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Forestry and Forest Health

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Forest Insect and Disease Conditions in the Southwestern Region, 2001

Cover Photo: White-spored gall rust, a rare disease of ponderosa pine, was found in the Sandia Mountains in 2001.

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Insect and Disease Conditions in the Southwestern Region, 2001

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Introduction

Insects and diseases act as both indicators and regulators of the condition or "health" of Southwestern forests. This report summarizes the current known status of insects and diseases in the forests of Arizona and New Mexico. Most of the insect information is based on annual aerial detection surveys. Most of the disease information is based on ground observations and surveys. Bark beetles and defoliating insects cause sudden, visually dramatic damage that is readily seen from the air, while most pathogens cause gradual, insidious damage that is not.

Bark beetles—the primary tree killers in the region—tend to be host specific; conversely, most tree species are attacked almost exclusively by a single type of bark beetle. A group of recent Douglas-fir "faders," for example, is most often a result of attack by the Douglas-fir bark beetle, *Dendroctonus pseudotsugae*. Ponderosa pines, however, are attacked and killed by several different bark beetles in the Southwest. Thus, ground surveys may be needed to confirm the species responsible for ponderosa pine mortality seen from the air. Where ground checking is not conducted, assignment of causal species is based on previous history/experience for a given location.

This report also includes a record of technical assistance provided by Arizona and New Mexico Zone personnel and brief descriptions of several special activities conducted in 2001. Much of the information for state and private lands is provided through our Cooperative by Bob Celaya, Forest Pest Specialist, Arizona State Land Department, and Bob Cain, Extension Forest Entomologist, New Mexico State University Cooperative Extension Service.

Damage detected on the newly acquired Valles Caldera National Preserve in northern New Mexico is reported here for the first time as within the National Forest System. In previous years, damage on this 95,000-acre tract, formerly known as the Baca Ranch, was reported under the category of state and private land.

Conditions in Brief

For the second consecutive year, bark beetle activity detected in the region increased greatly, with faders reported on about 160,000 acres compared to about 73,000 acres in 2000. Most of this mortality (126,000 acres) occurred in the ponderosa pine type, with the largest outbreaks on the Tonto National Forest and San Carlos Indian Reservation in Arizona, and the Gila National Forest in New Mexico. Note that much of the ponderosa pine mortality is from attacks occurring in mid to late 2000, a result of the severe drought that year.

Ponderosa pine mortality is reported as follows: western pine beetle (35,265 acres), mountain pine beetle (2,270 acres), roundheaded pine beetle (3,670 acres), Mexican pine beetle (485 acres), and *Ips* engraver beetles (83,960 acres). In the mixed conifer and spruce-fir cover types, trees were killed by spruce beetle (6,215 acres), fir engraver and western balsam bark beetle (7,465 acres), and Douglas-fir beetle (3,125 acres). Piñon pine sustained heavy damage from *Ips* engraver beetles at many locations, with about 17,150 acres of mortality detected during aerial surveys.

Western spruce budworm defoliation was detected on about 472,000 acres of mixed conifer forest in 2001, up considerably from about 192,000 acres the previous year. Aspen defoliation, caused by a variety of agents, was seen on about 50,000 acres in 2001 vs. 64,000 acres in 2000. Ponderosa pine needle miner activity dropped sharply, with only about 2,700 acres detected in 2001 compared to 68,000 acres in 2000.

Dwarf mistletoes continue to be the most widespread and damaging forest pathogens in the Southwest. They cause an estimated annual volume loss of 25 million cubic feet. Over one-third of the ponderosa pine acreage and about one-half of the mixed conifer acreage has some level of infection. The incidence of dwarf mistletoes changes little from year to year, but is thought to have increased over the past century.

Root diseases continue to cause an estimated 5 million cubic foot volume loss annually, and create hazard trees in campgrounds and along roadways. Incidence is usually higher in mixed-conifer and spruce-fir forests than in ponderosa pine forests.

The incidence of white pine blister rust continues to increase in the Sacramento and adjoining White Mountains of southern New Mexico. Infected white pines have also been found on Gallinas Peak, Cibola National Forest, 50+ miles north of the main outbreak area.

Status of Insects

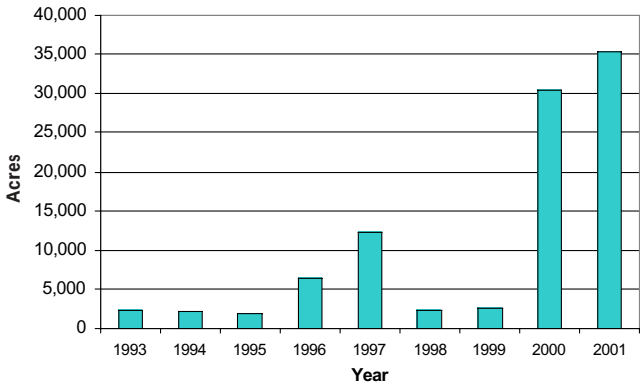
Bark Beetles

Western Pine Beetle

Dendroctonus brevicomis
Primary host: Ponderosa pine

Tree mortality attributed to this insect was detected on 35,265 acres in 2001 vs. 30,385 acres in 2000. In Arizona, mortality was detected on the Apache-Sitgreaves (3,840 acres), Coconino (30 acres) and Kaibab (15 acres) National Forests; Walnut Canyon National Monument (5 acres); Fort Apache (365 acres), Navajo (30 acres) and San Carlos (40 acres) tribal lands; and 50 acres of state and private lands. In New Mexico, activity was detected on the Cibola (2,730 acres) and Gila (27,545 acres) National Forests; Isleta Pueblo tribal lands (475 acres); and 140 acres of state and private lands.

Western Pine Beetle Activity in Arizona and New Mexico

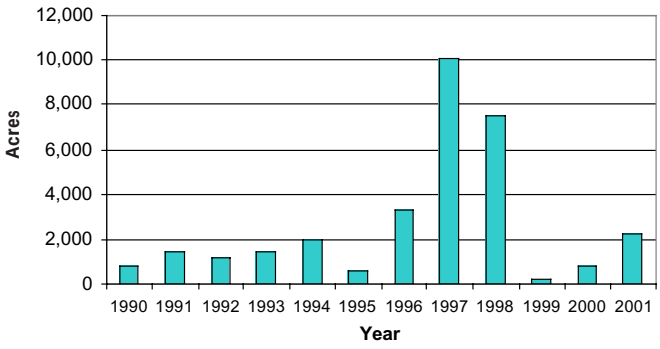


Mountain Pine Beetle

Dendroctonus ponderosae
Primary host: Ponderosa pine

Tree mortality attributed to this insect increased from 810 acres in 2000 to 2,270 acres in 2001. In Arizona, 25 acres of mortality was detected in Grand Canyon National Park. In New Mexico, trees killed by the mountain pine beetle were detected on the Carson (1,500 acres) and Santa Fe (490 acres) National Forests; Jicarilla Apache (100 acres), Picuris Pueblo (30 acres), Santa Clara Pueblo (5 acres), and Taos Pueblo (60 acres) tribal lands; and the Valles Caldera National Preserve (60 acres).

Mountain Pine Beetle Activity in Arizona and New Mexico

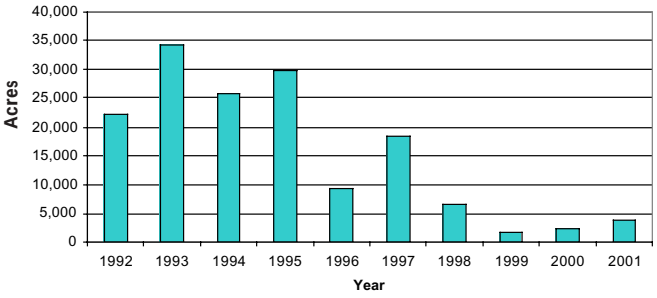


Roundheaded Pine Beetle

Dendroctonus adjunctus
Primary host: Ponderosa pine

Tree mortality in the region increased to 3,670 acres in 2001 compared to 2,235 acres in 2000. In Arizona, mortality was recorded on 2,140 acres of the Coronado National Forest. In New Mexico, mortality was detected on the Lincoln National Forest (690 acres) and Mescalero Apache tribal lands (840 acres).

Roundheaded Pine Beetle Activity in Arizona and New Mexico



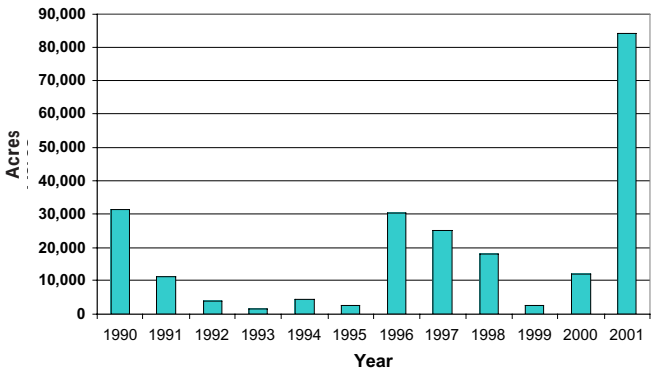
Ips Beetles

Ips spp.
Primary hosts: Ponderosa pine, Piñon pine

Ponderosa pine mortality attributed to *Ips* beetles was detected on 83,960 acres in 2001, compared to 11,965 acres in 2000. In Arizona, mortality was reported on the Apache-Sitgreaves (755 acres), Coconino (315 acres), Kaibab (35 acres), Prescott (8,090 acres) and Tonto (23,605 acres) National Forests; Grand Canyon National Park (5 acres); BLM lands (100 acres); Fort Apache (6,705 acres), Navajo (75 acres) and San Carlos (25,335 acres) tribal lands; and 895 acres of state and private lands. In New Mexico, mortality was detected on the Carson (275 acres), Cibola (1,640 acres), Gila (11,705 acres), Lincoln (1,370 acres), and Santa Fe (680 acres) National Forests; Jicarilla Apache tribal lands (295 acres); and state and private lands (2,080 acres). Much of the mortality detected in 2001 is thought to be due to attacks that occurred in mid to late 2000, a result of the severe drought that year.

Piñon pine mortality caused by *Ips* beetles was detected on about 17,150 acres in 2001 compared to 2,075 acres in 2000; however, these figures underestimate regional mortality since not all the woodland type is covered during aerial surveys. In Arizona, activity was recorded on the Apache-Sitgreaves (10 acres), Coconino (3,350 acres) and Kaibab (470 acres) National Forests; 2,300 acres of BLM land; and Fort Apache (60 acres) and Navajo (5 acres) tribal lands. Approximately 11,000 acres of piñon mortality were detected on state and private lands in New Mexico. The most serious outbreaks continue to be in Catron County, with other notable outbreaks near Santa Fe and in the Ojo Caliente area. Twig beetles have caused mortality of small diameter piñons in many of these areas.

Ips Beetle Activity in Ponderosa Pine in Arizona and New Mexico

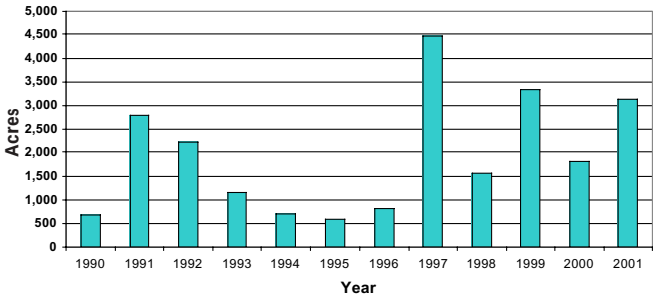


Douglas-fir Beetle

Dendroctonus pseudotsugae
Host: Douglas-fir

Tree mortality detected in the region increased from 1,815 acres in 2000 to 3,125 acres in 2001. In Arizona, mortality was recorded on the Apache-Sitgreaves (150 acres) and Coconino (1,965 acres) National Forests. In New Mexico, mortality was detected on the Carson (75 acres), Cibola (100 acres), Gila (180 acres), Lincoln (15 acres), and Santa Fe (405 acres) National Forests; Jicarilla Apache (50 acres), Mescalero Apache (65 acres) and Santa Clara Pueblo (45 acres) tribal lands; and Valles Caldera National Preserve (75 acres).

Douglas-fir Beetle Activity in Arizona and New Mexico

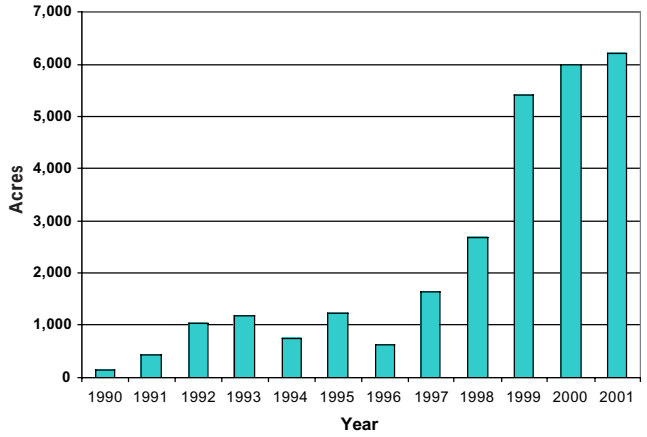


Spruce Beetle

Dendroctonus rufipennis
Host: Spruce

Tree mortality increased slightly from 5,990 acres in 2000 to 6,215 acres in 2001. In Arizona, spruce beetle mortality occurred on the Apache-Sitgreaves (10 acres) and Coronado (630) National Forests; Navajo tribal lands (55 acres), and 5 acres of state lands. In New Mexico, spruce beetle-related tree mortality was detected on the Carson (1,230 acres), Cibola (135 acres), Lincoln (745 acres), and Santa Fe (2,515 acres) National Forests; Taos Pueblo tribal lands (360 acres); Valles Caldera National Preserve (20 acres); and 510 acres of state and private lands.

Spruce Beetle Activity in Arizona and New Mexico

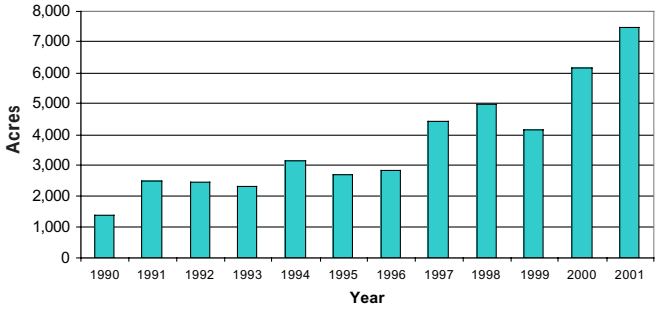


True Fir Beetles

Fir Engraver Beetle, *Scolytus ventralis*
Western balsam bark beetle, *Dryocoetes confusus*
Hosts: White and Subalpine/Corkbark fir

Tree mortality in the region increased somewhat in 2001 to 7,465 acres vs. 6,150 acres in 2000. In Arizona, fir mortality was recorded on the Apache-Sitgreaves (1,445 acres), Coconino (4,265 acres), Kaibab (80 acres), and Tonto (10 acres) National Forests; Grand Canyon National Park (125 acres); and Fort Apache tribal lands (5 acres). In New Mexico, fir mortality was reported on the Carson (200 acres), Cibola (335 acres), Gila (50 acres), Lincoln (15 acres), and Santa Fe (560 acres) National Forests; Jicarilla Apache (100 acres), Mescalero Apache (80 acres), and Santa Clara (5 acres) tribal lands; and 190 acres of state and private lands.

Fir Engraver and Western Balsam Bark Beetle Activity in Arizona and New Mexico



Mexican Pine Beetle

Dendroctonus mexicanus
Hosts: Pines

Mexican pine beetle was found on the Coronado National Forest in late 2000, the first record of its occurrence in the United States. Tree mortality was detected on 485 acres in this area in 2001. See also "Activities" section in this report.

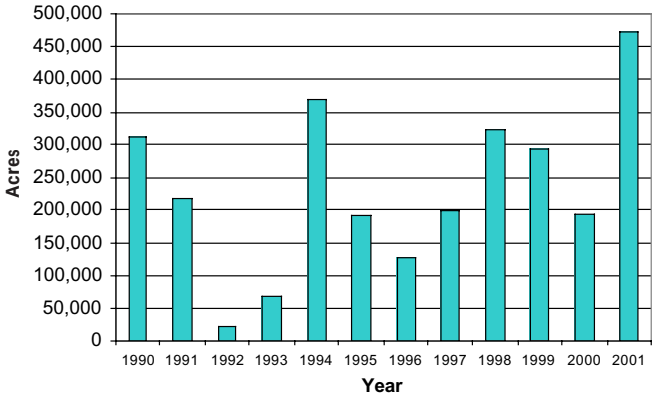
Defoliators

Western Spruce Budworm

Choristoneura occidentalis
Host: True firs, Douglas-fir, Spruce

Western spruce budworm defoliation more than doubled region-wide, increasing from 192,220 acres in 2000 to 472,100 acres in 2001. In Arizona, defoliation was recorded on the Apache-Sitgreaves (70 acres) and Kaibab (9,515 acres) National Forests; Grand Canyon National Park (40 acres); and Navajo tribal lands (4,540 acres). In New Mexico, budworm defoliation was detected on the Carson (290,610 acres), Cibola (5,750 acres), Gila (4,860 acres), Lincoln (1,420 acres), and Santa Fe (55,415 acres) National Forests; Jicarilla Apache (3,135 acres), Mescalero Apache (30 acres), Picuris Pueblo (45 acres), and Taos Pueblo (9,285 acres) tribal lands; Valles Caldera National Preserve (12,550 acres); and approximately 74,835 acres of state and private lands.

Western Spruce Budworm Activity in Arizona and New Mexico



Douglas-fir Tussock Moth

Orgyia pseudotsugata
Hosts: White fir, Douglas-fir, Spruce

A small outbreak detected in the Sacramento Mountains in 2000 expanded in 2001, causing visible defoliation on 810 acres of the Lincoln National Forest and 15 acres of Mescalero Apache tribal lands. While this insect has been a chronic problem on urban ornamentals in New Mexico for more than 30 years, this is the first reportable acreage of forest defoliation in the region since 1979.

Douglas-fir tussock moth defoliation in the Sacramento Mountains near Cloudcroft, NM.

Nepytia janetae

Host: Spruce and true firs

No defoliation from this insect was detected in 2001. However, tree mortality attributed to previous defoliation was recorded on 1,475 acres in Arizona. This occurred on the Apache-Sitgreaves National Forests (290 acres) and Fort Apache tribal lands (1,185 acres).

Spruce Aphid

Elatobium abietinum
Host: Spruce

No defoliation from this insect was detected in 2001. However, tree mortality resulting from defoliation in 2000 was recorded on 46,550 acres in Arizona. This occurred on the Apache-Sitgreaves National Forests (10,305 acres), Fort Apache tribal lands (36,230 acres), and 15 acres of state and private lands. No spruce aphid activity was observed in New Mexico.

Ponderosa Pine Needle Miner

Coleotechnites ponderosae

No needle miner was detected in Arizona in 2001, following 2 years of extensive activity. In New Mexico, the chronic outbreak in the eastern foothills of the Sangre de Cristo Mountains declined from over 12,000 acres in 2000 to around 2,700 acres in 2001.

Piñon Needle Scale

Matsucoccus acalyptus

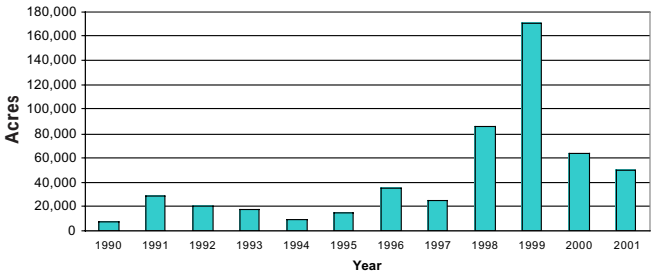
Scale continues to affect piñon at several locations in the woodlands of Arizona and New Mexico. Outbreaks of this insect tend to be chronic, but vary in intensity from year to year. The only activity detected during aerial surveys in 2001 was on the Magdalena Ranger District, Cibola National Forest (4,820 acres). Damage to landscape piñons continues to be common statewide in New Mexico.

Aspen Defoliation:

Western Tent Caterpillar, *Malacosoma californicum*
Large Aspen Tortrix, *Choristoneura conflictana*
Black Leaf Spot, *Marssonina populi*
Weather-related damage

Aspen defoliation, caused by the above combination of insects, disease, and abiotic factors, declined region-wide in 2001 to about 49,990 acres, from 63,515 acres the previous year. In Arizona, it was recorded on the Apache-Sitgreaves (14,150 acres), Coconino (2,100 acres), Kaibab (11,525 acres), and Tonto (10 acres) National Forests; Fort Apache (6,965 acres) and Navajo (3,220 acres) tribal lands; Grand Canyon National Park (910 acres); BLM land (15 acres); and 300 acres of state and private land. In New Mexico, defoliation was detected on the Carson (640 acres), Cibola (385 acres), Gila (270 acres), Lincoln (165 acres), and Santa Fe (3,515 acres) National Forests; Santa Clara Pueblo (50 acres); Valles Caldera National Preserve (505 acres); and about 5,265 acres of state and private lands.

Aspen Defoliation in Arizona and New Mexico



Miscellaneous Insects

New Reports

A twig beetle tentatively identified as the **walnut twig beetle**, *Pityophthorus juglandis*, killed mature and valuable landscape black walnut trees planted throughout the Española Valley in New Mexico. Drought conditions were likely responsible for the outbreak.

A new pest on boxelders, the **boxelder leaf miner**, *Caloptilia negundella*, defoliated trees for several miles along the Pecos River in Rowe, New Mexico.

Status Reports

Bagworms (*Thyriodopteryx* spp.) continue to be a problem in the Albuquerque area on junipers, cypress, and several hardwood trees.

Bull pine sawfly (*Zadiprion townsendii*) continued to cause minor defoliation of ponderosa pine in several chronically infested areas around Santa Fe. This winter-feeding insect has been observed periodically on several lower elevation ponderosa pine sites around New Mexico.

Elm leaf beetles (*Xanthogaleruca luteola*) continued at high levels throughout New Mexico in 2001.

Smaller European elm bark beetle (*Scolytus multistriatus*) continued to cause mortality in drought-stressed Siberian elms in eastern New Mexico, and to a lesser extent, statewide.

Fall webworm (*Hyphantria cunea*) continued to be common in New Mexico on landscape and lower riparian hardwoods, especially elms, mulberries, cottonwoods, and hybrid poplars. Activity also continued for the fourth consecutive year around Payson, Arizona.

Genista caterpillars (*Uresiphita reversalis*) again caused defoliation on Texas mountain laurel and brooms in Las Cruces area landscapes.

Juniper bark beetle (*Phloesinus* sp.) activity was observed near Payson, Arizona.

Nantucket pine tip moth (*Rhyaciona frustrana*), western pine tip moth (*R. bushnelli*), and other Rhyaciona species continued to damage landscape pines, especially ponderosa pine, in New Mexico.

Oak twig girdler (*Oncideres quercus*) activity was detected on scrub oak in the Payson, Pine, and Prescott areas.

Piñon needle miner (*Coleotechnites edulicola*) remained at detectable levels in the Santa Fe area, but was much less damaging in 2001 than in 2000.

Prescott scale (*Matsucoccus vexillorum*) was noted at several locations in northern New Mexico in 2001.

Tiger moth (*Halisidota* sp.) caterpillars were common in forests and woodlands of New Mexico on ponderosa pine, piñon pine, and Douglas-fir.

Status of Diseases

Dwarf Mistletoes

Arceuthobium spp.
Hosts: most conifers, especially pines and Douglas-fir

Dwarf mistletoes are the most widespread and damaging forest pathogens (disease-causing organisms) in the Southwest. There are eight species in the region, each with a different primary tree host. Three species—those affecting ponderosa pine, piñon pine, and Douglas-fir—are found throughout most of the ranges of their hosts, while the other species have more limited distributions. Regionally, over one-third of the ponderosa pine type and up to one-half the mixed conifer type have some level of infection.

Dwarf mistletoes are considered to be pathogens of trees because of their damaging effects—growth reduction, distortion (i.e. witches' brooms), and decreased longevity. Essentially, they re-allocate growth to infected portions of the tree at the expense of the rest of the tree. Severe infection can kill trees directly or predispose them to other agents, especially bark beetles. Regionwide, dwarf mistletoes cause an estimated 25 million cubic foot loss in timber production annually. On the other hand, as a natural part of the forest, dwarf mistletoes do have an ecological role and benefit some species.

On both the stand and landscape level, the distribution of dwarf mistletoes is usually patchy, with more or less discrete infection centers surrounded by areas without the disease. Infection centers expand very slowly, and overall incidence changes little from year to year. Thus, infestation is best described as a chronic situation rather than an outbreak or epidemic. However, because of fire suppression and selective cutting, the overall incidence of dwarf mistletoes has probably increased over the past century.

True Mistletoes

Phoradendron spp.
Hosts: Junipers; various hardwoods

Several species of true mistletoe occur in the Southwest. They are common in piñon-juniper woodlands throughout the region, and are locally abundant in lower riparian areas and desert shrublands. Heavy infection contributes toward host mortality, especially during periods of drought.

Root Diseases

Root diseases are associated with roughly one-third of the conifer mortality in the region each year.

They kill some trees outright and are often associated with bark beetle attack. They can also predispose trees to windthrow, an obvious concern in heavily-used areas. Root diseases are generally more common in mixed conifer and spruce-fir forests than in ponderosa pine forests. Like mistletoes, the incidence of root diseases changes little from year to year.

Armillaria Root Disease

Armillaria spp.
Hosts: most conifers, aspen

Armillaria is the most common root disease in the Southwest, and may account for up to 80 percent of the root disease mortality in the region. Recent surveys on the North Kaibab Ranger District found the fungus in about 30 percent of the standing live trees. In addition to causing disease, the fungus is a common decayer of dead woody material (a saprophyte).

Annosus Root Disease

Heterobasidion annosum
Hosts: most conifers

Annosus root disease is probably the second most common root disease in the Southwest. It is found most often on true firs, although most conifers are susceptible. Like *Armillaria*, *Heterobasidion* is a common decayer of dead woody material as well as a pathogen.

Other common root diseases in the Southwest include **Schweinitzii root/butt rot**, *Phaeolus schweinitzii*, often found on older Douglas-fir and occassionally ponderosa pine; **Tomentosus root/butt rot**, *Inonotus tomentosus*, on spruce; and **Ganoderma butt rot**, *Ganoderma applanatum*, found in many aspen stands. **Black Stain root disease**, *Leptographium wageneri*, appears to be rare in the Southwest.

Stem Decays

Stem decays are common in older trees throughout the region. Decay represents an economic loss in terms of timber production, and can increase hazard on developed sites. On the other hand, decayed trees provide important habitat for some wildlife species, particularly cavity nesters. The most common stem decays in the Southwest include **red rot**, *Dichomitus squalens*, of ponderosa pine; **red ring rot**, *Phellinus pini*, affecting most conifers; **rust-red stringy rot**, *Echinodontium tinctium*, on white fir; and **aspen trunk rot**, *Phellinus tremulae*.

Aspen Stem Cankers

The soft, living bark of aspen is highly susceptible to canker-causing fungi. One or more of these diseases are common in most aspen stands. The most common include **sooty bark canker**, *Encoelia pruinosa*; **black canker**, *Ceratocystis fimbriata*; **Cryptosphaeria canker**, *Cryptosphaeria populina*; and **Cytospora canker**, *Cytospora chrysosperma*. Cankers are one of the main reasons that aspen is a relatively short-lived tree.

Stem Rusts

White Pine Blister Rust

Cronartium ribicola
Host: Southwestern white pine

This very damaging, non-native disease occurs throughout most of the range of its host in the Sacramento and adjoining White Mountains of southern New Mexico. It appears to have arrived in this area by the early 1970's, but was not detected until 1990. Blister rust has since spread to the nearby Capitan Mountains and Gallinas Peak, located about 50 miles north of the Capitans. The disease has not yet been detected in northern New Mexico or in Arizona.

Within the outbreak area, moist mixed-conifer stands above 8000' typically have more blister rust than drier, lower elevation stands.

Broom Rusts

Melampsorella caryophyllacearum
Host: true firs

Chrysomyxa arctostaphyli
Host: spruces

Broom rusts are found at low levels throughout much of the ranges of their hosts in the Southwest. High concentrations of fir broom rust occur in the Sandia Mountains of New Mexico and a few other locations. The disease is often quite noticeable, although damage is usually minimal. Occasionally, falling brooms or stem breakage at the point of infection present a hazard.

Limb Rust

Cronartium arizonicum
Host: Ponderosa pine

This disease is fairly common in portions of Arizona, and can be quite damaging to individual trees. The fungus causes progressive branch mortality, usually from the center of the crown. Waves of new infection typically occur at intervals of several years.

Comandra Blister Rust

Cronartium comandrae
Host: Pines

This disease has caused branch dieback and mortality on non-native Eldarica/Afghan pine in the Prescott, Payson, and Sedona areas. It occasionally infects ponderosa pines in this area, but has caused minimal damage.

Western Gall Rust

Peridermium (Endocronartium) harknessii
Host: Pines

This disease, more common in other parts of the West, is occasionally found on ponderosa pine in the Southwest. An unusual white-spored variety of the fungus was found in the Sandia Mountains in 2001. (Western gall rust, like other tree rusts, usually have orange or rust-colored spores.) **White-spored gall rust** is also known from the Chiricahua Mountains of Arizona.

Foliage Diseases

(see also Aspen Defoliation in Insect section)

Ponderosa Pine Needle Cast

Lophodermella cerina and other species

Discoloration and/or defoliation of ponderosa pine attributed to needle cast fungi and was detected during aerial surveys on about 455 acres of Federal lands in 2001 vs. 2,175 acres in 2000. All of this activity occurred in New Mexico, with about 190 acres on the Santa Fe National Forest and 265 acres on Jicarilla Apache tribal lands. About 1,320 acres of private land in northern Colfax County were also affected.

Lophodermella appears to be the most common of several fungi that cause needle cast of ponderosa pine in the Southwest. Needle miner (an insect) and drought stress can produce symptoms very similar to those of needle cast. It can be difficult to determine the actual cause of discolored foliage during aerial surveys; assessments from the ground are often needed. The acreages reported here are usually based on limited ground checking and past experience.

Abiotic Damage

Drought

Discoloration of ponderosa pine attributed to drought occurred on about 7,215 acres in 2001. In Arizona, this occurred on the Coconino (3,874 acres) and Prescott (33 acres) National Forests, and on 187 acres of private land. About 3,120 acres of state and private lands were affected in northern New Mexico.

Frost Damage

A hard freeze in late June 2001 damaged newly-emerging foliage in many parts of the Southwest. Gambel oak and New Mexico locust were especially affected. Minor damage to conifers was observed in scattered locations throughout the region.

Table 1. Prominent 2001 Forest Insect and Disease Activity in Arizona and New Mexico

Agent	State	National Forest	Tribal Lands	Other Federal	State & Private	Total
Western pine beetle	AZ	3,885	435	5	50	4,375
	NM	30,275	475	0	140	30,890
Mountain pine beetle	AZ	0	0	25	0	25
	NM	2,050	195	0	0	2,245
Roundheaded pine beetle	AZ	2,140	0	0	0	2,140
	NM	690	840	0	0	1,530
Ips beetles (ponderosa pine)	AZ	32,800	32,115	105	895	65,915
	NM	15,670	295	0	2,080	18,045
Ips beetles (piñon pine)	AZ	3,830	65	2,300	0	6,195
	NM	**	**	**	10,960	10,960
Douglas-fir beetle	AZ	2,115	0	0	0	2,115
	NM	850	160	0	0	1,010
Spruce beetle	AZ	640	55	0	5	700
	NM	4,645	360	0	510	5,515
True fir beetles	AZ	5,800	5	125	0	5,930
	NM	1,160	185	0	190	1,535
Western spruce budworm	AZ	9,585	4,540	40	0	14,165
	NM	370,605	12,495	0	74,835	457,935
Ponderosa pine needle miner	AZ	0	0	0	0	0
	NM	5	0	0	2,725	2,730
Ponderosa pine needle cast	AZ	0	0	0	0	0
	NM	190	265	0	1,320	1,775
Aspen defoliation	AZ	27,785	10,185	925	300	39,195
	NM	5,480	50	0	5,265	10,795
Root disease	AZ	219,000	**	**	**	219,000
	NM	860,000	**	**	**	860,000
Dwarf mistletoes	AZ	1,174,000	674,000	**	25,000	1,873,000
	NM	1,144,000	348,000	**	581,000	2,073,000

** Significant activity observed/known, but acreage not determined.

Table 2. Region 3 2001 Forest Insect Incidence by Site (in acres).

	Western Pine Beetle	Mountain Pine Beetle	Round-headed Pine Beetle	Ponderosa *Ips*	Piñon *Ips*	Douglas-fir Beetle	Spruce Beetle	True Fir Beetles	Bark Beetle Totals	Western Spruce Budworm	Douglas-fir Tussock Moth	Ponderosa Needle Miner	Piñon Needle Scale	Aspen Defoliation	Defoliation Total
Apache-Sitgreaves NF	3,840			755	10	150	10	1,445	6,210	70				14,150	14,220
Coconino NF	30			315	3,350	1,965		4,265	9,925					2,100	2,100
Coronado NF			2,140				630		2,770						0
Kaibab NF	15	0		35	470			80	600	9,515				11,525	21,040
Prescott NF				8,090					8,090						0
Tonto NF				23,605				10	23,615					10	10
Grand Canyon NP		25		5				125	155	40				910	950
Canyon de Chelly NM									0						0
Chiricahua NM									0						0
Saguaro NM									0						0
Walnut Canyon NM	5								5						
BLM				100	2,300				2,400					15	15
Fort Apache Tribal	365			6,705	60			5	7,135						
Hualapai Tribal									0					6,965	6,965
Navajo Tribal	30			75	5		55		165	4,540				3,220	7,760
San Carlos Tribal	40			25,335					25,375						0
State & Private	50			895			5		950					300	300
AZ Total	4,375	25	2,140	65,915	6,195	2,115	700	5,930	87,395	14,165	0	0	0	39,195	53,360
Carson NF		1,500		275		75	1,230	200	3,280	290,610				640	291,250
Cibola NF	2,730			1,640		100	135	335	4,940	5,750			4,820	385	10,955
Gila NF	27,545			11,705		180		50	39,480	4,860				270	5,130
Lincoln NF			690	1,370		15	745	15	2,835	1,420	810			165	2,395
Santa Fe NF		490		680		405	2,515	560	4,650	55,415		5		3,515	58,935
Valles Caldera NP		60				75	20		155	12,550				505	13,055
Jicarilla Tribal		100		295		50		100	545	3,135					3,135
Mecalero Apache Tribal			840			65		80	985	30	15				45
Picuris Pueblo Tribal		30							30	45					45
Santa Clara Pueblo Tribal		5				45		5	55					50	50
Taos Pueblo Tribal		60					360		420	9,285					9,285
Isleta Pueblo Tribal	475								475						0
State & Private	140			2,080	10,960		510	190	13,880	74,835		2,725		5,265	82,825
NM Total	30,890	2,245	1,530	18,045	10,960	1,010	5,515	1,535	71,730	457,935	825	2,730	4,820	10,795	477,105
R3 Total	35,265	2,270	3,670	83,960	17,155	3,125	6,215	7,465	159,125	472,100	825	2,730	4,820	49,990	530,465

Biological Evaluations and Technical Assistance

Our staff is "on call" to provide information on forest insect and disease activity, including input for resource planning and management activities. We provide this information to the Forest Service and other land management agencies. The following letters/reports document much of this work done in 2001.

Arizona Zone

1. Bark beetle infestations in the Chiricahua Mountains, Douglas Ranger District, Coronado National Forest. 1/01.
2. Insect and disease activity at Oak Creek Campground, Sedona Ranger District, Coconino National Forest. 8/01.
3. Hazard tree evaluation at Sierra Blanca, Alpine, Arizona. 8/01.
4. Spruce beetle in recreation sites on the Pinaleños, Safford Ranger District, Coronado National Forest. 9/01.
5. Southwestern dwarf mistletoe of ponderosa pine in the Huffer stand improvement project area, Long Valley Ranger District, Coconino National Forest. 10/01.
6. Spruce beetle at Snowbowl Ski Area, Peaks Ranger District, Coconino National Forest. 10/01.
7. Biological evaluation of FY 2002 proposed Malay Gap dwarf mistletoe suppression project, San Carlos Reservation. 10/01.
8. Biological evaluation of the FY 2002 Corn Creek Plateau dwarf mistletoe suppression project, White Mountain Apache Reservation. 11/01.
9. Biological evaluation of the Horton-2 dwarf mistletoe suppression project, Alpine Ranger District, Apache-Sitgreaves National Forests. 11/01.
10. Bark beetle activity in Cave Springs Campground, Sedona Ranger District, Coconino National Forest. 11/01.
11. Bark beetle activity in Summer Haven Homeowners Association, Arizona State Land Department. 12/21.

New Mexico Zone

1. Forest insect activity in the Cerro Grande burn area, Santa Fe National Forest and Los Alamos National Laboratory. 4/01.
2. Historical overview of insect activity for the Red River Watershed assessment, Carson National Forest. 5/01.
3. Examination of tree conditions at the Cree and Scott Able Fire salvage areas, Smokey Bear and Sacramento Ranger Districts, Lincoln National Forest. 6/01.
4. Prescott scale damage, Coyote Ranger District, Santa Fe National Forest. 7/01.
5. Douglas-fir tussock moth monitoring activities, Sacramento Ranger District, Lincoln National Forest. 8/01.
6. Hazard tree survey at Bandelier National Monument. 8/01.
7. Piñon pine mortality in Santa Clara Canyon, Santa Clara Pueblo. 10/01.
8. Proposed FY 2002 Cabin Finger dwarf mistletoe control project, Jicarilla Apache Indian Reservation. 10/01.
9. Proposed FY 2002 forest health projects, Mescalero Apache Indian Reservation. 10/01.
10. Proposed FY 2002 Parish Tank and Felipito thinning projects, Tres Piedras and El Rito Ranger Districts, Carson National Forest. 11/01.
11. Proposed FY 2002 Borrego Mesa and Santa Fe Watershed thinning projects, Espanola Ranger District, Santa Fe National Forest. 11/01.
12. Proposed FY 2002 Curtis Canyon thinning project, Sacramento Ranger District, Lincoln National Forest. 11/01.
13. Effects of prescribed fire on dwarf mistletoe infection, Jemez Ranger District, Santa Fe National Forest. 12/01.
14. Douglas-fir tussock moth pheromone trapping results, Sacramento Ranger District, Lincoln National Forest, and Mescalero Apache Indian Reservation. 12/01.
15. Douglas-fir tussock moth pheromone trapping results, Sandia Ranger District, Cibola National Forest. 12/01.
16. Forest health issues in developed and special use recreation sites on the Carson, Santa Fe, and Lincoln National Forests. 12/01.

Publications

Conklin, D. A.; Armstrong, W.A. 2001. Effects of three prescribed fires on dwarf mistletoe infection in Southwestern ponderosa pine. USDA Forest Service, Southwestern Region, R3-01-02. 17 p.

Coyle, D. R., J. D. McMillin, R. B. Hall & E. R. Hart. 2001. Cottonwood leaf beetle (Coleoptera: Chrysomelidae) larval performance on eight *Populus* clones. Environmental Entomology 30: 748-756.

Dymerski, A.D., J.A. Anhold, and A.S. Munson. 2001. Spruce beetle (*Dendroctonus rufipennis*) outbreak in englemann spruce (*Picea engelmannii*) in Central Utah, 1986-1998. Western North American Naturalist 61(1), pp 19-24.

Karsky, D., H. Thistle, and J. Anhold. 2001. Demonstration of aerial spray aircraft navigation systems in deep mountain valleys. Tech. Tip 0134-2336-MTDC. Missoula, MT:USDA Forest Service Missoula Technology and Development Center. 6p.

Negron, J.F., J.A. Anhold, and A.S. Munson. 2001. Within-stand distribution of tree mortality caused by the Douglas-fir beetle (*Coleoptera*: *Scolytidae*). Environ. Entomol., 30(2): 215-224.

Niwa, C G., R. E. Sandquist & 19 others. 2001. Invertebrates of the Columbia River basin assessment area. (T M. Quigley, Ed.) Interior Columbia Basin Ecosystem Management Project: Scientific Assessment. USDA Forest Service General Technical Report PNW-GTR-512, Portland, OR. 74 p.

Other Entomology and Pathology Activities in 2001

Insect and Disease Management Workshops

We periodically offer 2 to 3-day workshops on forest insect and disease identification, biology and management. These sessions are attended by Forest Service, Bureau of Indian Affairs, and National Park Service personnel; as well as by Tribal resource managers and employees from other Federal and state agencies. In the spring, we usually offer a workshop for recreation managers and their staffs that emphasizes hazard tree management. In the fall, we usually offer a workshop that covers the entire forest ecosystem. We also offer more informal training on request, particularly for field crews.

Southern Pine Beetle/Mexican Pine Beetle Monitoring in the Chiricahua Mountains of Southern Arizona

In 2000, 11,705 acres of tree mortality caused by southern pine beetle, *Dendroctonus frontalis*, was recorded in the Chiricahua Mountains of Southern Arizona. Based on a destructive sampling survey, it was determined that the trees were initially infested by *Ips* spp. Southern pine beetle then attacked and killed the *Ips* infested trees. By December of 2000, a few Mexican pine beetles, *Dendroctonus mexicanus* were found in infested trees along with southern pine beetle. A line of four Lindgren funnel traps, two baited with frontalure and two baited with a 3 component experimental lure for western pine beetle, were established in Pinery Canyon in April 2001 to monitor the populations. Trap contents are checked weekly to determine what beetles are actively flying at that time. Periodically infested trees are destructively sampled to determine infesting beetle species at different heights on the bole. Insects from the funnel traps and from the destructively sampled trees are sent to the Southern Research Station with a sub sample sent to Dartmouth College. Beetles are checked for phoretic mites and mites are checked for mycangial fungi. Both trapping and sampling indicated that the population of southern pine beetles has decreased while the population of Mexican Pine Beetle has increased. The phoretic mites infesting both species are being studied at the Southern Research Station by John Moser and Kier Klepzig. The mycangial fungi are being studied at Dartmouth by Richard Hoffstettler.

Contact Bobbe Fitzgibbon for additional information.

Spruce Aphid/*Nepytia janetae* impact plots on Mt. Graham, in the White Mountains and other locations with host type within Arizona

The exotic spruce aphid, *Elatobium abietinum*, caused spruce mortality at varying levels on 46,548 acres in Arizona in both spruce-fir and mixed conifer stands. The looper, *Nepytia janetae*, had previously defoliated high elevation spruce and fir trees. In 2001, several pockets of tree mortality, totaling 1,472 acres, occurred in stands defoliated during the winters of 97-98 and 98-99 by *Nepytia janetae*. Impact plots have been established for both defoliators. Plots are monitored annually for current defoliation, tree mortality, bark beetle activity, and impact to regeneration size classes. Temperature is monitored in several areas to determine trends associated with local weather conditions. Data collected is being used to determine the impact of these two defoliators, key factors that trigger outbreaks, and the biology of the insects. This is a cooperative venture between Forest Health and Ann Lynch of the Rocky Mountain Research Station.

Contact Bobbe Fitzgibbon for additional information.

The role of wildland fire and subsequent insect attack on ponderosa pine mortality

This project will define the impact caused by insects when interacting with another disturbance agent, wildfire. This will allow us to more accurately assist land managers in predicting potential tree mortality in post-fire situations. Currently, there is little information regarding fire/insect impact in ponderosa pine ecosystems. For example, written and visual guidelines are lacking for field personnel to determine what tree will live or die in the near future in relation to the amount of damage caused by fire or the probability of injured trees being killed by insects. Furthermore, the probability of fire-damaged trees providing the source of an insect outbreak that subsequently spreads to uninjured trees has not been rigorously examined. This project will address the lack of adequate information by formulating models and creating visual guides and, therefore, permit land managers to make more informed decisions regarding salvaging and insect control. This information will also be useful in the development of prescriptions for prescribed burning. This 3-year, multi-regional (Regions 1, 2 and 3) study is examining fires that occurred in 2000. In 2001 we established plots in 4 National Forests:

Black Hills in South Dakota, Custer in Montana, Arapaho-Roosevelt in Colorado and Kaibab/ Coconino in Arizona. In each area, we sampled 1500+ trees in burned areas and 500 trees in unburned areas. For each tree, we measured height, dbh, pre-fire live crown ratio, percent crown scorch, percent crown consumption, percent scorched basal circumference, scorch height on the bole, and insect presence. In addition, we collected 4 phloem samples from each of 200+ additional trees in each area to quantify the relationship between exterior signs of fire-caused damage and cambium damage. Tree mortality will be monitored for 3 years post burn. Our goal is to provide land managers with quantitatively based guidelines for assessing potential tree mortality following wildland burns.

Contact Joel McMillin for additional information.

Surveying for White Pine Blister Rust in Arizona

The search for white pine blister rust in Arizona continued in 2001, with emphasis on the southern sky islands. In early May, a team of rust experts from across the West helped survey the Pinaleño, Chiricahua and Santa Rita Mountains. Fortunately, no diseased pines were found, but some high elevation sites in the Chiricahua and Pinalenos were determined to be at risk due to the close proximity of white pines and ribes. The Santa Rita Mountains are considered immune since ribes, the alternative host, is absent.

Contact Mary Lou Fairweather for additional information.

White Pine Blister Rust Resistance Work

With assistance from Sacramento Ranger District personnel, we relocated and marked 80 southwestern white pine "resistant candidates" on the Lincoln National Forest. These trees had originally been selected in 1995 in an area heavily infected with blister rust. Cones were later collected from 17 of these trees and sent to the Institute of Forest Genetics (IFG) in Placerville, California and the Dorena Tree Improvement Center in Cottage Grove, Oregon for genetic testing. Initial testing at IFG in 1998 had indicated that low levels of genetic resistance do exist within the local population. Testing of these additional trees should provide a better understanding of resistance and help us predict the long-term impacts of this disease in the Southwest. Eventually, we may be able to use the results to develop resistant planting stock and/or to encourage natural regeneration of resistant parent trees.

Contact Dave Conklin for additional information.

Effects of Prescribed Fire on Dwarf Mistletoe

We are continuing to monitor the effects of prescribed fire (underburns) on dwarf mistletoe infection in ponderosa pine. In 2001, remeasurements were conducted on a set of plots located in the San Juan Mesa burn area on the Jemez Ranger District, Santa Fe National Forest. This area was burned in 1998, resulting in an average crown (needle) scorch of 55 percent on our sample trees. Mistletoe infection levels (DMR's) were reduced on each of three plots, with an average reduction of about 0.6. A reduction of this magnitude, although not dramatic, represents several years of stand growth before the mistletoe returns to its pre-burn level. Similar reductions had been measured in older prescribe-burned areas on the Espanola Ranger District. In 2001, we also remeasured plots in two of these older burns to track the post-burn intensification of dwarf mistletoe.

Contact Dave Conklin for additional information.

Visit Us On-line

In an effort to better serve the internet user, we continue to expand our on-line information base. The Arizona Zone Office maintains a website hosted by the Northern Arizona University School of Ecosystem Science and Management at *http://www.for.nau.edu/usfs/r3_fpm*. The Forest Service Southwestern Region hosts the Forestry & Forest Health website at *http://www.fs.fed.us/r3/resources/forestry/index.html* with links to the New Mexico and Arizona Zones. Technical information posted on these sites includes annual Forest Insect and Disease Conditions reports, literature on pest biology and management, and general information on the forest types of the Southwest. Administrative information includes roles, activities, and organizational staffing. Additionally, our Forest Health Protection national office maintains a website at *http://www.fs.fed.us/foresthealth/* which includes program overviews as well as excellent publication links.

Appendix

Instructions for Submitting Insect and Disease Specimens for Identification

Both Zone offices are equipped to receive forest insect or disease specimens submitted from the field for identification. Specimens may be shipped to the appropriate Zone office as listed on the title page of this report. The following procedures for collecting and shipping specimens should be used:

Collecting:

1. Adequate material should be collected.
2. Adequate information should be recorded, including:
    a. location of collection,
    b. when collected,
    c. who collected the specimen,
    d. host description (species, age, condition, etc.),
    e. area description (forest type, site conditions, etc.), and
    f. unusual conditions (frost, poor drainage, etc.).
3. Personal opinion of the cause of the problem may be helpful.

Packing:

1. **Larvae and other soft-bodied insects** should be shipped in small screw-top vials or bottles containing at least 70 percent isopropyl (rubbing) alcohol. Make sure bottles are well sealed.
2. **Pupae and hard-bodied insects** may be shipped either in alcohol or in small boxes. Specimens should be placed between layers of tissue paper in the boxes. Pack carefully and make sure there is little movement of material within the box. Do not pack insects in cotton.
3. **Needle or foliage diseases:** Do not ship in plastic bags as condensation can become a problem. Use a paper bag or wrap in newspaper. Pack carefully and make sure there is little movement within the box.
4. **Mushrooms and conks:** Do not ship in plastic bags. Either pack and ship immediately or air-dry and pack. To pack, wrap specimens in newspaper and pack into a shipping box with more newspaper. If on wood, include some of the decayed wood.