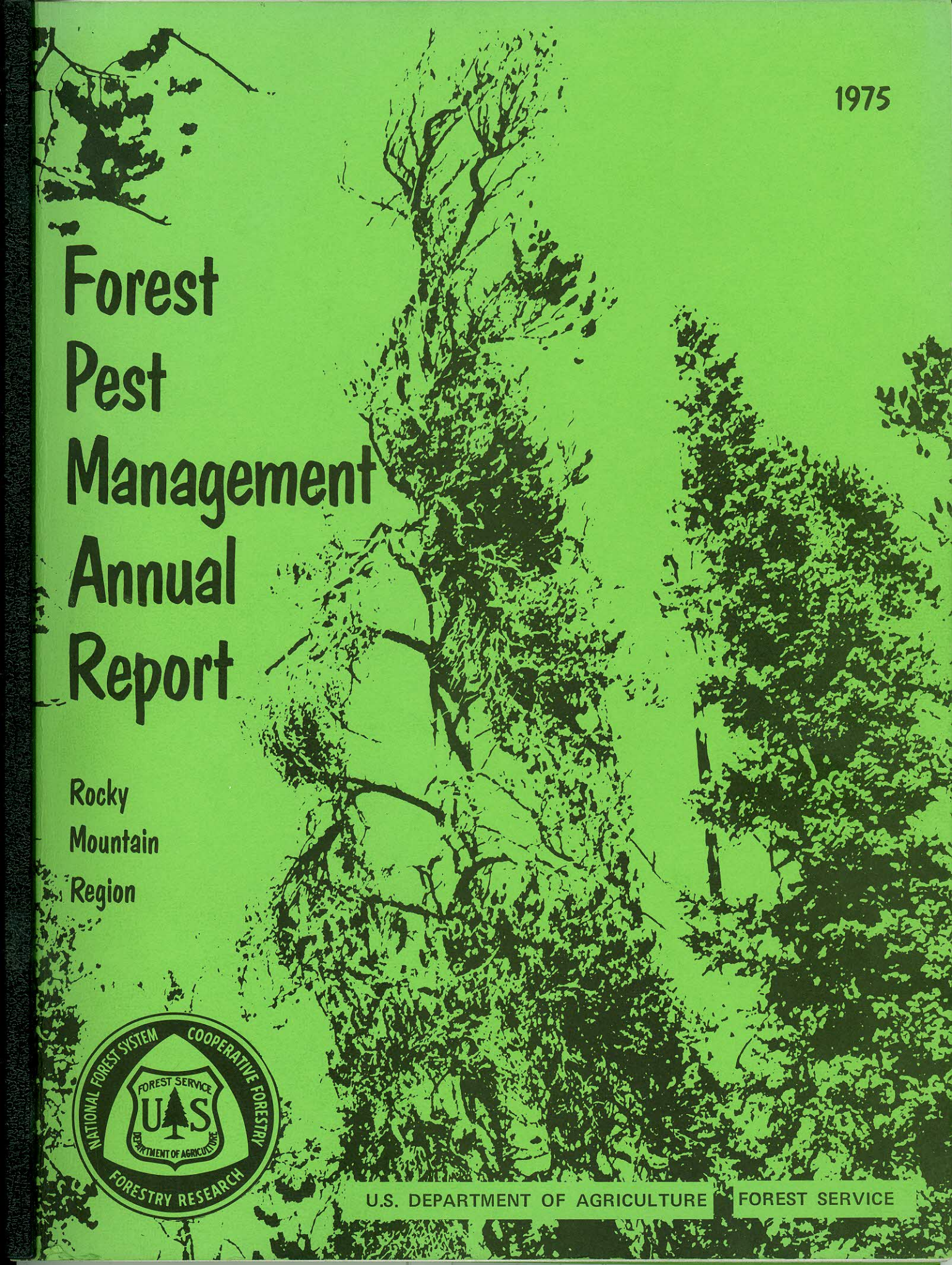
1975

Forest Pest Management Annual Report

Rocky Mountain Region



U.S. DEPARTMENT OF AGRICULTURE | FOREST SERVICE

FOREST PEST MANAGEMENT

ANNUAL REPORT

ROCKY MOUNTAIN REGION

1975

By

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and

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February 1976

Forest Pest Management
State and Private Forestry
Rocky Mountain Region
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ACKNOWLEDGMENT

This is the first annual report of forest pest conditions in Region Two which includes the states of Colorado, Kansas, Nebraska, South Dakota, and part of Wyoming. Forest pest occurrences were reported through the combined surveillance efforts of many organizations and individuals. Acknowledgment is made to the numerous research, extension, and state personnel that have contributed information for this report.

INTRODUCTION

The Forest Pest Control Act of June 25, 1947, as amended, provides that on lands administered by the Forest Service, Forest Pest Management (FPM), is responsible for prevention, detection, evaluation, and suppression of forest insects and diseases; on lands administered by other Federal agencies, FPM is responsible for detection surveys, biological evaluations and for providing technical assistance and advice to the land managers in all matters relating to forest insect and disease prevention and suppression. On non-Federal land, state agencies and private landowners are responsible for all phases of forest insect and disease control.

Forest insect and disease infestations were detected and recorded during aerial and ground surveys throughout most of the Region in 1975. Some of these surveys were made in cooperation with the States of Colorado, Kansas, Nebraska, South Dakota, and Wyoming. Ground surveys were conducted to verify aerial survey findings, to evaluate stand conditions, and to determine the need for control action. A map depicting the distribution of selected major forest pests is included in the Appendix.

Included in the Appendix is a listing of biological evaluations of pest infestations completed by FPM Staff. Also included, is a listing of current forest insect and disease projects conducted throughout the Region.

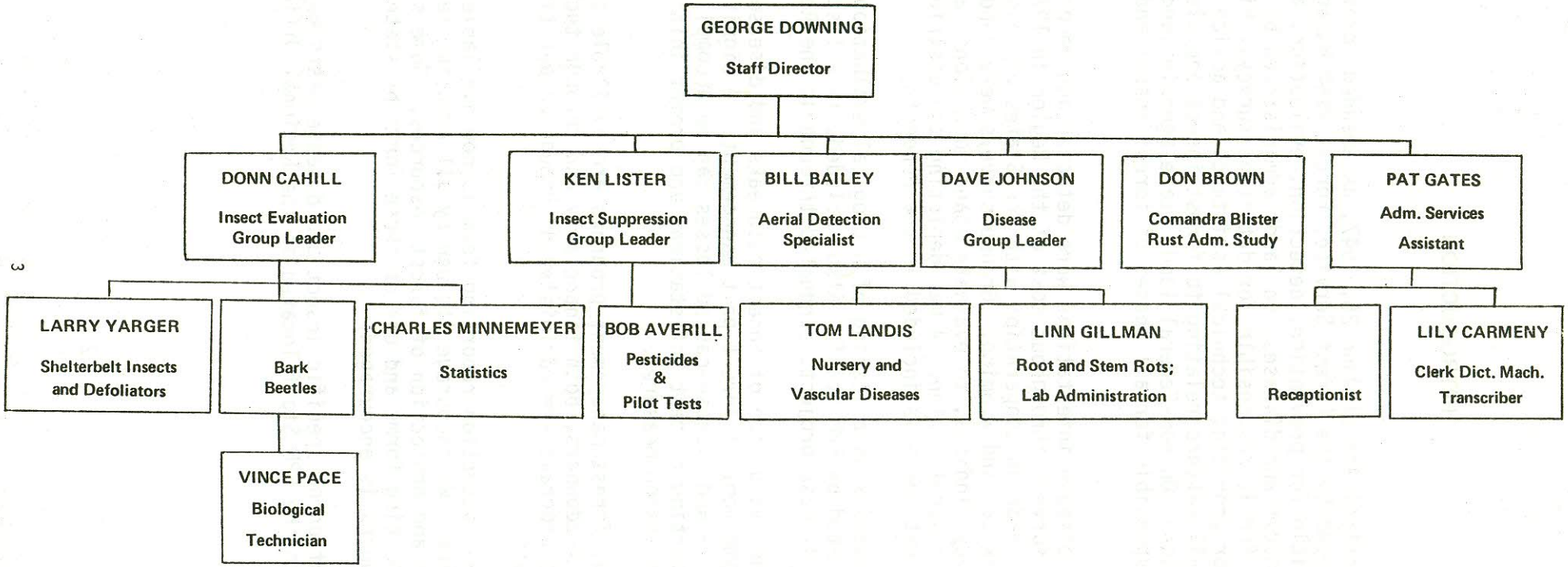
Early detection and evaluation of insect outbreaks and disease occurrence is an important component of forest pest management. A significant reduction in insect- and disease-caused losses can be accomplished through timely reporting of pest infestations and prompt initiation of prevention or suppression measures.

A number of Federal forest management programs are available to assist state and private landowners, both financially and through technical assistance. These programs are administered through cooperative agreements with the states.

A newly revised pest detection reporting form is now available from the U. S. Forest Service. We encourage its use by all agencies responsible for the management and protection of forest resources. Some states also have detection reporting forms and use of these forms by state personnel and private landowners is encouraged.

Additional information on specific insect and disease pests may be obtained through requests to the FPM Staff located in the Regional Office.

FOREST PEST MANAGEMENT[1/] ORGANIZATIONAL CHART



1/ Name has recently been changed to Forest Insect and Disease Management.

CONDITIONS IN BRIEF

Old growth stands are the major problem confronting insect and disease management activities in the Rocky Mountain Region. The limited development of the Region's timber resource has tended to perpetuate the overmature condition of much of the forest. Survey data indicates that for practically all forest types the preponderance of sawtimber volume is in overmature, slow-growing trees.

Insects and disease cause more than 80 percent of the annual sawtimber mortality. The combined effects of insects and disease result in an annual sawtimber mortality of over 500 million board feet, or nearly twice the annual harvest. Growth loss from these agents is not known, but probably exceeds mortality. Diseases are the major contributors to growth loss.

Epidemic infestations of the mountain pine beetle continued at high levels in ponderosa pine along the Front Range of Colorado and in the Black Hills of South Dakota and Wyoming. Other smaller infestations in ponderosa pine were scattered in and near the Bighorn Mountains in Wyoming. Lesser infestations of the mountain pine beetle in lodgepole pine were present in several areas in the Region. Western spruce budworm activity was low, except for some areas of moderate to heavy defoliation on the Roosevelt National Forest and adjacent lands. No epidemic spruce beetle infestations were present. White fir needle miner caused severe defoliation on white fir near La Veta Pass, Colorado. Some ornamental plantings of spruce in Denver, Colorado were heavily defoliated by the Douglas-fir tussock moth. Several insects continued to damage pine plantations and shelterbelt plantings in the plains states. Tip moths and the Zimmerman pine moth were the most destructive of these insects.

Lodgepole pine dwarf mistletoe and Comandra blister rust continued to cause growth loss and mortality of lodgepole pine in the Region. Cankers and stem rots caused aspen decline and mortality in many recreation sites in Colorado. Oak wilt was detected in two additional counties in Kansas, and one county in Nebraska. Dutch elm disease continued to spread in natural stands of elm in rural areas, as well as in urban communities. Black staining root disease was detected in 10 western counties of Colorado on pinyon pine; no disease centers were found east of the Continental Divide. Weather damage was suspected as the major cause of damage to ponderosa pine over several hundred acres of the San Juan National Forest in Colorado. Excess nitrogen was suspected as the cause of chlorosis and stunting of lodgepole pine seedlings in one U. S. Forest Service nursery.

STATUS OF INSECTS

BARK BEETLES

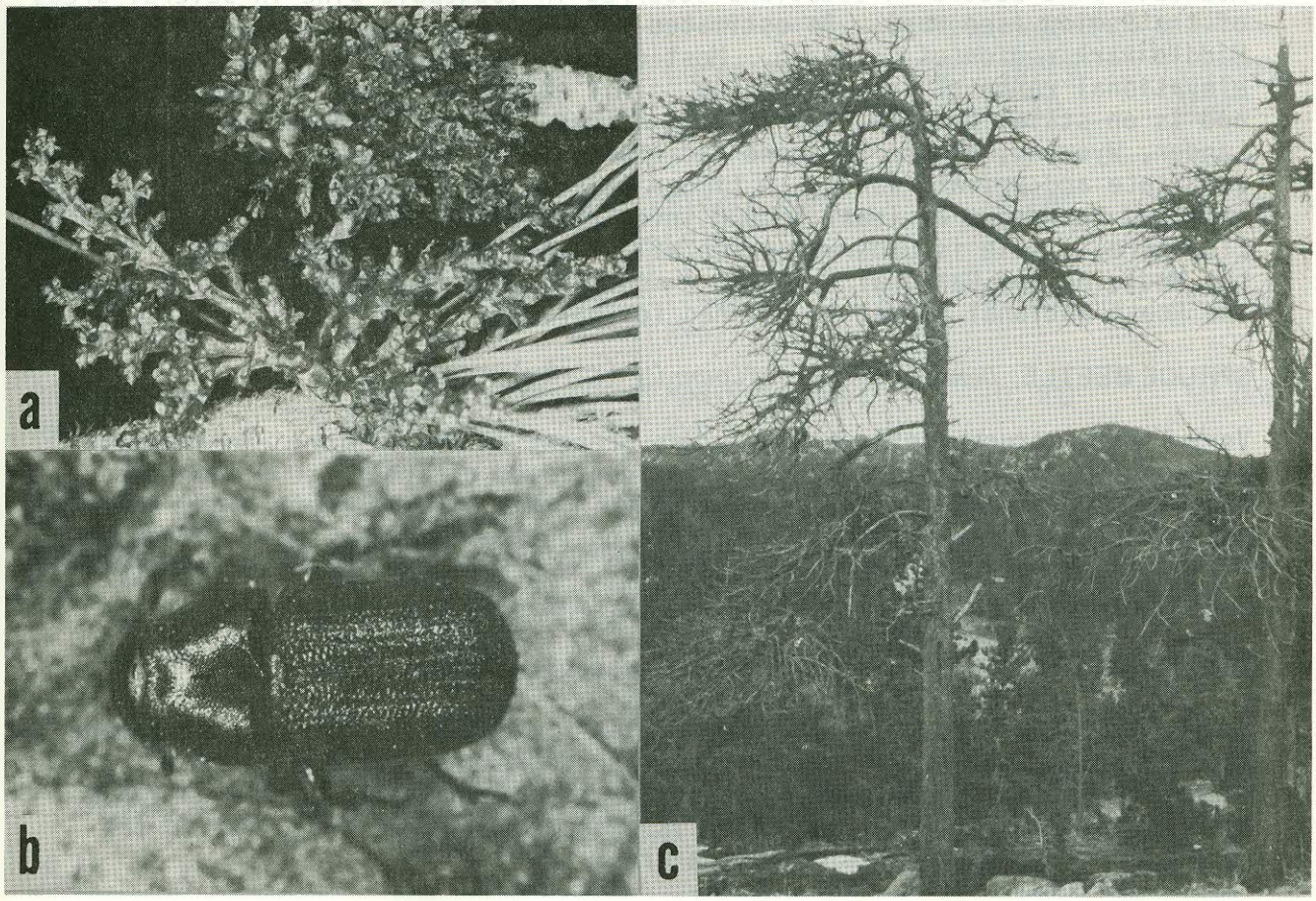
MOUNTAIN PINE BEETLE, *Dendroctonus ponderosae* Hopk.

The mountain pine beetle is by far the most serious forest insect problem in the Region. The number of infested trees within major outbreaks is estimated at 2,478,000 (Tables 1 & 2). Both the Black Hills of South Dakota and Wyoming and the Front Range of Colorado continued to sustain high levels of loss in ponderosa pine from the mountain pine beetle (see map). The predicted insect populations in both areas will remain at the current high levels or increase.

An estimated 470,000 trees were determined by aerial survey to be infested in the Black Hills in the summer of 1975. After the August beetle flight, a ground survey was conducted. This survey showed approximately a 1:1.8 buildup ratio of old to new infested trees. Therefore, about 850,000 trees were estimated to be infested. Because of the large volume of suitable host material, this infestation is expected to continue. The beetle epidemic is most intensive in the northern half of the Black Hills and extends over a million acres. An accelerated sanitation salvage program is underway to log beetle-infested trees concurrent with an increased timber sale program to improve stand conditions. The goal of the timber sale program is to reduce basal area in stands that are currently overstocked. This would make these stands less susceptible to attack by the mountain pine beetle.

Along the Front Range of Colorado, the mountain pine beetle epidemic was so extensive that a precise count of the number of infested trees was not feasible. At least a million trees were estimated to have been killed in the summer of 1975. Ground surveys conducted after the beetle flight period showed an approximate 1:1.4 buildup ratio of old- to newly-attacked trees. The number of infested trees probably exceeds one and a half million. Vast acreages of overstocked, mature, and dwarf mistletoe infested trees will probably ensure continuation of the epidemic. Effective suppression programs are difficult to achieve because of urbanization of the area, the mixed land ownership pattern, lack of adequate road access, the extremely rugged terrain in many areas, and size of the infestation. Some sanitation salvage was accomplished, but was quite limited due to very little mill capability. Some insect-killed trees were removed for use as firewood in the metropolitan areas along the Front Range. The State of Colorado continued suppression efforts using chemical control, primarily in residential, forested areas.

In Wyoming, mountain pine beetle infestations increased at several locations along the eastern slope of the Bighorn Mountains on state, private, Bureau of Land Management, and National Forest lands. At least 6,000 ponderosa



DWARF MISTLETOE AND MOUNTAIN PINE BEETLE CONTRIBUTE TO GROWTH LOSS AND MORTALITY OF PONDEROSA PINE IN THE COLORADO FRONT RANGE.

(a) Male and female plants of the southwestern dwarf mistletoe, *Arceuthobium vaginatum* subsp. *crytopodum*.

(b) Adult mountain pine beetle.

(c) Mountain pine beetle-killed pines on a poor site exhibiting extensive dwarf mistletoe infection.

pines were infested. Small, active infestations were present on state and Bureau of Land Management land in scattered ponderosa pine stands near Midwest and Kaycee, Wyoming.

Mountain pine beetle infestations occurred in lodgepole pine in several areas of the Region (see map). An estimated 12,000 trees were infested in the Middle Park region of Colorado. Most of these trees were at the lower elevational range of lodgepole pine. This epidemic is several years old and is on state, private, and federal lands. Another infestation is near Lander, Wyoming, on the Shoshone National Forest, Bureau of Land Management, and State and private lands. A timber sale is being prepared which is expected to remove at least 50,000 infested trees from this area in 1976. Elsewhere, a sale is underway which will remove beetle-infested trees on the Medicine Bow National Forest. A mountain pine beetle infestation on the Routt National Forest is planned for harvest.

SPRUCE BEETLE, *Dendroctonus rufipennis* (Kirby).

Very little spruce beetle activity was present in the Region. An infestation on the Rio Grande National Forest consisted of about 2,000 infested trees on 200 acres. Woodpecker activity in this area was very high, and the infestation is not expected to develop further. Three small infestations were present on the Routt, Gunnison, and San Juan National Forests (see map). These should be eliminated by current sale programs.

DOUGLAS-FIR BEETLE, *Dendroctonus pseudotsugae* Hopk.

Beetle activity in commercial-size Douglas-fir on Bureau of Land Management land near Douglas Pass in western Colorado decreased. Extensive tree mortality has occurred in previous years. This created a lack of suitable host material. This host depletion is expected to cause a decline in the Douglas-fir beetle population in the area.

IPS BEETLES, *Ips* spp.

A complex of several insects and diseases has caused mortality in ponderosa pine in the San Juan National Forest for several years. The relationship between the various insects and diseases that results in tree mortality is not yet known. The trees were attacked by *Ips knausi* Sw. and *I. pini* Say. At the same time, they were defoliated by tiger moths, *Halisidota sp.* Two diseases, Armillaria root rot and blue stain, *Ceratocystis minor* (Hedg.) Hunt, were found in the dying trees.

TABLE 1
ESTIMATED TREE MORTALITY FROM MOUNTAIN PINE BEETLE IN 1975
AND GROSS AREA AFFECTED

LOCATION OF INFESTATION	PONDEROSA PINE NO. TREES INFESTED	PONDEROSA PINE INFESTED ACRES	LOCATION OF INFESTATION	LODGEPOLE PINE NO. TREES INFESTED	LODGEPOLE PINE INFESTED ACRES
Black Hills Wyo. - S. Dak.	850,000	1,000,000	Middle Park, Colo.	12,000	100,000
Colorado Front Range	1,500,000	1,250,000	Lander, Wyo.	100,000	50,000
Bighorn Mtns. Wyo.	6,000	40,000	Medicine Bow, Wyo.	10,000	50,000
SUBTOTALS:	2,356,000	2,290,000	SUBTOTALS:	122,000	200,000

TOTAL INFESTED TREES: 2,478,000

TABLE 2
ACRES OF HOST TREES IN AND ADJACENT TO
CURRENT INFESTATIONS WHICH ARE
THREATENED IN 1976 1/

	PONDEROSA PINE	LODGEPOLE PINE
Colorado	411,000	63,000
Wyoming	268,200	56,900
S. Dakota	181,000	

1/ Preliminary figures from Western Forest Insect Issues Study.

DEFOLIATORS

WESTERN SPRUCE BUDWORM, *Choristoneura occidentalis* Freeman.

Defoliation from this insect was detected over a large area of Colorado. The major host species, Douglas-fir, is generally found in mixed conifer stands and does not comprise a continuous component of the forest stand. Damage usually is not severe. Two areas totaling about 10,000 acres of moderate to heavy defoliation were present on the Roosevelt National Forest and on adjacent land in Rocky Mountain National Park (see map). Moderate to heavy defoliation was also present along the Front Range of Colorado on some state and private lands. The annual spruce budworm egg mass survey was conducted in August. Foliage samples were collected from 470 trees at 42 points in Colorado. Predicted defoliation from this survey did not indicate defoliation levels greater than light in any new areas. Moderate to heavy defoliation is predicted for small areas in the Roosevelt National Forest and Rocky Mountain National Park.

A pilot control project to determine the effectiveness of ground application of 3 insecticides was conducted during the summer of 1975. Insecticides tested were malathion, acephate, and carbaryl. This test was conducted in an effort to find a chemical which would be useful for Christmas tree growers and private landowners. Results of the test were generally disappointing. Only malathion resulted in good budworm mortality. Early application of acephate provided the best foliage protection. Complete results of this test will be published later. Additional testing is anticipated in 1976.

DOUGLAS-FIR TUSSOCK MOTH, *Orgyia pseudotsugata* McD.

High value ornamental spruce were heavily defoliated throughout much of the Denver and Colorado Springs areas. Damage was severe at Lowry Air Force Base where a pilot test of ground application of *Bacillus thuringiensis* was conducted in 1975 in conjunction with Pacific Northwest Experiment Station personnel. Several formulations were tested. None were effective, possibly because cold, rainy weather immediately following treatment retarded larval development and washed the spray off the foliage.

WHITE FIR NEEDLE MINER, *Epinotia meritana* Heinrich.

Defoliation by this insect on white fir near La Veta Pass, Colorado increased to severe levels. This insect has been present in this area for four years. Many of the fir were also infested with western spruce budworm. Total area of the infestation is about 7,000 acres, on private and Bureau of Land Management land. Some mortality occurred in weakened trees which were attacked by the fir engraver, *Scolytus ventralis* LeC. Additional mortality in weakened, standing white fir is likely. A new species of an ichneumonid parasitic wasp was identified from needle miners in this infestation.

Pilot testing ground application of insecticides with a mistblower to control the western spruce budworm in Colorado.

PINE TORTRIX, *Choristoneura lambertiana ponderosana* Obraztsov.

Endemic populations of this insect continued to cause light defoliation of ponderosa pine terminals and laterals in the Roosevelt National Forest and private lands, primarily in the St. Vrain and Big Thompson Canyons. Light defoliation also occurred in the San Juan National Forest.

SHELTERBELT INSECTS

ZIMMERMAN PINE MOTH, *Dioryctria zimmermani* (Grote).

This insect caused severe branch damage to Scots pine and Austrian pine in north central Nebraska. Up to 75 percent of the trees in some plantations and shelterbelts was damaged.

ELM LEAF BEETLE, *Pyrrhalta luteola* (Muller).

Heavy defoliation by this insect occurred on elms throughout the Region. The insect attacked elms in shelterbelts and in urban areas. Many trees were severely defoliated. In addition, the large numbers of the insect made it a nuisance pest in urban areas.

TIP MOTHS, *Rhyacionia* spp.

The western pine tip moth, *R. bushnelli* (Busck), and the southwestern pine tip moth, *R. neomexicana* Dyar., continued to cause stunting, deformity and growth loss in seedling and sapling size pines throughout most of the Region. In the plains states, the loss is found in shelterbelts and pine plantations. A provenance study conducted at a pine plantation near Plattsmouth, Nebraska, showed significant differences in percent infestation between seed sources to tip moths. In Colorado, ponderosa pine along the Front Range were attacked.

MISCELLANEOUS INSECTS

STRAWBERRY ROOT WEEVIL, *Otiorhynus ovatus* (L.).

The strawberry root weevil, which caused substantial loss of spruce seedlings in the Mt. Sopris Nursery in 1972 and 1973, is no longer a problem. Chemical fumigation, combined with cultural practices, have eliminated this problem.

OTHER INSECTS.

Minor damage was observed in lodgepole pine from the lodgepole terminal weevil, *Pissodes terminalis* Hopp. The pitch nodule moth, *Eucosma sonomana* Kearf., infested ponderosa pine. Feeding by the smaller European elm bark beetle,

Scolytus multistriatus (Marsh.), continued to spread Dutch elm disease throughout the Region. Mortality of subalpine fir killed by *Dryocetes confusus* Sw. was observed near Steamboat Springs, Colorado. The large aspen tortrix, *Choristoneura conflictana* (Walker), defoliated aspen near Vail, Colorado, and was also observed on the Uncompahgre National Forest and the San Juan National Forest. Much of the aspen in the northern Black Hills was infested with the aspen leaf miner, *Phyllocnistis populiella* Chamb. Three species of tent caterpillar, *Malacosoma californicum* (Pack.), *M. californicum lutescens* Neumoegen and Dyar, and *M. incurvum discoloratum* Neumoegen, were collected in the Region (San Isabel National Forest, Nebraska National Forest, and Colorado National Monument, respectively). The limber pine cone beetle, *Conophthorus flexilis* Hopk., occurred on limber pine in the Medicine Bow National Forest. The white-marked tussock moth, *Hemerocampa leucostigma* (J. E. Smith), was collected from apple and birch trees in Nebraska.

STATUS OF DISEASES

DWARF MISTLETOES

LODGEPOLE PINE DWARF MISTLETOE, *Arceuthobium americanum* (Nutt. ex Engelm.).

This is the most damaging disease in the Rocky Mountain Region. It has been estimated that 50 percent of the commercial lodgepole pine forest in the Region is infested with this parasite.

Evaluations of the extent and intensity of dwarf mistletoe infestations were conducted on several forests. Over 25,000 acres of lodgepole pine were surveyed during the summer of 1975 in the Red Feather Ranger District, Roosevelt National Forest. Approximately 40 percent of the forested acres surveyed were infested with dwarf mistletoe.

A systematic survey of 66 acres was conducted in cooperation with the Wyoming State Forest Service in a 53-year-old lodgepole pine stand located near Mountain Home, Wyoming. Over 91 percent of the trees were infected with dwarf mistletoe. Infected trees per acre averaged 1,008.

A 10-year examination was made of plots established in 1965 to determine the practicability of sanitation thinning of young (20-40 years old) lodgepole pine stands with varying intensities of dwarf mistletoe infection. The results of this cooperative study between the Rocky Mountain Experiment Station and Forest Pest Management staffs will be analyzed in early 1976.

SOUTHWESTERN DWARF MISTLETOE, *A. vaginatum* subsp. *cryptopodum* (Engelm.) Hawks. and Wiens.

This is the most important disease of ponderosa pine in the Rocky Mountain Region. The current outbreak of mountain pine beetle in the Front Range of Colorado has stimulated interest to determine the relationship between bark beetles and dwarf mistletoe, which weakens its host and may predispose it to bark beetle attack. It has been estimated that 46 percent of the commercial ponderosa pine acreage in the Front Range is infested with dwarf mistletoe.

Over 1.2 million acres of commercial lodgepole pine and ponderosa pine in Colorado and Wyoming are in need of dwarf mistletoe control through timber sales, commercial and pre-commercial thinning. Ninety percent of this acreage is on federally-administrated lands.

STEM DISEASES

COMANDRA BLISTER RUST, *Cronartium comandrae* Peck.

This is the second most damaging disease of lodgepole pine in the Region. Disease impact, including spike tops, growth loss and mortality to pole- and sawtimber-size (5" to 14" d.b.h.) trees in northern and western Wyoming is of particular concern to forest managers. Commercial forested acreage in Wyoming infested with the rust has been estimated as follows: Bighorn National Forest - 87,000 acres; Medicine Bow National Forest - 91,000 acres; Shoshone National Forest - 80,000 acres.

An administrative study was initiated in 1975 to determine the impact of the disease on timber yield. Of 21 stands sampled, rust incidence ranged from 8-72 percent; mortality ranged from 0-29 percent. After the data are analyzed, a mathematical expression of impact will be incorporated into an existing computerized simulation yield program for lodgepole pine. The ultimate goal of the study is to develop silvicultural guidelines for the land manager to use in making administrative decisions for infected stands.

WHITE PINE BLISTER RUST, *Cronartium ribicola* J. C. Fisher ex Rabenh.

Blister rust was discovered on limber pine, *Pinus flexilis*, in Yellowstone National Park in 1950. Since the original discovery, the disease has been identified on pines (*P. flexilis* and *P. albicaulis*) in six counties in Wyoming.

The disease is well established and intensifying in Albany county in the Laramie Mountains south of Douglas (see map). This is the most southern extent of the disease in the central Rocky Mountains. Some of the most heavily damaged stands are present in Turkey Creek near Steamboat Point in the Bighorn National Forest. With the exception of tree mortality in

Turkey Creek, the principal damage has been branch flagging and some top-kill.

Additional surveys in the Laramie Mountains in 1975 failed to reveal any new infection centers. Even though the disease has not yet been detected in the Laramie Mountains east of Laramie or the Medicine Bow Mountains west of Laramie, the potential for spread into these areas is very good.

CANKERS AND STEM ROTS

A cooperative study between the Forest Pest Management Staffs of Regions Two and Three, and the Rocky Mountain Experiment Station, was initiated in 1975 in 6 quaking aspen stands (cut 1 to 3 years ago), in the San Juan and Rio Grande National Forests, to evaluate the significance of cankers and stem rots in relation to timber harvesting methods.

Silvicultural systems currently used include selection cutting and patch clearcutting of less than 20 acres. Wounding of leave trees during selective logging is a major deterrant to the use of this silvicultural system. Wounds were noted on 68-84 percent of the residual stems; 34-56 percent of the wounds were infected. Injuries from boring insects were found on 10-23 percent of the stems. Infection of wounds by canker and rot fungi appears to increase with time after logging. The identification of specific wound-invading organisms will be determined in the future.

Several biological evaluations conducted in recreation sites in the Gunnison and Rio Grande National Forests indicated the need for annual inspections to identify and remove trees hazardous to the public. Recreation sites established in decadent, old growth spruce-fir (*Picea engelmanii - Abies lasiocarpa*) stands contained many hazardous trees. *Phellinus (Fomes) pini* (Thore ex Fr.) Pilat was the most common decay fungus in defective trees.

Aspen decline and mortality increased in many recreation sites. Camper abuse, as well as frost cracks and sunscald, predispose trees to infection by canker and decay fungi.

Guidelines designed to aid field personnel in inspecting and evaluating hazardous trees in recreation sites are currently being developed for the Region. This information will be available for distribution in the spring of 1976.

VASCULAR WILTS

OAK WILT, *Ceratocystis fagacearum* (Bretz) Hunt.

During July 1975, aerial and ground surveys were conducted in 15 counties in Nebraska. These counties bordered areas with previously-confirmed oak wilt centers. Characteristic "flagged" trees were ground-checked to confirm the presence or absence of the disease. Oak wilt infected red oaks and bur oaks were found in one new county (Thurston) in northeastern Nebraska. Oak wilt was also detected in two new counties in Kansas; red oaks in the northeast (Jackson County) and blackjack oaks in the southeast (Neosho County) (see map).

DUTCH ELM DISEASE, *Ceratocystis ulmi* (Buism.) C. Mor.

Dutch elm disease continued to cause losses of American elm throughout the Region. Rural spread of the disease among native elm populations along river bottoms has resulted in up to 50 percent loss of trees in some areas.

In urban areas, the success of community efforts to reduce losses appears to vary directly with local funding and timing of sanitation.

Diseased trees were reported for the first time in eight counties (Brown, Day, Grant, Hand, Marshall, Mellette, Potter, and Stanley) in South Dakota in 1975 (see map). Diseased trees were reported in only one new county (Boyd) in Nebraska (see map). The disease has been previously reported throughout most of the eastern half of Nebraska. No new reports were available from Kansas this year.

Confirmed cases of the disease did not increase at the rate predicted for most areas in Colorado. Although 3,937 cases were confirmed in 1975, compared to 2,845 cases in 1974, most of this increase was attributed to increased diagnostic effort in the Denver area. This year, an effort was made to submit specimens of all symptomatic elms to the Colorado State Forest Service for diagnosis, revealing that 1,296 Denver elms were lost to the disease. The disease was reported in one new county (Elbert) for the first time in 1975 (see map). The disease has been reported in 22 of the 63 Colorado counties. The Colorado State Forest Service, in cooperation with the U. S. Forest Service and Northeast Forest Experiment Station, initiated an elm bark beetle-trapping study. Twenty-five hundred pheromone-baited sticky traps were used to attract the insect. Indications were that the population is quite low.

BLACK STAINING ROOT DISEASE, *Verticicladiella wagenerii* Kend.

This root disease was confirmed on pinyon pine in 10 western counties of Colorado (see map). The fungus has not been detected east of the Continental

Divide. Black staining root disease is limited to pinyon pine as a host in Colorado, although other susceptible tree species were found within infection centers. Many infection centers were approximately one acre in size. Root contacts have been implicated in local spread of the disease; bark beetles are suspected as long-range vectors of the fungus.

PONDEROSA PINE DECLINE

The cause of decline and mortality of ponderosa pine in Fawn Gulch on the Pagosa Ranger District, San Juan National Forest, was determined. *Ips* spp. attacking the bole in mid-crown carry a blue stain fungus, *Ceratocystis minor* (Hedg.) Hunt, which is pathogenic to ponderosa pine. The fungus spreads within the water-conducting tissues over a 2 to 3 year period, resulting in desiccation of the crown, needle shed, and growth loss. Other *Ips* spp. and secondary insects were noted in affected trees.

ROOT DISEASES

SHOESTRING ROOT ROT, *Armillariella (Armillaria) mellea* (Vahl. ex Fr.) Karst.

This disease is common in regenerated lodgepole pine cutovers (up to 25 years old) in Colorado and southern Wyoming. This disease has also been a problem in ponderosa pine in a few areas of the Black Hills of South Dakota.

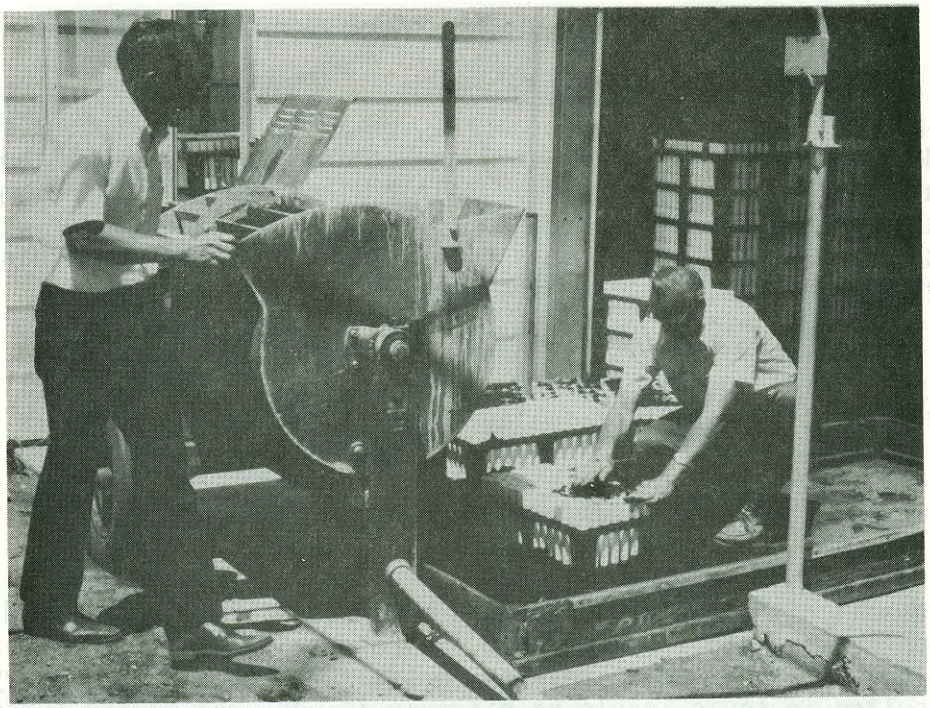
The fungus was diagnosed as the cause of disease centers (up to one acre in size) in pinyon pine stands near Buena Vista, Poncha Springs, Cotopaxi, and Gardner, Colorado. Additional work is needed to define the extent and impact of *A. mellea* in this forest type.

Other tree species in the Region affected by *A. mellea* include subalpine fir, Colorado blue spruce, Engelmann spruce and aspen. No analysis of the impact of the disease on these species is available.

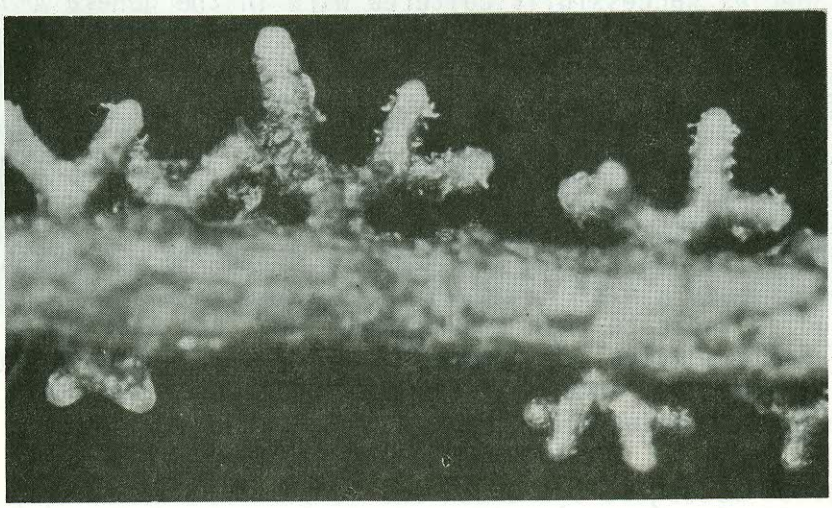
WHITE MOTTLED ROT, *Ganoderma applanatum* (Pers. ex Wallr.) Pat (= *Fomes applanatus*).

This rot is common in aspen windthrow. Following a severe windstorm in the fall of 1971, 86 percent of the blowdown in a Colorado aspen stand, located on Missionary Ridge in the San Juan National Forest, exhibited signs of infection; whereas, only 5.2 percent of residual standing trees showed evidence of the fungus. These data suggest a strong, positive relationship between susceptibility of infected trees to windthrow.

Knowledge of the incidence of this fungus in recreation sites is needed to reduce the hazard to the public of infected aspen.



Inoculation of peat-vermiculite mix with the mycorrhizal fungus, *Pisolithus tinctorius*. Ponderosa pine seeds will be sown in each container cell.



Dichotomous branching rootlets indicate successful mycorrhizal formation on ponderosa pine seedlings.

APPENDIX

REPORT TITLE	FPM FILE DESIGNATION	NUMBER OF PAGES
Fading Ponderosa Pine on the Mancos, Animas and Pagosa Districts, San Juan National Forest	R2-75-12	2
Spruce Beetle Biological Evaluation in the "Greenhorn Sale Area," Pike and San Isabel National Forests	R2-75-13	1
Biological Evaluation (Mountain Pine Beetle), Medicine Bow National Forest	R2-75-14	1
Biological Evaluation of Douglas-Fir Beetle Near Douglas Pass	R2-75-15	1
Recreation Site Examinations, Rio Grande National Forest, Del Norte and Creede Ranger Districts	R2-75-16	5
Mountain Pine Beetle Evaluation, Routt National Forest	R2-75-17	2
Biological Evaluation of Spruce Beetle near the Workman and Fernwood Sale, Rio Grande National Forest	R2-75-18	2
Mountain Home Tract, Wyoming State Forest Service, (LPP Dwarf Mistletoe Evaluation)	R2-75-19	5
Mountain Pine Beetle, Colorado Middle Park, Arapaho-Roosevelt National Forests, Bureau of Land Management, State and Private Lands	R2-75-20	2
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Mountain Pine Beetle, Colorado Front Range, Arapaho-Roosevelt, Pike-San Isabel National Forests, and Rocky Mountain National Park	R2-75-22	4
Western Spruce Budworm, Federal Lands in Colorado	R2-75-23	5
Mountain Pine Beetle, Green Mountain, Lander Bureau of Land Management Office, Wyoming	R2-75-24	2
Mountain Pine Beetle, Shoshone National Forest, Bureau of Land Management, State and Private Land, South Pass City, Atlantic City, Wyoming	R2-75-25	15

REPORT TITLE	FPM FILE DESIGNATION	NUMBER OF PAGES
White Fir Needle Miner and Western Spruce Budworm Defoliation, South Central Colorado, Bureau of Land Management, and Private Lands	R2-75-26	7
Post Control Evaluations - Dwarf Mistletoe Control Projects, Routt National Forest, North Park Ranger District	R2-75-27	46
Dwarf Mistletoe, Clint Creek Timber Stand Improvement Project, Shoshone National Forest, Wind River Ranger District	R2-75-28	17
Mountain Pine Beetle, Black Hills of South Dakota and Wyoming	R2-75-29	6
Tip Moth in Ponderosa Pine Provenance Planting at Horning State Farm, Plattsmouth, Nebraska	R2-75-30	7

LISTING OF CURRENT FOREST INSECT AND DISEASE PROJECTS FOR THE ROCKY MOUNTAIN REGION 1/ 1975

1/ Includes projects conducted by the USDA - Forest Service, State and Private Forestry (USFS - R-2) and Rocky Mountain Forest and Range Experiment Station (RMFRES); Colorado State Forest Service (CSFS); Colorado State University (CSU); Kansas State University (KSU); South Dakota State University (SDSU); University of Nebraska (UN); and the University of Wyoming (UW). Projects are listed in the above order.

FOREST INSECTS

BARK BEETLES

Mountain Pine Beetle

Preventive spraying of carbaryl against mountain pine beetle attacks (USFS - R-2).

Cutting strategies to reduce probability of mountain pine beetle epidemics in lodgepole pine (USFS - R-2).

Comparative study of survey methods for use in mountain pine beetle infestations in lodgepole pine (USFS - R-2).

Aerial survey of the mountain pine beetle in the Black Hills (USFS - R-2).

Aerial survey of the mountain pine beetle in the Colorado Front Range (USFS - R-2).

Buildup ratio survey of the mountain pine beetle in the Black Hills (USFS - R-2).

Buildup ratio survey of the mountain pine beetle in the Colorado Front Range (USFS - R-2).

Refinement of preventive spraying of carbaryl against mountain pine beetle attacks (USFS - R-2).

Development of laboratory techniques for rearing Black Hills beetles (mountain pine beetle) using limber pine as host (RMFRES).

Screening tests in a search for repellents of mountain pine beetles (RMFRES).

Protecting ponderosa pine from attacks by mountain pine beetles (RMFRES).

Population characteristics - mountain pine beetle in ponderosa pine, Kaibab Plateau, Arizona (RMFRES).

Spruce Beetle

Net impact of spruce beetle outbreaks on the White River National Forest, 1939 - 1951 (USFS - R-2).

Refinement of the lethal trap tree method for spruce beetle control (USFS - R-2).

Engelmann spruce beetle populations in unmerchantable material resulting from logging (RMFRES).

Engelmann spruce beetle populations in stumps (RMFRES).

Spruce beetle populations in blowdown (RMFRES).

Other Bark Beetles

Polyethylene sheeting for control of *Dendroctonus adjunctus* in felled trees (RMFRES).

Pheromone trapping of the lesser European elm bark beetle (CSFS; NEFES (Delaware, Ohio).

Cacodylic acid studies on Dutch elm disease - translocation and effects on bark beetle broods (CSU).

Phermone trapping studies of the elm bark beetle (CSU; CSFS; RMFRES).

Parasite release studies, *Dendroster protuberans* (hymenopterous parasitoid of Dutch elm bark beetles) (CSU; Colorado Department of Agriculture).

DEFOLIATORS

Douglas-Fir Tussock Moth

Ground application of *Bacillus thuringiensis* for control of the Douglas-fir tussock moth (USFS - R-2; PNWFRES).

Efficacy of ground applications of *Bacillus thuringiensis* against the Douglas-fir tussock moth (RMFRES).

Natural enemies of the Douglas-fir tussock moth in the Southwest (RMFRES).

Control of Douglas-fir tussock moth with insecticides (CSU).

Spruce Budworm

Ground application of malathion, acephate, and carbaryl for western spruce budworm (USFS - R-2).

Spruce budworm egg mass survey (USFS - R-2).

Ground application of acephate for western spruce budworm (USFS - R-2).

Needle Miners

Variation in biology and behavior of *Epinotia meritana* Heinrich in Colorado (USFS - R-2).

Studies of needle miner, *Coleotechnites* n. sp., on pinyon pine (CSU).

Studies of *Contarinia coloradensis* on ponderosa pine (CSU).

Physiological studies of needle gall formation (CSU).

Biology of pinyon needle gall midges (CSU).

Development of an insect-parasite-host population model for the spindle needle midge, *Pinyonia edulieola* (CSU).

Other Defoliators

A biological study of *Halisidota* sp. on ponderosa pine in Colorado (RMFRES).

Evaluation of chemicals for control of elm leaf beetle on Siberian elm (CSU).

REPRODUCTION INSECTS

Tip Moths

Tip moth study in ponderosa pine provenance planting at Horning State Farm, Plattsmouth, Nebraska (USFS - R-2; RMFRES).

Impact of southwestern pine tip moth damage on ponderosa pine regeneration (RMFRES).

Biology of *Petrova luculentana* (RMFRES).

Survey for sources of ponderosa pine "resistant" to *Petrova luculentana* (RMFRES).

Distribution of *Petrova luculentana* (RMFRES; ARS, Beltsville, Maryland).

Screening synthetic attractants of male olethreutid moths attacking ponderosa pine (RMFRES; ARS, Beltsville, Maryland).

Studies of tip moth, *Petrova arizonensis* on pinyon pine (CSU).

Identification, biology and control of pine tip moths in the genus *Rhyacionia* (KSU).

SHELTERBELT INSECTS

Tests of insecticides for control of borers in green ash (RMFRES).

Borer-drought relationship study in green ash (RMFRES).

Influence of trapping males on the relative abundance of ash borer in North Dakota shelterbelts (RMFRES; Ohio Agricultural Research and Development Center).

Biological evaluation of the spring cankerworm, *Paleacrita vernata* (Peck) (RMFRES).

Seasonal activity of the carpenterworm (RMFRES).

Biology and control of insects and related arthropods attacking forest and windbreak tree species (KSU).

Cankerworm control in shelterbelts (SDSU).

SEED AND CONE INSECTS

Seed and cone insects affecting seed production in Engelmann spruce, *Picea engelmannii* Parry, in the central Rocky Mountains (RMFRES).

OTHER INSECTS

A new species of *Glypta* (Hymenoptera: Ichneumonidae) from Colorado and Utah (USFS - R-2).

The effects of sagebrush eradication in insect populations (RMFRES).

Dwarf mistletoe pollination (RMFRES).

Fog as a vehicle for dispersal of *Bacillus thuringiensis* (RMFRES; NDSU).

Nectar analysis of dwarf mistletoe (CSU; RMFRES).

Arthropod pests of landscape trees and shrubs (CSU).

FOREST DISEASES

DWARF MISTLETOES

Effects of thinning and pruning on the incidence of dwarf mistletoe in lodgepole pine (USFS - R-2).

Silvicultural control of dwarf mistletoe in young lodgepole pine stands (USFS - R-2; RMFRES).

Life tables for lodgepole and ponderosa pine dwarf mistletoes (RMFRES).

Resin disease of lodgepole pine dwarf mistletoe (RMFRES; CSFS; CSU).

Life cycle of lodgepole pine dwarf mistletoe (RMFRES).

Taxonomy, host ranges and geographic distribution of the genus *Arceuthobium* (RMFRES).

Ecologic factors affecting the distribution and abundance of dwarf mistletoes (RMFRES).

Pollination ecology of dwarf mistletoes (RMFRES).

Economic analysis of dwarf mistletoe control in southwestern ponderosa pine (RMFRES; INTFRES; USFS - R-3).

Development and refinement of yield simulation procedures for dwarf mistletoe infested ponderosa pine and lodgepole pine stands (RMFRES).

Silvicultural control of dwarf mistletoe in uneven-aged ponderosa pine (RMFRES).

Silvicultural control of dwarf mistletoe in two-aged ponderosa pine (RMFRES).

Silvicultural control of dwarf mistletoe in a ponderosa pine recreation forest (Grand Canyon National Park, Arizona) (RMFRES).

Silvicultural control of dwarf mistletoe on a large commercial ponderosa pine forest (Mescalero Apache Reservation, New Mexico) (RMFRES).

Interrelationships between birds and ponderosa pine dwarf mistletoe (RMFRES; CSU).

Evaluation of thinning to various levels in mistletoe-infested lodgepole pine stands (RMFRES).

Quantification of rates of spread and intensification of ponderosa pine dwarf mistletoe (RMFRES; CSU).

Effects of pruning on oleoresin pressure in dwarf-mistletoed and healthy ponderosa pines (RMFRES; CSU).

Development of a computer-based information retrieval system (FAMULUS) for the world mistletoe literature (RMFRES).

Biology, ecology, and taxonomy of three Arizona white pine dwarf mistletoes (RMFRES; University of Arizona).

STEM RUSTS

Development of silvicultural guidelines for lodgepole pine stands infected with Comandra blister rust (USFS - R-2).

Recent discoveries extend known distribution of two destructive diseases of limber pine in Wyoming (USFS - R-2).

ROOT DISEASES

Armillariella mellea in pinyon pine stands (USFS - R-2).

Black stain root disease in Colorado (USFS - R-2; CSFS).

Root diseases of aspen in Wyoming (UW).

DECAYS

Survey for *Fomes fraxinophilus* stem rot of green ash in Nebraska - Praire States Forestry Project Windbreaks (USFS - R-2; RMFRES).

Rate of deterioration of beetle-killed Engelmann spruce in Colorado (RMFRES).

VASCULAR WILTS

New locations of oak wilt in Kansas and Nebraska (USFS - R-2).

Dutch elm disease survey and evaluation (CSFS).

Dutch elm disease population dynamics (CSFS).

Chemical control of Dutch elm disease (CSU; CSFS).

STEM CANKERS

An evaluation of aspen cankers and stem rots in relation to timber harvesting methods (USFS - R-2; R-3; RMFRES).

Etiology of aspen cankers (RMFRES).

Pathogenicity of Ceratocystis and Nectria-like cankers of aspen (RMFRES; NCFRES; University of Minnesota; Syracuse University).

Study of honey locust canker, *Thyronectria austro-americana* (CSU).

FOLIAGE DISEASES

Foliage diseases of conifers in the Rocky Mountains and Southwest (RMFRES).

Lophodermium needle casts of Scots pine Christmas trees: biology and control (RMFRES; Northwest Christmas Tree Growers' Association).

Type specimen study of Lophodermia of pines (RMFRES).

Exhaust pollutant effects on photosynthesis of ponderosa pine seedlings (RMFRES; CSU).

Highway salting influences on ponderosa pine seedlings (RMFRES; CSU).

Dothistroma pini resistance in ponderosa pine (RMFRES).

Inheritance of resistance to *Dothistroma pini* in Austrian pine (RMFRES).

Pathological histology of Dothistroma needle blight of pines (RMFRES).

Naemacyclus niveus needle cast of pines: damage, epidemiology, and control (RMFRES).

Diplodia tip blight of pines: infection (RMFRES).

Control of brown spot of Scotch pine caused by *Scirrhia acicola* (KSU).

NURSERY DISEASES

Nitrogen fertilizer injuries pine seedlings in Rocky Mountain nursery (USFS - R-2).

Foliage nutrient levels for three Rocky Mountain tree species (USFS - R-2).

Pathological histology of eastern red cedar infected with *Phomopsis juniperovora* (RMFRES).

Cercospora blight of junipers: infection and geographic distribution (RMFRES).

Soil fumigation for production of hardwood nursery stock: effects on seedling growth, mycorrhizae, root-pathogenic fungi and nematodes (RMFRES).

Herpobasidium deformans blight of honeysuckle (RMFRES).

Chemical control of Phomopsis blight of junipers (RMFRES; SDSU; Oklahoma State University; University of Missouri; University of Rhode Island).

RECREATION SITE PATHOLOGY

Tree hazards: recognition and reduction in recreation sites (USFS - R-2).

Aspen mortality in Rocky Mountain campgrounds (RMFRES).

SHELTERBELT DISEASES

Etiology of Russian-olive canker (RMFRES).

Botryodiplodia hypodermia canker of Siberian elm: factors affecting fungal growth and disease development (RMFRES).

MYCORRHIZAE

Artificial inoculation of ponderosa pine, *(Pinus ponderosa* Laws), seedlings with a mycorrhizal fungus to improve planting success (USFS - R-2; CSFS; CSU).

Indigenous mycorrhizal fungi of Colorado forests as related to successful forest reproduction (USFS - R-2).

Ectomycorrhizae of container seedlings: production of symbiont inoculum, synthesis of mycorrhizae, and effects on survival and growth of seedlings in field plantings (RMFRES).

Role of ectomycorrhizas in conversion of nitrogen from inorganic to organic forms (CSU).

Selection and induction of drought-resistance in trees from ectotypes in the Colorado Front Range (includes mycorrhizas) (CSU).

OTHER DISEASES

A study of paraquat-induced blue stain inhibition and oleoresin modification in ponderosa pine (CSU).

Stimulation healing of pruning scars in shade trees by chemical sprays (CSU).

Taxonomy of the genus *Ceratocystis* (CSU).

Fungi causing decays of native trees in Taiwan (CSU).

USDA - FOREST SERVICE, DETECTION REPORT
FOREST INSECT AND DISEASE DAMAGE
R-2 5200-2

To encourage forest pest reporting for the Rocky Mountain Region, we invite all interested agencies to complete Form R-2 5200-2 which was revised this past year. Instructions for completing the form are found at the top of the page on each form.

Copies of R-2 5200-2 are available upon request from the Forest Service, State and Private Forestry, Forest Pest Management, 11177 West 8th Avenue, Post Office Box 25127, Lakewood, Colorado 80225, Phone (303) 234-4877.

Whenever possible, insect or disease specimens or damage samples should be submitted with the form. Resource managers of Federal forest lands should submit specimens for identification to the Forest Pest Management Staff at the above address. Managers of non-Federal forest lands in Colorado, Kansas, Nebraska, South Dakota, and Wyoming should send detection reports and specimens to their respective state forestry organizations. A complete listing follows:

STATE FORESTRY ORGANIZATIONS

Colorado State Forest Service
State Forester - Thomas B. Borden
Colorado State University
Fort Collins, Colorado 80523
Telephone: 482-8185, 491-6304/6305
(AC 303)

Kansas State and Extension Forestry
State and Extension Forester
Harold G. Gallaher
Forestry Building, 2610 Claflin Road
Manhattan, Kansas 66502
Telephone: 532-5752 (AC 913)

Nebraska State and Extension Forestry
Chairman, Department of Forestry and
State Forester - Mitchell D. Ferrill
201 Miller Hall
University of Nebraska
Lincoln, Nebraska 68503
Telephone: 472-2944
(AC 402)

South Dakota State Division of Forestry
Director of Forestry - James D. Verville
Sigurd Anderson Building
Pierre, South Dakota 57501
Telephone: 224-3481 (AC 605)

Wyoming State Forestry Division
State Forester - Carl E. Johnson
1100 W. 22nd Street
Room 113 Capitol Building
Cheyenne, Wyoming 82002
Telephone: 777-7586 (AC 307)

USDA–Forest Service

USDA - FOREST SERVICE
DETECTION REPORT
FOREST INSECT AND DISEASE DAMAGE

INSTRUCTIONS: After detection of insect or disease activity
(a) Immediately prepare detection report in 4 parts.
(b) Part 1 & 2 sent to Regional Forester, Forest Service, S&PF, USDA, 11177 W 8th Ave. P.O. Box 25127, Lakewood, Colorado 80225.
(c) Send Part 3 to Supervisor Unit
(d) Retain Part 4
(e) Forest Pest Mgmt. will acknowledge, answer and return.

PEST DETECTION IS FOR YOUR PROTECTION

Be alert. Report promptly any new or unusual forest pest to the Regional Forester (See FSM 5220). · Forest Pest Management ·

Pest Management action on your Detection Report: _____ (date)

- ☐ Answer
- ☐ Lab rearing & will reply at later date.
- ☐ Sent out for identification & will reply at later date.
- ☐ Sample was damaged, please send another under different packaging.

Administrative Unit _____ (Forest, National Park, etc.)

Sub-Unit _____ (Ranger, District, etc.)

Date of Observation _____

Observed by _____

Location of Damage (Attach ¼" scale map)

_____

_____

GENERAL INFORMATION

Host _____ Avg. d.b.h. _____

Size class affected:
- ☐ Seedlings
- ☐ Saplings
- ☐ Poles
- ☐ Sawtimber
- ☐ Overmature timber

Damaged standing Stems/acre _____

Down stems/acre _____ (Blowdown, slash, cull, etc.)

Number of acres infested _____

Damage to:
- ☐ Single Trees
- ☐ Groups _____ (No. of) _____ (No. per)

TREE DAMAGE SYMPTOMS–(Check term(s) applicable)

Crown:
- ☐ Top
- ☐ Middle
- ☐ Lower
- ☐ Entire
- ☐

Needles or leaves:
- ☐ Chewed
- ☐ Mined
- ☐ Webbed
- ☐ Spotted
- ☐ Discolored
- ☐ Missing

Tree foliage:
- ☐ Green
- ☐ Fading
- ☐ Sorrel
- ☐ Red
- ☐ Brown
- ☐ Black

Enclosures:
- ☐ Appropriate Maps
- ☐ Damage Samples
- ☐ Insect Specimens

Damage to:
- ☐ New Foliage
- ☐ Old Foliage
- ☐ Both

Tree bole:
- ☐ Cracked
- ☐ Sluffed bark
- ☐ Boring dust
- ☐ Pitch tubes
- ☐ Woodpecker feeding
- ☐ Canker
- ☐ Conks
- ☐ Pitch flow

Branches:
- ☐ Broken
- ☐ Swollen
- ☐ Discolored
- ☐ Cankers
- ☐ Mistletoe shoots
- ☐ Girdled
- ☐ Brooms

Associated disturbance:
- ☐ Fire
- ☐ Logging
- ☐ Thinning
- ☐ Blowdown
- ☐ Insects
- ☐ Disease

Unusual weather conditions:
- ☐ Wind
- ☐ Rain
- ☐ Hail
- ☐ Sleet
- ☐ Snow
- ☐ Flood
- ☐ Drought

INFESTATION OR INFECTION CHARACTERISTICS

Insect(s) or Disease(s) if known _____ How long active _____

Status: Static _____ Decreasing _____ Increasing _____ Unknown _____

Remarks: _____

(FOR REGIONAL OFFICE USE ONLY)

Remarks:

Unisort Cards _____ (Yr Pest No) Date _____ Acknowledged By _____

R-2 5200-2 (3/75)

INDEX OF INSECTS

INDEX OF INSECTS
(Continued)

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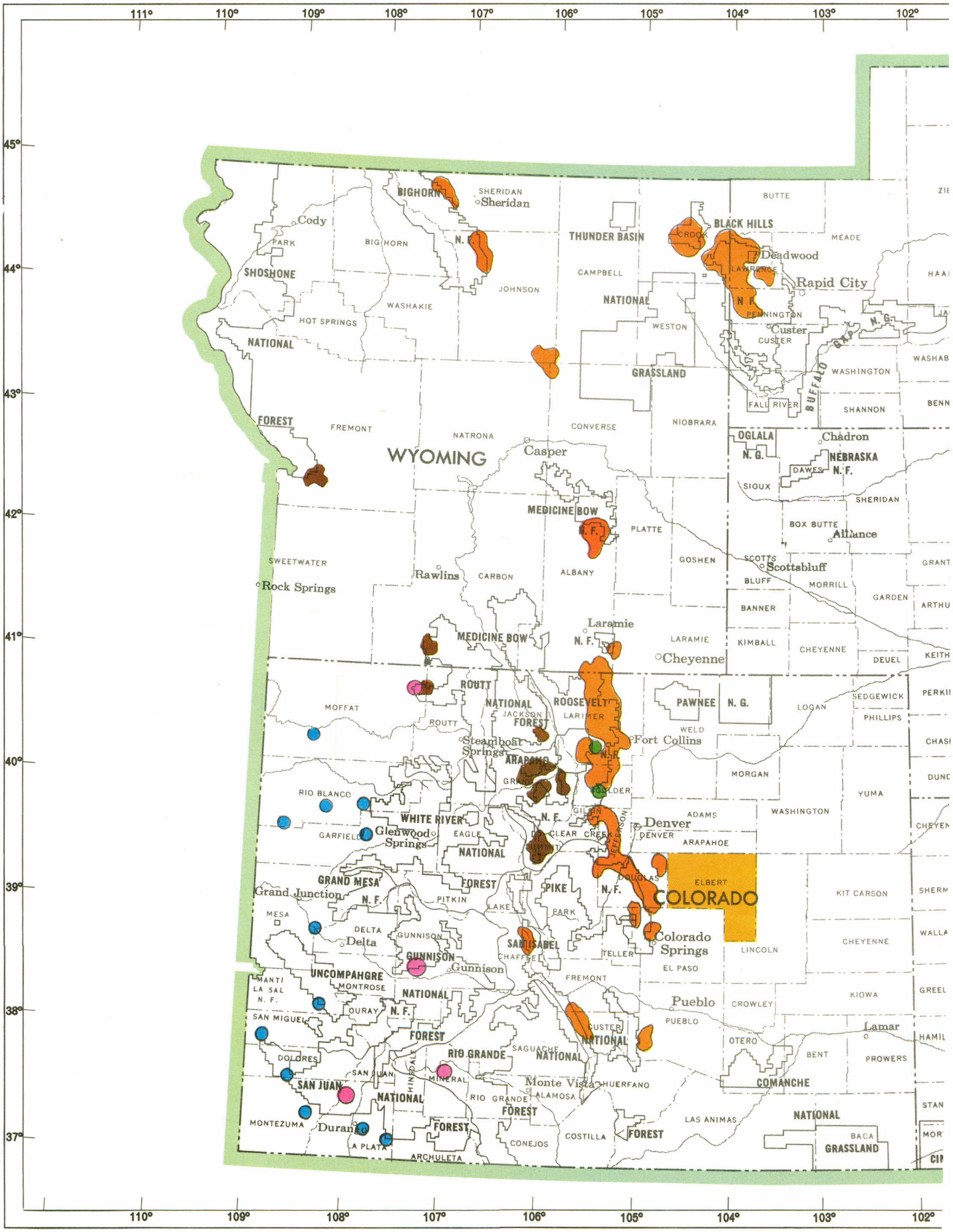
INDEX OF DISEASES

1/ Colorado (C)
Kansas (K)
Nebraska (N)
South Dakota (SD)
Wyoming (W)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WASHAKIE
HOT SPRINGS
NATIONAL
FOREST
FREMONT
NATRONA
Casper
CONVERSE
NIOBRARA
THUNDER BASIN
CAMPBELL
NATIONAL
GRASSLAND
WESTON
BUTTE
CROOK
BLACK HILLS
MEADE
Deadwood
LAWRENCE
Rapid City
N. F.
PENNINGTON
Custer
CUSTER
BUFFALO GAP N. G.
WASHINGTON
FALL RIVER
SHANNON
OGLALA N. G.
Chadron
NEBRASKA
DAWES N. F.
SIOUX
SHERIDAN
BOX BUTTE
Alliance
MEDICINE BOW N. F.
PLATTE
GOSHEN
SCOTTS BLUFF
Scottsbluff
SWEETWATER
Rock Springs
Rawlins
CARBON
ALBANY
BANNER
MORRILL
GARDEN
Laramie
MEDICINE BOW
N. F.
LARAMIE
KIMBALL
CHEYENNE
Cheyenne
DEUEL
ROUTT
NATIONAL
FOREST
ROOSEVELT
LARIMER
PAWNEE N. G.
SEDGEWICK
LOGAN
PHILLIPS
MOFFAT
ROUTT
JACKSON
Steamboat Springs
WELD
Fort Collins
ARAPAHO
N. F.
MORGAN
YUMA
RIO BLANCO
GILPIN
ADAMS
WASHINGTON
WHITE RIVER
N. F.
Denver
GARFIELD
Glenwood Springs
EAGLE
CLEAR CREEK
JEFFERSON
DENVER
ARAPAHOE
NATIONAL
FOREST
GRAND MESA
Grand Junction
N. F.
PITKIN
LAKE
PARK
PIKE
N. F.
DOUGLAS
ELBERT
KIT CARSON
MESA
DELTA
GUNNISON
Delta
SAN ISABEL
CHAFFEE
TELLER
Colorado Springs
LINCOLN
CHEYENNE
GUNNISON
Gunnison
EL PASO
UNCOMPAHGRE
MONTROSE
MANTI LA SAL N. F.
NATIONAL
FOREST
FREMONT
Pueblo
CROWLEY
KIOWA
OURAY
N. F.
SAN MIGUEL
PUEBLO
CUSTER
NATIONAL
FOREST
Lamar
OTERO
BENT
PROWERS
DOLORES
RIO GRANDE
NATIONAL
FOREST
SAGUACHE
SAN JUAN
HINSDALE
MINERAL
Monte Vista
HUERFANO
COMANCHE
SAN JUAN
NATIONAL
FOREST
RIO GRANDE
ALAMOSA
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LA PLATA
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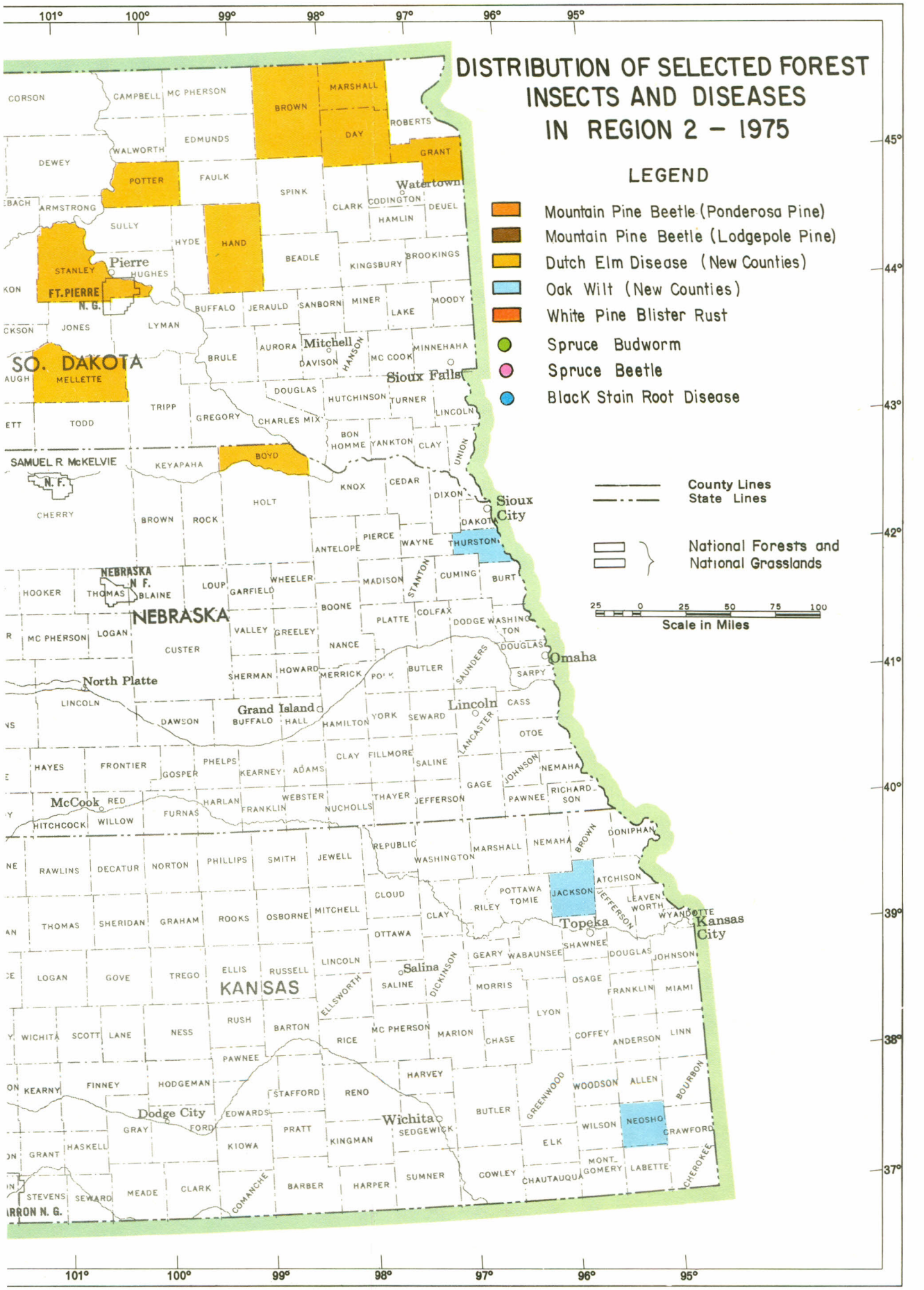
NATIONAL
BACA
GRASSLAND


DISTRIBUTION OF SELECTED FOREST INSECTS AND DISEASES IN REGION 2 – 1975
LEGEND
Mountain Pine Beetle (Ponderosa Pine)
Mountain Pine Beetle (Lodgepole Pine)
Dutch Elm Disease (New Counties)
Oak Wilt (New Counties)
White Pine Blister Rust
Spruce Budworm
Spruce Beetle
Black Stain Root Disease
County Lines
State Lines
National Forests and National Grasslands
25 0 25 50 75 100
Scale in Miles
SO. DAKOTA
NEBRASKA
KANSAS
Pierre
Watertown
Mitchell
Sioux Falls
Sioux City
Omaha
North Platte
Grand Island
Lincoln
McCook
Dodge City
Salina
Wichita
Topeka
Kansas City
SAMUEL R McKELVIE N. F.
NEBRASKA N. F.
FT. PIERRE N. G.
CORSON
CAMPBELL
MC PHERSON
MARSHALL
BROWN
ROBERTS
DAY
GRANT
DEWEY
WALWORTH
EDMUNDS
POTTER
FAULK
SPINK
CLARK
CODINGTON
DEUEL
HAMLIN
ARMSTRONG
SULLY
HYDE
HAND
BEADLE
KINGSBURY
BROOKINGS
STANLEY
HUGHES
BUFFALO
JERAULD
SANBORN
MINER
LAKE
MOODY
JONES
LYMAN
AURORA
DAVISON
HANSON
MC COOK
MINNEHAHA
BRULE
MELLETTE
DOUGLAS
HUTCHINSON
TURNER
LINCOLN
TRIPP
GREGORY
CHARLES MIX
TODD
BON HOMME
YANKTON
CLAY
UNION
BOYD
KEYAPAHA
KNOX
CEDAR
DIXON
CHERRY
BROWN
ROCK
HOLT
DAKOTA
PIERCE
WAYNE
THURSTON
ANTELOPE
HOOKER
THOMAS
BLAINE
LOUP
GARFIELD
WHEELER
MADISON
STANTON
CUMING
BURT
BOONE
PLATTE
COLFAX
DODGE
WASHINGTON
MC PHERSON
LOGAN
VALLEY
GREELEY
CUSTER
NANCE
DOUGLAS
SHERMAN
HOWARD
MERRICK
BUTLER
SAUNDERS
SARPY
LINCOLN
DAWSON
BUFFALO
HALL
HAMILTON
YORK
SEWARD
LANCASTER
CASS
OTOE
HAYES
FRONTIER
GOSPER
PHELPS
KEARNEY
ADAMS
CLAY
FILLMORE
SALINE
JOHNSON
NEMAHA
GAGE
RICHARDSON
RED WILLOW
HITCHCOCK
FURNAS
HARLAN
FRANKLIN
WEBSTER
NUCKOLLS
THAYER
JEFFERSON
PAWNEE
REPUBLIC
WASHINGTON
MARSHALL
NEMAHA
BROWN
DONIPHAN
RAWLINS
DECATUR
NORTON
PHILLIPS
SMITH
JEWELL
CLOUD
POTTAWATOMIE
RILEY
JACKSON
ATCHISON
JEFFERSON
LEAVENWORTH
WYANDOTTE
THOMAS
SHERIDAN
GRAHAM
ROOKS
OSBORNE
MITCHELL
CLAY
OTTAWA
SHAWNEE
DOUGLAS
JOHNSON
LOGAN
GOVE
TREGO
ELLIS
RUSSELL
LINCOLN
SALINE
DICKINSON
GEARY
WABAUNSEE
OSAGE
FRANKLIN
MIAMI
ELLSWORTH
MORRIS
LYON
WICHITA
SCOTT
LANE
NESS
RUSH
BARTON
RICE
MC PHERSON
MARION
CHASE
COFFEY
ANDERSON
LINN
PAWNEE
HARVEY
KEARNY
FINNEY
HODGEMAN
STAFFORD
RENO
GREENWOOD
WOODSON
ALLEN
BOURBON
GRAY
FORD
EDWARDS
PRATT
KINGMAN
SEDGWICK
BUTLER
WILSON
NEOSHO
CRAWFORD
GRANT
HASKELL
KIOWA
ELK
STEVENS
SEWARD
MEADE
CLARK
COMANCHE
BARBER
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SUMNER
COWLEY
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