finney, Barton, and Riley.

The elm leaf beetle, *Pyrrhalta luteola* (Muller), defoliated elms in South Dakota, Kansas, and Nebraska. Members of the genus *Malacosoma* caused heavy defoliation of chokecherry in wildlife production areas in Bonhomme County, S. Dak. The pine butterfly, *Neophasia menapia* (Feld and Feld) caused light defoliation in the Keystone area of the Black Hills of Wyoming and along the Front Range of Colorado. Pitch nodule moth, *Petrova arizonensis* (Heim.), damage on pinyon on the Upper Arkansas River Drainage was lower than in past years. An unidentified species of *Petrova* caused forked tops in the ponderosa pine seed orchard in the Dolores District, San Juan National Forest. The pine shoot moth, *Eucosma sonomama* (Kearf.), continued to damage young pines in the San Juan National Forest.

Status of Diseases

Dwarf mistletoe, *Arceuthobium* spp. The southwestern dwarf mistletoe, *A. vaginatum* subsp. *cryptopodum* (Engelm.) Hawks. and Wiers, caused pockets of tree mortality on 310,000 acres of commercial ponderosa pine forests in Colorado, particularly in the Pike-San Isabel and Roosevelt National Forests. A detection survey in the Laramie Mountains of Wyoming revealed three large pockets of dead limber pine, up to 10 acres in size, that were caused by limber pine dwarf mistletoe, *A. cyanocarpum* (Colv. & Nels.) Over 25,000 acres of lodgepole pine were surveyed for dwarf mistletoe in the Ball Mountain area of the Red Feather Ranger District, Roosevelt National Forest. Another evaluation survey was conducted in infested lodgepole pine in the Cebolla District of the Gunnison National Forest. With use of these data in the LPMIST [7] computer program, management alternatives can be provided. Recent estimates showed that 50 percent of the lodgepole pine stands in the Region were infected by *A. americanum* (Nutt. ex Engelm.).

Rusts. The most economically important rust in the Rocky Mountain Region was Comandra blister, *Cronartium comandrae* Pk., which damaged lodgepole pine forests on the Routt, Medicine Bow, and Roosevelt National Forests. The greatest impact of the disease occurred in the Bighorn and Shoshone National Forests in Wyoming, where an estimated 300,000 acres of commercial forest were affected (fig. 15).

A detection survey in southern Wyoming revealed several new infection centers of white pine blister rust, *Cronartium ribicola* Fisch., on limber pine scattered over approximately 1,000 acres in the Laramie Mountains of Wyoming. The survey indicated that the disease was intensifying.

Fir broom rust, *Melampsorella caryophyllacearum* Schroet., on white fir is widespread in the San Juan, Gunnison, and San Isabel National Forests. It was estimated that on the San Juan National Forest 100 percent (nearly 220,000 acres) of the white fir type was infested by this parasite.

Dutch elm disease. *Ceratocystis ulmi* (Buism.) C. Mor. is the most destructive vascular wilt disease, with the major host in this Region being American elm. This disease, which is found in natural stands of elm in Kansas, Nebraska, and South Dakota, has caused over 60 percent loss of trees along river bottoms. In these stands, the disease has already reached its maximum level, and the problem now is dead tree removal. In urban areas, losses are being minimized through active community forest programs of prompt identification and removal of forest trees. A serious epidemic at Fitzsimmons Army Hospital in Denver (fig. 16) will result in the eventual removal of all American elms on the grounds.

[7] Meyers, C.A., F.G. Hawksworth, and J.L. Stewart. 1971. Simulating yields of managed dwarf mistletoe infested lodgepole pine stands. USDA For. Serv. Res. Pap. RM–72, 15 pp.

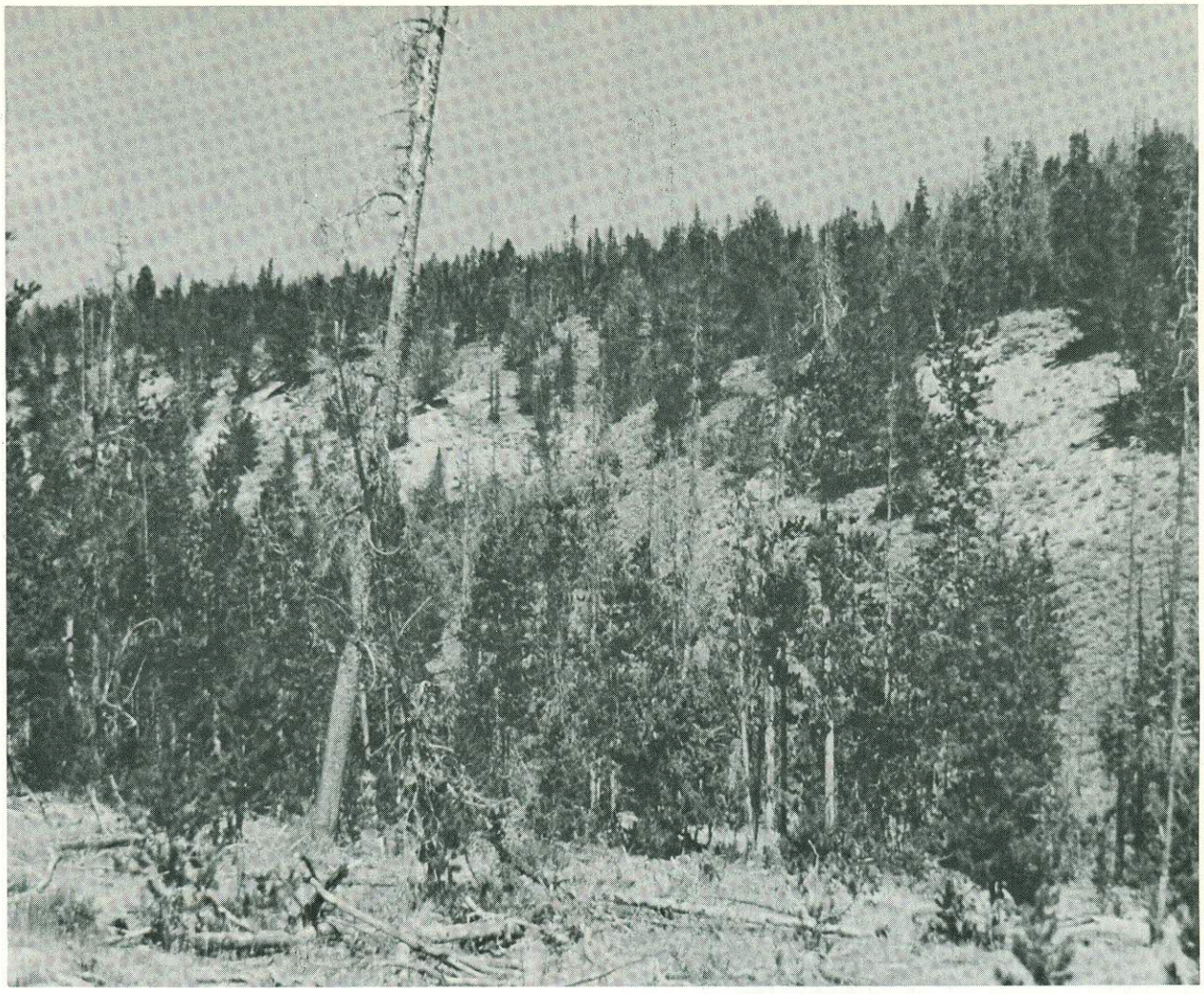

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Figure 15.—Comandra blister rust caused a severe impact on this lodgepole pine stand (Shoshone National Forest, Wyo.).

Oak wilt, *Ceratocystus fagacearum* (Bretz) Hunt. The spread of this disease has apparently reached a state of equilibrium in the oak stands of Nebraska and Kansas. New infection centers (one approximately 5 acres in extent) have been found in Indian Caves State Park in southeastern Nebraska and in several eastern counties of Kansas. Most of these infection centers are spreading slowly because of resistance in the native oaks and unsuitable climate.

Shoestring root rot, *Armillaria mellea* (Fr.) Karst. Stocking in a reproduction spacing study in the Black Hills National Forest, S. Dak., was severely reduced by this disease.

Black stain root rot, *Verticicladiella wageneri* (Kend.). This disease was responsible for pockets of mortality in pinyon stands in Mesa Verde National Park and on the San Juan and Grand Mesa-Uncompahgre National Forests, and recently became a problem in suburban housing developments.

Foliage diseases. Needle blight damage to planted pine was reported from Christmas tree plantations and windbreaks in Kansas and Nebraska. Brown spot, caused by *Scirrhia acicola* (Dearn) Siggers, affected ponderosa and Scots pine *(P. sylvestris* L.), whereas *Dothistroma pini* Hulb. damaged Austrian pine (*P. Nigra* Ar-

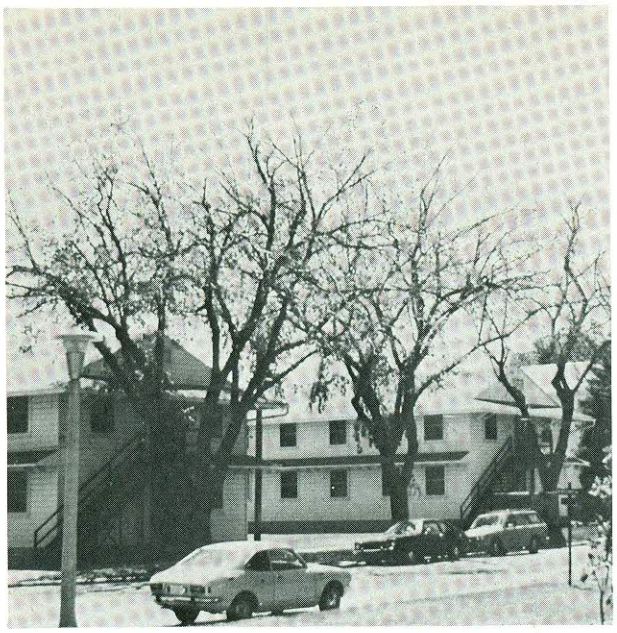

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Figure 16.—Three American elm trees killed by Dutch elm disease in 1 year (Fitzsimmons Army Hospital, Denver, Colo.).

nold). Tip blight caused by the fungus *Diplodia pinea* (Desm.) Kickx. caused serious damage to lateral buds and shoots in Austrian, ponderosa, and Scots pines in Kansas, Nebraska, and South Dakota.

Other diseases. Aspen decline was observed in many recreation areas in Colorado, and severe mortality was especially noted in the popular Maroon Lakes campground near Aspen (fig. 17). Studies showed that the causal agents were canker fungi, notably *Cenangium singulare* (Rehm.) Davids. & Cash, and *Cytospora chrysosperma* (Pers.) F. Although these fungi were responsible for the actual mortality, the aspen are usually predisposed to disease by camper abuse. Severe dieback and mortality of Siberian elm in shelterbelts and other plants in the Plains were caused by a canker fungi, *Botryodiplodia hypodermia* (Sacc.) Petr. & Syd.

SOUTHWESTERN STATES (R–3) [8]

by

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Conditions in Brief

Bark beetles continued as the most destructive group of insects in the Southwestern Region. Severe drought conditions during the winter, spring, and early summer months weakened and killed ponderosa pine trees throughout the Region, providing favorable conditions for buildups of secondary bark beetles. Widespread outbreaks of pine engraver beetles occurred on the Apache-Sitgreaves, Prescott, and Tonto National Forests, Ariz. and on the Cibola and Lincoln National Forests, N. Mex. The roundheaded pine beetle caused scattered mortality of pole-size ponderosa pine in the Lincoln National Forest and Mescalero-Apache Indian Reservation, N. Mex., but heavier tree losses are predicted for 1975. Many sawtimber-size ponderosa pines were killed by the western pine beetle in the Region. A mountain pine beetle outbreak in ponderosa pine continued to increase on the Kaibab National Forest, Ariz. Engelmann spruce beetle infestations declined for the second year.

Defoliating insects attacked conifers and aspen in portions of the Region, but damage was minimal. There were localized increases in western spruce budworm defoliation in northern Arizona and New Mexico. Ornamental spruce, white fir, and Douglas-fir trees were defoliated by the Douglas-fir tussock moth in Santa Fe, Ruidoso, and Los Alamos, N. Mex. The efficacy of ground application of *Bacillus thuringiensis* was tested against the Douglas-fir tussock moth; excellent control was achieved.

The most important disease agents were the dwarf mistletoes. Treatment for the prevention and suppression of mistletoes was limited to commercial stands and high priority recreation areas. Noncommercial stands were not treated.

[8] Includes all forested lands in Arizona and New Mexico, and National Park Service land in western Texas.

End