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FOREST PEST MANAGEMENT

ANNUAL REPORT for 1981



FOREST PEST MANAGEMENT

1981

ANNUAL REPORT

ROCKY MOUNTAIN REGION

by

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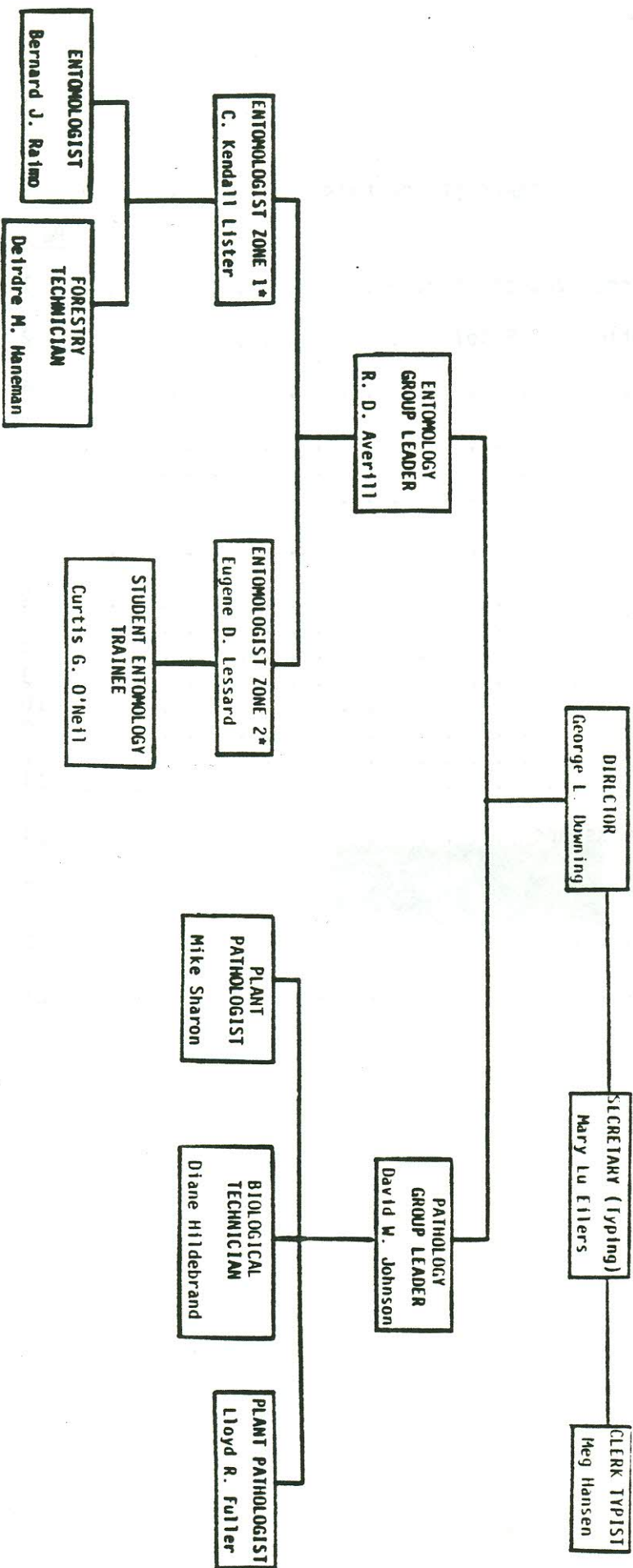
Timber, Forest Pest, and
Co-op Forestry Management
Rocky Mountain Region
USDA Forest Service
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TABLE OF CONTENTS

	<u>Page</u>
Forest Pest Management Organization Chart	1
Insect and Disease Conditions in Brief	2
Status of Insects	4
Bark Beetles	4
Defoliators	5
Other Insects	7
Status of Diseases	9
Dwarf Mistletoes	9
Blister Rust	9
Armillaria Root Rot	9
Pine Needlecast	9
Diplodia Tip Blight	10
Ash Heart Rot	10
Air Pollution Survey	10
Other Diseases	14
Forest Pest Management Workshops	19
Pesticide Use in Region 2	20
Active Projects in R-2	22
Recent Publications	27

Effective April 18, 1982, Forest Pest Management will be transferred from State and Private Forestry to the new Staff Unit known as Timber, Forest Pest, and Cooperative Forestry Management.

FOREST PEST MANAGEMENT
ORGANIZATION CHART



* Zone 1 - Colorado; Zone 2 - Kansas, Nebraska, South Dakota and Wyoming

CONDITIONS IN BRIEF

Mountain pine beetle (MPB) remains the most destructive forest pest in the Rocky Mountain Region. Mortality of ponderosa pine caused by MPB in the Black Hills of South Dakota and Wyoming is nearly equal that reported in 1980. MPB caused ponderosa pine mortality increased around Casper Mountain and Laramie Peak in Wyoming and decreased along the Front Range in Colorado. MPB caused ponderosa pine mortality increased on the White River, Routt and Arapaho and Roosevelt National Forests in Colorado, Medicine Bow National Forest and Casper Mountain and decreased on the Shoshone National Forest in Wyoming.

An increase in spruce beetle activity was detected on the Routt and Rio Grande National Forests. Approximately 75,000 beetle killed spruce were found in two separate infestation centers.

The western spruce budworm remains at epidemic levels mainly in Colorado. Approximately 2.2 million acres are currently infested. This represents about a 2 fold increase in acres infested over the 1980 estimate.

Lodgepole pine dwarf mistletoe and comandra blister rust continue as the two most damaging diseases in the Rocky Mountain Region. This year, using Forest Pest Management (FPM) funding, 24,946 acres were surveyed for dwarf mistletoe while suppression was completed on 2,174 acres. FPM also provided funds to Colorado State University to evaluate effects of lodgepole pine dwarf mistletoe and comandra rust on cone and seed production.

Spring of 1981 provided ideal conditions for foliage diseases. A marked increase in the following foliage diseases was observed: Shepherd's crook on aspen, Phomopsis blight on juniper, Rhizosphaera needlecast of spruce, Marssonina blight on aspen, and red band needle blight on pines.

A survey conducted in cooperation with the Rocky Mountain Forest and Range Experiment Station, Lincoln, Nebraska, for green ash heartrot in Kansas and Nebraska showed the disease in 86% of the counties surveyed.

Surveys for Armillaria root rot and insect associations revealed that this disease is associated with 57% of mountain pine beetle killed ponderosa pine in the Colorado Front Range.

Forest Pest Management funding for the Federal Dutch Elm Disease Demonstration Project ended in 1981, however, of the 122 Colorado communities with significant elm populations, 62 are conducting excellent sanitation programs with guidance from the Colorado State Forest Service.

As of July 1981, the correct scientific name for the pine wood nematode has been changed from *Bursaphelenchus lignicolus* to *B. xylophilus* (Steiner and Buhrer) Nickle. Yankton County, South Dakota, is a new citing for the pine wood nematode.

Colorado is a new citing for *Fusarium avenaceum* (Fr.) Sacc. This disease has been implicated with the mortality of over 140,000 containerized Douglas-fir at a private nursery.

Ceratocystis wageneri Goheen & Cobb, the cause of black stain root disease, has been confirmed for the first time east of the Continental Divide. The initial citing was made by the Colorado State Forest Service on a Douglas-fir in the Indian Hills area (two miles east of Evergreen). Subsequent attempts to locate this Douglas-fir failed, but another *C. wageneri* infected Douglas-fir was found four miles away on North Turkey Creek by Forest Pest Management personnel.

STATUS OF INSECTS

BARK BEETLES

MOUNTAIN PINE BEETLE: *Dendroctonus ponderosae* Hopkins

The mountain pine beetle (MPB) continues to be the most significant bark beetle in Colorado, Wyoming and the Black Hills of South Dakota.

MPB in Colorado declined in ponderosa pine along the Front Range. Population increases in lodgepole pine occurred for the second year in the following areas: the White River National Forest, near the towns of Minturn and Eagle; the Routt National Forest, near Steamboat Lake; and on the Arapaho and Roosevelt National Forests, near the towns of Dillon and Tabernash.

In Wyoming, mortality is decreasing on the Shoshone National Forest in lodgepole pine, increasing on BLM Lands, Grend mountain, BLM, State and private lands on Casper Mountain and on the Medicine Bow National Forest south of Laramie Peak. Increases were also detected in ponderosa pine south of Laramie Peak, on Casper Mountain and in isolated stands east of Casper Mountain, and in the Bear Lodge Mountains.

Populations in the northern Black Hills of South Dakota are generally declining. Populations in the remainder of the Black Hills are endemic.

SPRUCE BEETLE: *Dendroctonus rufipennis* (Kirby)

Infestations in Englemann spruce occur on the Routt and Rio Grande National Forests. The infestation on the Routt is located on Rabbit Ears Peak, which was discovered the summer of 1980. The Rio Grande infestation was discovered during the fall of 1981.

The infestation on Rabbit Ears Peak involves about 2,500 acres of mostly Forest Service land and extends some onto private lands. After cursory examinations the number of infested trees is estimated to be 25,000. The trees became infested during the beetle flight during the summer of 1980. Forest personnel and private landowners are preparing timber sales to salvage the beetle-killed spruce.

The infestation on the Rio Grande is located in the Crystal Lakes-Race Creek area. The outbreak is 2,200 acres which was surveyed to evaluate the seriousness. There are 53,247 infested trees on the Rio Grande. Of these 12,670 were infested in 1980 and 40,577 were infested in 1981. Some trap trees were felled in the fall of 1981 to absorb some of the 1982 beetle flight. In addition, salvage sales will be made to remove the dead and infested trees in the next 2-4 years.

DOUGLAS-FIR BEETLE: *Dendroctonus pseudotsugae* Hopkins

Douglas-fir beetle populations occur in small scattered pockets throughout the Douglas-fir *Pseudotsuga menziesii* (Mirb) type in Colorado and in the Bighorn Mountains of Wyoming.

DEFOLIATORS

WESTERN SPRUCE BUDWORM: *Choristoneura occidentalis* Freeman

Western spruce budworm remains the most serious defoliator in the Rocky Mountain Region. The budworm caused noticeable defoliation on approximately 1.4 million acres and very light defoliation on .8 million acres of Douglas-fir and white fir, *Abies concolor* (Gord. & Glend) in Colorado and of Douglas-fir on the Shoshone National Forest in Wyoming.

Results of the 1981 egg mass survey indicate moderate (35 to 65 percent) to heavy (65 to 100 percent) defoliation will occur in 1982 on the Pike, San Isabel and Roosevelt National Forests in Colorado. Elsewhere in Colorado, it is likely budworm defoliation will continue in most of the defoliated areas of 1981 with a substantial probability for the severity to increase during 1982.

WESTERN TENT CATERPILLAR: *Malacosoma californicum* (Packard)

Severe aspen, *Populus tremuloides* Michx., defoliation by the tent caterpillar occurred on about 27,000 acres of private and San Juan National Forest lands in the vicinity of V-Rock Mountain near Pagosa Springs, Colorado. This is an increase of 9,000 acres over 1980. Some of the expansion occurred to the north of Buckles and Harris Lakes on the National Forest, and the greatest increase was also north on private land further up the Navajo River drainage. This outbreak was first reported in 1976.

Results of the 1981 egg mass survey indicate severe defoliation and expansion of the infestation will result. On the other hand, it could collapse due to a nucleopolyhedroses virus. Virus has been observed in the larval population for the past two years. Historically, western tent caterpillar infestations have collapsed suddenly with virus being credited as the major factor. However, we do not have the ability to predict an infestation collapse; at best, we can only point out the potential for an infestation collapse exists.

DOUGLAS-FIR TUSSOCK MOTH: *Orgyia pseudotsugata* (McDunnogh)

Douglas-fir tussock moth continues to be a problem of ornamental fir and spruce in the Colorado Springs and Denver metropolitan areas. However, no defoliation was detected in forested areas.

PONDEROSA PINE NEEDLE MINER: *Coleotechnites ponderosae* Hodges & Stevens, n.sp.

Damage again occurred in much of the ponderosa pine type along the Colorado Front Range and on the Uncompahgre Plateau, near Naturita. Some needle miner activity was also detected on the San Juan National Forest.

OTHER INSECTS - R-2

Insect	Host	Location	Remarks
Turpentine beetle <i>Dendroctonus valens</i>	Ponderosa pine	Colorado, South Dakota	Turpentine beetle has been found on the Manitou Experiment Forest and in the Black Hills in association with timber harvesting. Tree mortality due to this insect has not been observed.
Ips beetles <i>Ips</i> sp.	Ponderosa pine, pinyon pine, Todgepole pine	South Dakota, Wyoming, Kansas, Colorado	<i>Ips</i> beetles occurred in and around recently thinned stands and stands associated with fire.
Western balsam bark beetle <i>Dryocoetes confusus</i>	True fir	Colorado	Tree loss of alpine fir continues throughout its range in Region 2. Western balsam beetle seems to be closely associated with root decays.
<u>APHIDS</u>			
Cooley spruce gall aphid <i>Adelges cooleyi</i>	Spruce	Colorado	Detected mostly on ornamentals in Colorado.
<u>TIP & SHOOT MOTHS</u>			
Zimmerman pine moth <i>Dorycteria zimmermani</i> (Grote)	Austria pine, ponderosa pine, Scots pine	Nebraska, Kansas, Colorado	Occurs extensively in ornamentals and shelterbelts. The impact in shelterbelts has not been determined.
Pine tip moth <i>Rhyacionia</i> sp.	Austrian pine, ponderosa pine, Scots pine	Kansas	Occurs in nursery (Christmas tree) and ornamentals.
<i>R. neomexicana</i>	Ponderosa pine	Colorado	Occurs in nursery (Christmas tree) and ornamentals.

OTHER INSECTS (continued)

<u>Insect</u>	<u>Host</u>	<u>Location</u>	<u>Remarks</u>
<u>TIP AND SHOOT MOTHS (conti.)</u>			
Pitch nodule moth <i>Petrova</i> sp.	Autrian pine, ponderosa pine	Kansas, Nebraska, Colorado	A light infestation was discovered in plantations at the Air Force Academy. The infestation is decreasing.
<i>P. arizonensis</i>	Pinyon pine	Colorado	Light occurrences were noted on ornamentals.
<u>DEFOLIATORS - NEEDLE MINERS</u>			
Pine sawfly <i>Neodiprion</i> sp.	Ponderosa pine	Kansas	Endemic throughout the ponderosa and pinyon pine types in the Region.
<i>N. edulicolis</i>	Pinyon pine	Colorado	
<i>N. fulviceps</i>	Ponderosa pine	Colorado	Found occasionally on ornamentals.
Jack pine budworm	Jack pine	Nebraska	Populations remain at low levels after suppression in 1980.
Pine butterfly <i>Neophasia menapia</i>	Ponderosa pine	Colorado	Low level populations detected in Colorado.

STATUS OF DISEASES

LOGEPOLE PINE DWARF MISTLETOE: *Arceuthobium americanum* Nutt.

Action plans for survey and suppression of lodgepole pine dwarf mistletoe have been initiated or completed for the Redfeather and Sulfur Ranger Districts, Arapaho and Roosevelt National Forests; Brush Creek, Hayden and Laramie Ranger Districts, Medicine Bow National Forest; Cebolla and Taylor River Ranger Districts, Gunnison National Forest; and the Wyoming State Forest Service. These plans outline a systematic control strategy for dwarf mistletoe, thus allowing more efficient budgeting than was possible in the past.

Presuppression surveys for lodgepole pine dwarf mistletoe were conducted on 4,000 acres of the White River National Forest; 14,000 acres on the Arapaho and Roosevelt National Forests; and 6,946 acres on the Grand Mesa, Uncompahgre and Gunnison National Forests.

Control Operations: Dwarf mistletoe infected, nonmerchantable lodgepole pine were felled on 116 acres of State lands in Wyoming; 860 acres on the Shoshone National Forest; 1,138 acres on the Arapaho and Roosevelt National Forests; and 60 acres on the Medicine Bow National Forest.

COMANDRA BLISTER RUST: *Cronartium comandrae* Peck

The effects of *A. americanum* and comandra blister rust (*Cronartium comandrae*) on cone and seed production of infected lodgepole pine were evaluated in a FPM funded study at Colorado State University. Trees heavily infected with *C. comandrae* had significantly fewer cones and seeds because of significant reduction in live crown size. Trees heavily infected with dwarf mistletoe had significantly smaller cones and seeds which may have resulted from a reduction in tree vigor caused by this parasite.

ARMILLARIA ROOT ROT: *Armillariella mellea* (Vahl. ex. Fr.) Karst.

Armillaria root rot and its association with mountain pine beetle attacks was investigated on Colorado Front Range ponderosa pine. This disease occurred on 57% of all dead ponderosa pine with evidence of mountain pine beetle activity.

PINE NEEDLECAST: *Lophodermella cerina* (Darker)

An unknown needlecast fungus, tentatively identified as *Lophodermella cerina*, was noted in July on ponderosa pine throughout the eastern portion of the Black Hills in South Dakota. Affected trees were located

along roadsides from Deadwood south to Custer and east to Rapid City. It appeared that the disease has affected some trees over the past several years. Severely affected trees showed poor vigor, however, no mortality could be attributed to the fungus. The effects of the disease on tree growth and survival are unknown.

DIPLODIA TIP BLIGHT: *Diplodia pinea* (Desm.) Kickx.

Diplodia tip blight was first reported on ponderosa pine in the Black Hills of South Dakota during July 1979. During July 1980 and July 1981, additional surveys were conducted to determine the distribution of the disease throughout the Black Hills and to evaluate the potential impact of the disease on tree growth and survival. Results of three years survey indicate the disease occurs primarily along the eastern edge of the Hills with scattered locations around Spearfish (north end of the Hills) and Hot Springs (south end of the Hills) (See map). This scattered distribution suggests the fungus has not been introduced recently, but may be native. Drought conditions prior to 1978 may have played a significant role in the apparent recent damage caused by *D. pinea*.

The disease does not appear to be increasing in severity or distribution. Since the disease is more severe on open-grown trees with large cone crops, it poses no threat to most established managed stands. The disease, however, could be a threat in areas of regeneration, if they are near infected cone-bearing pines. High value trees in developed recreation sites and around homesites can be protected by application of chemical sprays. Effective spray schedules have been developed during the past few years.

ASH HEARTROT: *Fomes fraxinophilus* (Peck)

Ash heartrot continued to cause damage to green ash, *Fraxinus pennsylvanica* var. *lanceolata* (Burkh.) Sarg., in the Great Plains. An extensive statewide survey of natural hardwood stands was completed in 1981. Three hundred and sixty plots scattered over 64 counties were examined. *Fomes fraxinophilus* occurred in 86% of the counties examined. Over 1000 trees were found on the survey plots.

AIR POLLUTION SURVEY

Five permanent plots in the vicinity of Denver continued to be monitored for oxidant injury on ponderosa pine. In general, the incidence of ozone injury symptom was unchanged from previous examinations. However, the average plot score for total injury (discrete spot stippling and mottle) suggests an increase in the incidence of foliage injury. Tree mortality did not occur on any of the plots.

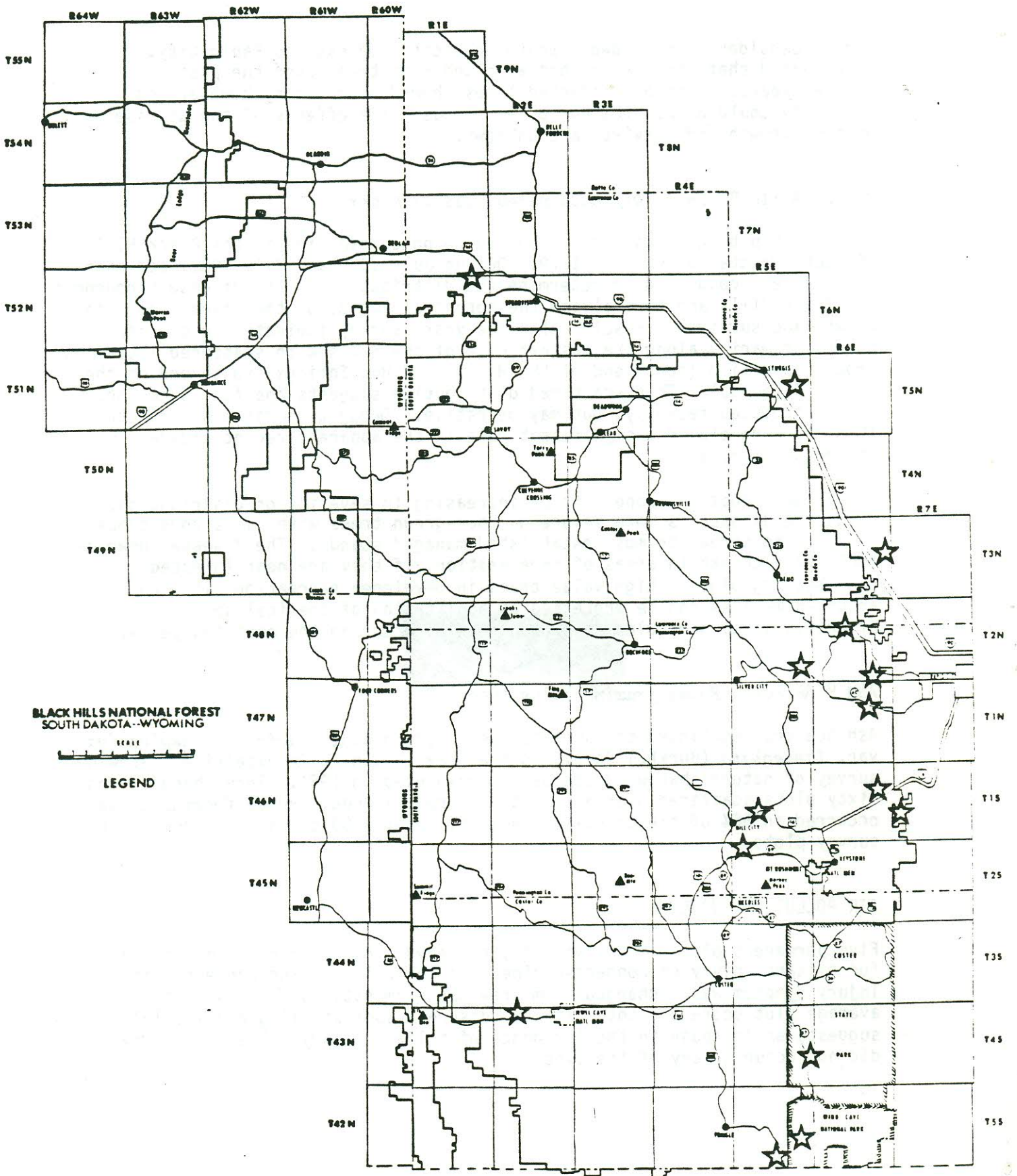


Figure 1. Locations of *Diplodia pinea* infected ponderosa pine in the Black Hills, South Dakota - 1979-81 ★

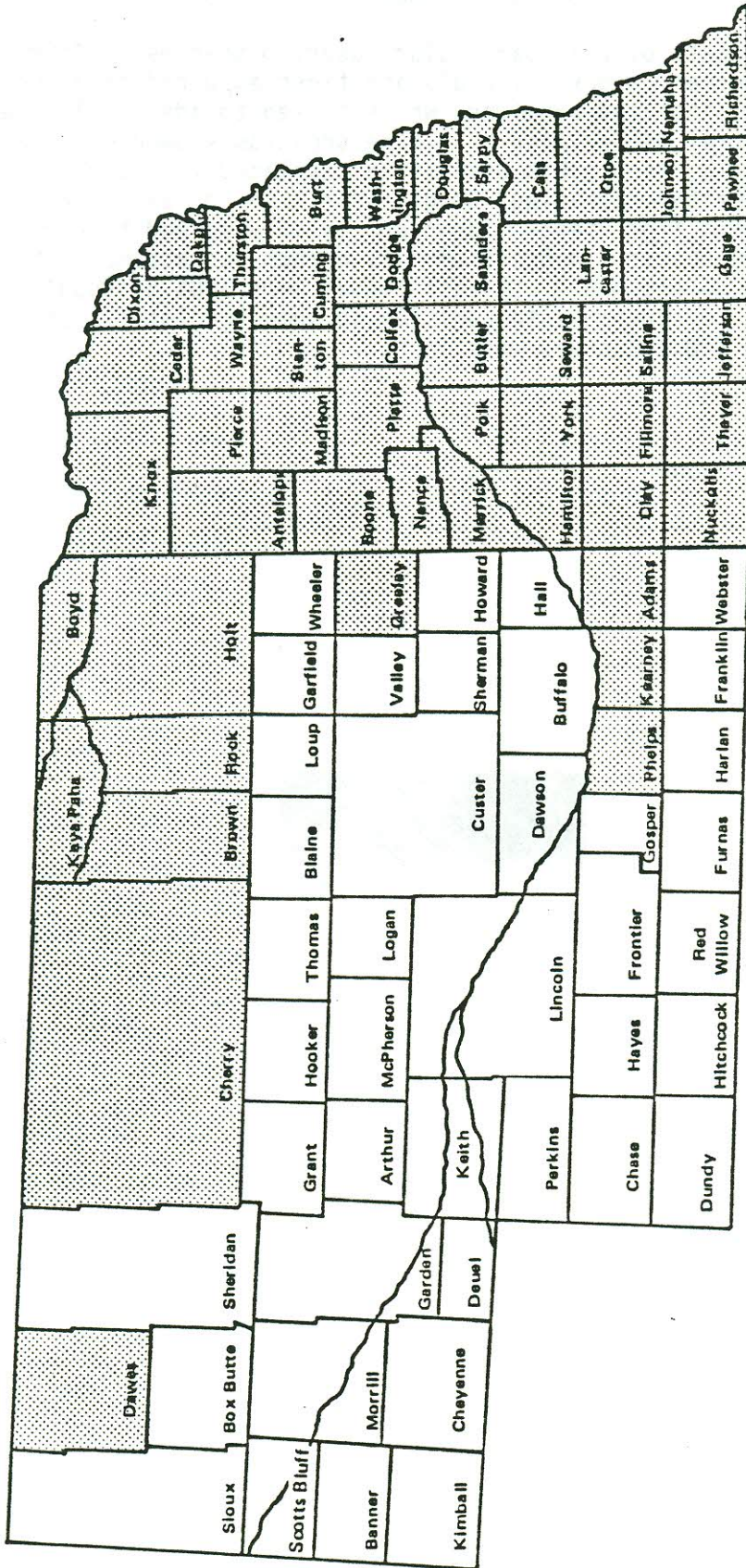


Figure 2. The known distribution of *Diplodia pinea* in Nebraska.

SEEDLING CORTICAL ROT: *Fusarium avenaceum* (Fr.) Sacc.

This is a new report of this particular *Fusarium* species in Colorado containerized nursery stock. The disease first appeared as a top rot on Douglas-fir containerized seedlings which failed to adequately shed the seedcoats. Several weeks later this same organism showed up as a cortical stem rot on Douglas-fir. This disease was isolated from the roots of diseased and "healthy-appearing" Douglas-fir. The disease first appeared in one seed source from Pierce, Idaho and quickly spread to other Douglas-fir stock in the greenhouse. A Benlate® soil drench was attempted but failed to slow disease development. Disease losses were 100% of Douglas-fir seedlings grown for Region 1 in addition to some Douglas-fir stock for Region 2. Over 140,000 trees were lost.

OTHER DISEASES - R-2

<u>Disease</u>	<u>Host</u>	<u>Location</u>	<u>Remarks</u>
<u>FOLIAGE DISEASES</u>			
Pine needlecast <i>Lophodermella cerina</i> (Darker)	Lodgepole pine	Approximately 200 acres showing severe defoliation on the Medicine Bow NF, WY	Damage appeared about 1-year after severe hail damage.
<i>Lophodermium</i> sp.	Ponderosa pine	Throughout eastern Black Hills of SD from Deadwood south to Custer & east to Rapid City	This fungus, fruiting on pine litter, has not been previously reported from these areas, and has not been observed during the past 19 years. It appears the disease has affected some trees for several years. Trees show poor vigor, but no mortality has been seen.
<i>Naemacyclus</i> sp.	Ponderosa pine	Redfeather Lakes, CO	Several trees affected around a work center.
	Scots pine	Sioux Falls, SD	
Diplodia tip blight <i>Diplodia pinea</i> (Desm.) Kickx.	Ponderosa pine	Primarily along eastern edge of the Black Hills SD, with scattered locations around Spearfish & Hot Springs	Scattered distribution suggests disease may be native and not introduced.
	Nebraska		Now reported from 54 Nebraska counties

OTHER DISEASES (continued)

Disease	Host	Location	Remarks
<u>FOLIAGE DISEASES (cont.)</u>			
Aspen shoot blight <i>Venturia populina</i> (Wittl.) Fabric.	Aspen	Approximately 2,000 acres in northern CO south of Toponas & west side of Rabbit Ears Pass	Damage was quite extensive on the edges of mature stands.
<i>Elytroderrma deformans</i> (Weir) Dark.	Ponderosa pine	Colorado, South Dakota	Most common on the Salida Ranger District San Isabel National Forest
Phomopsis blight <i>Phomopsis juniperovora</i> Hahn	Junipers	Glenwood Spgs, Colorado South Dakota	Numerous ornamental junipers showed evidence of damage. Some juniper shelterbelts showed up to 10% of the trees diseased.
Rhizosphaera needlecast <i>Rhizosphaera kalkhoffii</i> Bubak	Spruce	South Dakota	A problem statewide on ornamental plantings
Conifer-aspen rust <i>Melampsora medusae</i> Thuem.	Aspen	Canon City, CO	Approximately 2 acres where disease was noticeable.
	Cottonwood	Kansas	Very common in the eastern third of state.
Marssonina blight <i>Marssonina populii</i> (Lb.) Magn.	Aspen	Paonia, CO	Extensive acreage (10,000) experienced damage.

OTHER DISEASES (continued)

Disease	Host	Location	Remarks
Elm anthracnose <i>Gnomonia ulmea</i> (Schw. ex Fr.) Thuem.	Elm	Canton, SD Denver, CO Nebraska, Kansas	Scattered occurrences throughout all states.
Red band needle blight <i>Dothistroma pini</i> Hulbary	Ponderosa pine Austrian pine	Trent, SD Platsmouth, NE	Minor occurrences in ornamentals. Infections in 1981 of experimental plantings on the Horning State Farm were extremely high.
Sirococcus tip blight <i>Sirococcus strobilinus</i> Preuss.	Spruce	Sioux Falls, SD	Minor occurrences in ornamentals.
<u>BRANCH & STEM DISEASES</u>			
Thyronectria canker <i>Thyronectria austro-americanana</i> (Speg.) Seeler	Honeylocust	Colorado, Kansas	An increasing problem for ornamental plantings in Colorado and Kansas shelterbelts.
Limb rust <i>Peridermium filamentosum</i> Pk.	Ponderosa pine Forests.	Colorado	Spotty occurrences in the Roosevelt, Arapaho, Pike, San Isabel, and Uncompahgre National
<u>ROOT DISEASES</u>			
Shoestring root rot <i>Armillariella mellea</i> (Vahl. ex Fr.) Karst.	All conifers	Colorado, Wyoming South Dakota	The most common root disease in the Region. Based on a photographic survey, approximately 45,600 trees were killed in 1981 by <i>A. mellea</i> in association with mountain pine beetle.

OTHER DISEASES (continued)

Disease	Host	Location	Remarks
<u>ROOT DISEASES (cont.)</u>			
Annosus root rot <i>Heterobasidium annosum</i> (Fr.) Bref.	Subalpine fir, white fir	Colorado	This disease occurring in association with <i>A. mellea</i> and the western balsam bark beetle on subalpine fir, was confirmed in 3 new locations in southern Colorado. Appears this disease is more of a problem on subalpine fir than previously thought.
Black stain root disease <i>Ceratocystis wageneri</i> Goheen & Cobb	Pinyon	Western Colorado	This disease is continuing unabated in southwestern Colorado.
<u>VASCULAR WILTS</u>			
Dutch elm disease <i>Ceratocystis ulmi</i> (Butsm.) C. Mor.	Elm species	Colorado, Nebraska, Kansas	Of the 122 Colorado areas with significant elm populations, 62 are conducting excellent sanitation programs. In 1981, state pathologists confirmed 789 DED cases in 65 of the 122 areas. Funding for the Federal DED Demonstration Project was terminated this year.
Pine wilt disease <i>Bursaphelenchus xylophilus</i> (Steiner & Buhner) Nickle	Austrian pine, white pine, Scots pine	Nebraska, Kansas, South Dakota	Yankton Co., South Dakota is a new report for this nematode.

OTHER DISEASES (continued)

Disease	Host	Location	Remarks
<u>NURSERY DISEASES</u>			
Grey mold <i>Botrytis cinerea</i> (Fr.) Pers.	Scots pine, ponderosa pine	South Dakota, Colorado	A persistent problem in all nurseries. May be controlled chemically.
<i>Phoma</i> sp.	Conifers	Nebraska	Has been a serious problem after root-pruning lodgepole pine and ponderosa pine.
Damping-off	Conifers	Colorado	One nursery lost more than 80% of bareroot stock to <i>Fusarium</i> spp.
Crown gall <i>Agrobacterium tumefaciens</i> (E.F. Smith & Towns.) Conn.	Redcedar	South Dakota	An unusually high incidence was noted in a bareroot nursery.
ABIOTIC	Ponderosa pine	Colorado	Because of improper overwinter storage procedures, 124,880 trees died 3 days after being planted.

FOREST PEST MANAGEMENT WORKSHOPS

During the past year the Forest Pest Management staff offered classroom and field training in recognition and suppression of major forest diseases and insects in the Region. Training consisted of a two-day workshop held in Ignacio, Colorado. This session was attended by representatives of the Southern Ute and Jicarilla Indian Tribes, the Bureau of Indian Affairs, Colorado State Forest Service and National Forest resource management personnel. In addition, a special two-day workshop on dwarf mistletoe was held for Bureau of Land Management personnel in Craig, Colorado.

Training materials used in the Forest Pest Management Workshops are currently undergoing revision. The new Training Manual will be available for workshops scheduled for the spring of 1982.

PESTICIDE USE IN REGION 2

TYPE OF PESTICIDE	TARGET PEST	CHEMICAL USED	UNITS TREATED ^{1/}	APPLICATION METHOD ^{2/}	USER ^{3/}
Fumigant	Nematodes, root disease fungi, and weeds in nursery beds	Methyl bromide	13	G	I
Fungicide	Fungi in greenhouse and nursery beds	Benomyl Captan Chlorothalonil Zineb	65 1 greenhouse 6 3	G G G G	I I I I
Herbicide	Weed control in nursery beds or other noxious weed control	Amitrole Bifenox DCPA Dicamba Diphenamid Glyphosate Picloram Picolinic acid Napropamid	10 30 56 399 30 197 2202 179 6	G G G G G G G G G	I I I I, II I I, III I, II, III III I
	Weed and grass control around well heads, meter runs, cattle-guards, compressor sires, tank batteries, launches	Atriazine Bromacil Krovar-1 Simazine Tebuthiuron	50 sites 35 sites 50 sites 10 sites 30 sites	G G G G G	III III III III III
	Noxious weed control	2,4-D	950	G	I, II, III

^{1/} Units are in acres unless otherwise indicated.

^{3/} Users: I = USFS

^{2/} A = Aerial application

III = Other federal or public agencies.
G = ground application

II = Permittees, licensees, and grantees

PESTICIDE USE IN REGION 2 (continued)

<u>TYPE OF PESTICIDE</u>	<u>TARGET PEST</u>	<u>CHEMICAL USED</u>	<u>UNITS TREATED</u>	<u>APPLICATION METHOD</u>	<u>USER</u>
Herbicide	Big sagebrush/range improvement	2,4-D	205	G	I
	Sand sagebrush/range improvement	2,4-D	14, 297	A	III
	Noxious weed control	2,4-D picloram mixture	100	G	I
Insecticide	Noxious weed control	2,4-D banvel mixture	21	G	I
	Leaf beetles and grasshoppers	Carbaryl	6	G	I
	Cattle flies	Counaphus	900 head	G	III
Piscicide	pine tip moth	Dimethoate	12	G	I
	Mountain pine beetle	EDB	2,000 trees	G	II
	Cattle lice, ticks, flies	Toxaphene	6,000 head	G	III
Rodenticide	Western whitefish	Rotenone	75	G	II
	Prairie dog	Zinc phosphide	19,079	G	I, III

ACTIVE PROJECTS IN R-2

The following list represents projects currently underway by FPM Staff members, Rocky Mountain Forest and Range Experiment Station, and State researchers. Only those workers who responded to our questionnaire are represented; therefore, this is a partial list.

DISEASES

Root Diseases

- Surveys of root diseases in managed conifer stands in R-2. (FPM)
- Fomes annosus* on true firs in Colorado - distribution and impact. (FPM)
- Verticicladiella wagenerii* on pinyon at Mesa Verde National Park and the Dolores River Project - disease spread characteristics, vector relationships and control. (FPM)
- Interactions between root diseases and insects on true firs. (FPM)
- Spread of *Armillariella mellea* disease centers in managed pine stands. (FPM)
- Regionwide surveys to establish impacts of root rots (FIDIS). (FPM)

Dwarf Mistletoes

- Dwarf mistletoe loss assessment surveys. (FPM; RMFRES)
- Dwarf mistletoe presuppression and suppression action plans. (FPM; Forests, R-2)
- Silvicultural control of dwarf mistletoe in young lodgepole pine stands. (FPM; RMFRES)

Decays

- Phellinus robineae* stem decay of black locust; infection and damage. (RMFRES, Lincoln).
- Rate of deterioration of beetle-killed Engelmann spruce in Colorado. (RMFRES)

Stem Diseases

- An evaluation of aspen cankers and stem rots in relation to timber harvesting methods in Colorado and New Mexico. (FPM, R-2, R-3; RMFRES)
- Evaluation of jack pine mortality on the Nebraska National Forest. (FPM)
- Canker diseases of honeylocust: etiology, infection, and disease development. (RMFRES, Lincoln)
- Evaluations of canker diseases on energy plantation hardwoods in Kansas. (FPM, R-2; Kansas State and Extension Forestry)

Foliage Diseases

- Diplodia tip blight in the Black Hills of South Dakota. (FPM; RMFRES)
- Evaluation of air pollution effects on ponderosa pine in the Colorado Front Range. (FPM; RMFRES)
- Dothistroma pini* resistance in ponderosa pine. (RMFRES, Lincoln)
- Inheritance of resistance to *Dothistroma pini* in Austrian pine. (RMFRES, Lincoln)
- Resistance to *Phomopsis juniperovora* in geographic sources of *Juniperus virginiana*. (RMFRES, Lincoln)
- Resistance to *Cercospora sequoiae* var. *juniperi* in geographic sources of *Juniperus virginiana* and *J. scopulorum*. (RMFRES, Lincoln)
- Diplodia pinea* tip blight of pines: etiology of stem infections. (RMFRES, Lincoln)
- Growth of germ tubes positively-directed toward stomates -- Is this a common phenomenon of fungi infecting plant foliage? (RMFRES, Lincoln)
- Foliage diseases of conifers in the Rocky Mountains and Southwest. (RMFRES)
- Lophodermium needlecasts of Scots pine Christmas trees: biology and control. (RMFRES; Northwest Christmas Tree Growers' Association)
- Type specimen study of Lophodermium of pines. (RMFRES)
- Chemical control of maple leaf diseases in northeast Kansas. (Kansas State and Extension Forestry)

Recreation Site Pathology

Evaluation of hazardous trees in forested recreation sites and ski areas. (FPM)

Nursery Diseases

Seedcoat sterilization of conifer seeds using hydrogen peroxide. (FPM)

Mesuro1® as a seed treatment to reduce bird predation. (FPM)

Reduction of pathogenic soil fungi in a forest nursery using solar pasteurization. (FPM)

Control of fusarium cortical rot in containerized conifers. (FPM)

Mycorrhizae

Endemic ectomycorrhizal fungi of ponderosa pine in central Great Plains plantings and native stands: identification of fungi and isolation in pure culture. (RMFRES, Lincoln)

Siderophore production by mycorrhizal fungi: its importance in iron availability in terrestrial ecosystems. (University of Texas; Colorado State University)

Photosynthesis and carbon allocation in mycorrhizal pine seedlings. (Colorado State University)

Use of mycorrhizal conifers in the revegetation of high altitude mine waste sites. (Colorado State University)

INSECTS

Defoliators

Impact of carbaryl and Bt on nontarget insects. (RMFRES, Lincoln; NDSU, Fargo)

Evaluation of the impact on tolerance to and resistance to cankerworm defoliation of Siberian elm in North Dakota shelterbelts. (RMFRES, Lincoln; ARS, Mandan)

Borers

Screening synthetic attractants for male Olethreutid moths attacking ponderosa pine. (RMFRES, Lincoln)

Biology of *Petrova luculentana*. (RMFRES, Lincoln)

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Seed and Cones

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