United States
Department of
Agriculture

Forest
Service

**Southwestern Region**

**Forestry and Forest Health**

**R3-05-01**

# Forest Insect and Disease Conditions in the Southwestern Region, 2004

**Cover photo**: Aspen mortality and dieback at Dry Lake near Flagstaff, Arizona, 2004.



Printed on recycled paper – June 2005

# Forest Insect and Disease Conditions in the Southwestern Region, 2004

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# Conditions in Brief

Although the Southwest's long-term drought continued through the 2004 growing season, it was not as extreme as the previous 2 years. This contributed to the overall decrease in conifer mortality from bark beetles, detected on 426,680 acres in 2004 compared to 2,700,000 acres in 2003. The most dramatic decrease in 2004 was in piñon mortality by piñon ips. New mortality was detected on only 146,145 acres. This figure is not directly comparable to the 1,914,345 acres detected in 2003, since not all the same acres were surveyed, but it is still a significant reduction.

Ponderosa pine mortality was attributed to *Ips* engraver beetles (84,595 acres), western pine beetle (58,160 acres), roundheaded pine beetle (525 acres), and mountain pine beetle (5 acres). Note that *Ips* activity was significantly reduced from the 695,130 acres observed in 2003. Although the number of acres affected by western pine beetle decreased by 5,000 acres across the region, there was a slight increase in mortality on the Gila National Forest and on State and private lands in New Mexico.

Bark beetle-related mortality in high elevation forests increased in 2004. In the mixed conifer and spruce-fir cover types, trees were killed by spruce beetle (21,205 acres), fir engraver beetle and western balsam bark beetle (25,700 acres), and Douglas-fir beetle and/or *Scolytus monticolae* and *Pseudohylesinus nebulosus* (87,965 acres). Mortality to true firs and Douglas-fir represent twofold and threefold increases, respectively, over observations in 2003.

**Figure 1. Bark beetle related mortality of Douglas-fir and subalpine fir on the San Francisco Peaks, Arizona.**

Defoliation by western spruce budworm increased in 2004, with 248,895 acres detected vs. 167,325 acres in 2003. Spruce aphid (*Elatobium abietinum*) defoliation occurred on 28,730 acres in 2004, which was down from 121,060 acres in 2003. New Mexico fir looper activity decreased to 5,915 acres in the Sacramento Mountains of southern New Mexico.

Aspen defoliation or dieback was observed on 54,275 acres across the region in 2004. There are differences in the type of damage between the two states. In New Mexico, over 25,000 acres were defoliated by the western tent caterpillar. In Arizona, nearly 29,000 acres of mortality and dieback of aspen were observed. This was initiated by weather related events over the past 5 years.

Dwarf mistletoes have a major impact on tree growth and mortality of ponderosa pine in the Southwest. Over one-third of the ponderosa pine acreage and about one-half of mixed conifer forest acreage has some level of infection. Bark beetle mortality is often related to dwarf mistletoe infection severity. The incidence of dwarf mistletoe changes little from year to year, but is thought to have increased over the past century.

Root diseases are widely distributed across the region, especially in higher elevation forests. Mortality and blowdown are related to forest conditions that include host species, age, and past stand management. Incidence of the most common root disease in the region, *Armillaria ostoyae*, is common in both plantations and old growth forests.

**Figure 2 White pine blister rust sporulating on alternate host, *Ribes pinetorum*.**

The incidence of white pine blister rust continues to increase in the Sacramento Mountains of southern New Mexico. Approximately 40 percent of white pines are estimated to be infected with this often fatal disease. Smaller blister rust outbreaks have been detected to the north in the Capitan and Gallinas Mountains.

# Status of Insects

## Bark Beetles

### Western Pine Beetle

*Dendroctonus brevicomis*
Primary host: Ponderosa pine

Tree mortality attributed to this insect decreased slightly across the region to 58,160 acres in 2004 vs. 63,315 acres in 2003. In Arizona, western pine beetle mortality was detected on the Apache-Sitgreaves (230 acres), Coconino (305 acres), Coronado (5 acres) and Kaibab (5 acres) National Forests; Fort Apache (145 acres), Navajo (110 acres) and San Carlos (60 acres) Indian Reservations; and 5 acres of State and private lands. Note that western pine beetle frequently occurs on ponderosa pine initially attacked by pine engraver beetles in Arizona; therefore, this beetle is likely more widespread than reported by aerial detection surveys.

Although activity decreased on most forests in New Mexico, increases were observed on the Gila National Forest and State and private lands. Mortality was detected on the Carson (1,345 acres), Cibola (1,180 acres), Gila (35,375 acres), Lincoln (6,160 acres), and Santa Fe (3,735 acres) National Forests; Valles Caldera National Preserve (15 acres), Bandelier National Monument (160 acres) and BLM lands (130 acres); Acoma Pueblo (20 acres), Isleta Pueblo (260 acres), Mescalero Apache (1,595 acres), Taos Pueblo (55 acres) and other (170 acres) tribal lands; and 7,095 acres of State and private lands.

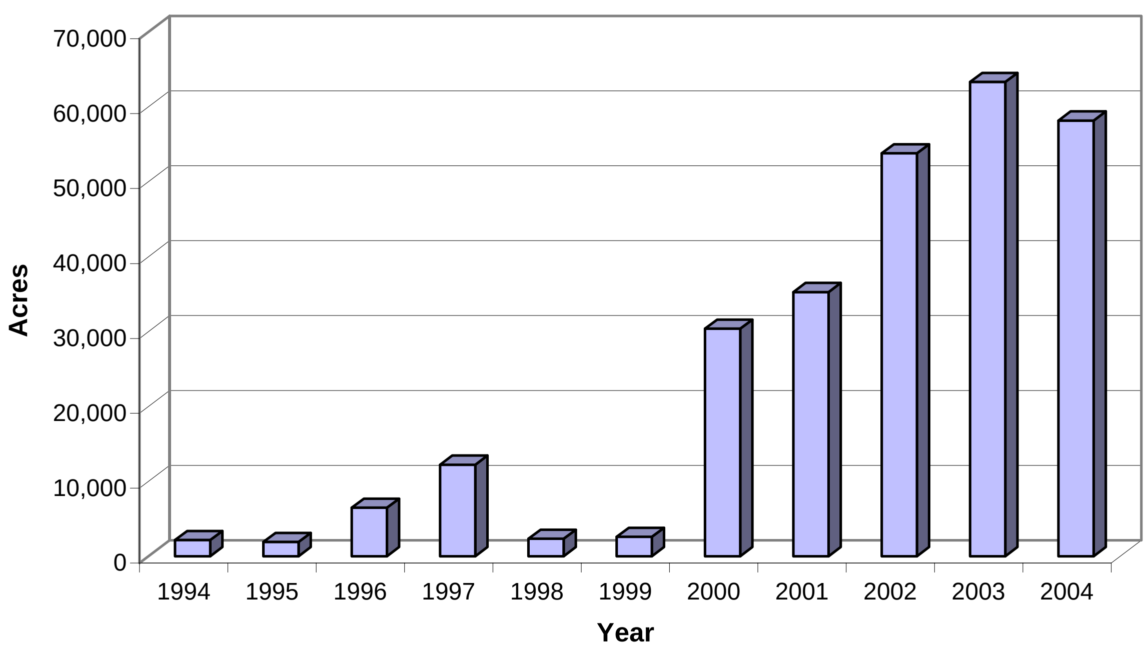



**Figure 3. Western pine beetle activity in Arizona and New Mexico, 1994 – 2004.**

## Mountain Pine Beetle

*Dendroctonus ponderosae*
Primary hosts: Ponderosa, limber and bristlecone pine

Mountain pine beetle-caused ponderosa pine mortality decreased from 190 acres in 2003 to 5 acres in 2004. In Arizona, 5 acres of mountain pine beetle-caused mortality occurred on Grand Canyon National Park. Although not detected by aerial surveys, limited limber pine mortality caused by mountain pine beetle was observed from the ground on the San Francisco Peaks and Kendrick Mountain near Flagstaff, Arizona. In New Mexico, no mountain pine beetle-caused mortality was recorded.

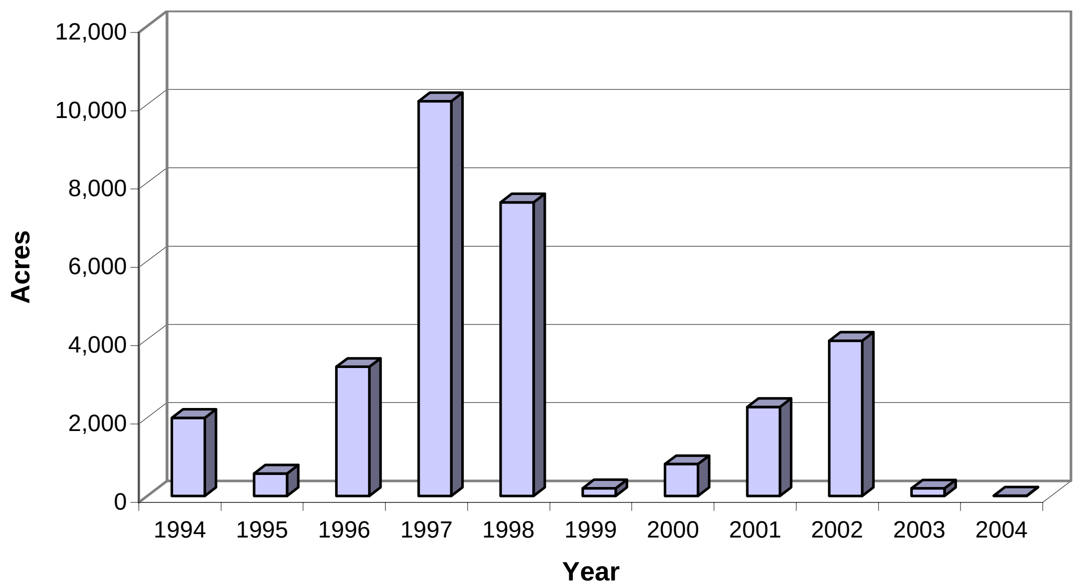



**Figure 4. Mountain pine beetle activity in Arizona and New Mexico, 1994 – 2004.**

## Roundheaded Pine Beetle

*Dendroctonus adjunctus*
Primary host: Ponderosa pine

Roundheaded pine beetle-caused tree mortality in the region decreased significantly to 525 acres in 2004 compared to 4,530 acres in 2003. In Arizona, roundheaded pine beetle mortality was recorded on 315 acres of the Coronado National Forest and 210 acres of the Chiricahua National Monument. In New Mexico, no mortality was attributed to this insect. Roundheaded pine beetle has a fairly wide distribution, is often associated with other bark beetles and may be active in areas where mortality is attributed to other species. For example, ground surveys detected roundheaded pine beetle activity near Alpine, Arizona, but no mortality was attributed to this species in aerial surveys. Note that the 2002 data in Figure 3 includes about 13,000 additional acres in New Mexico affected by a combination of roundheaded and western pine beetle.

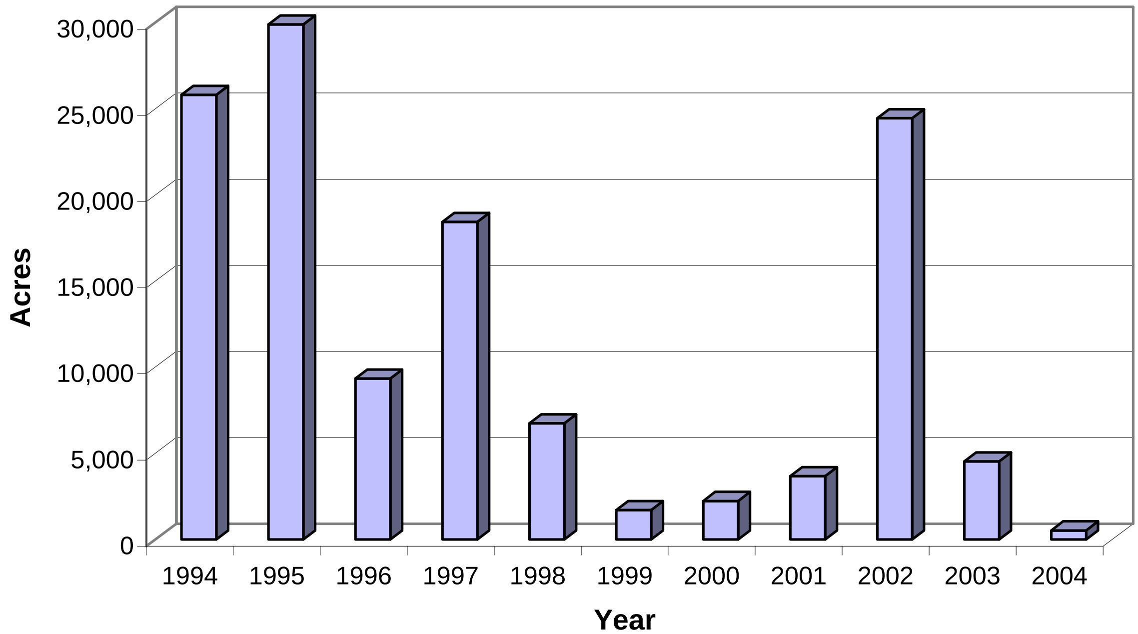



**Figure 5. Roundheaded pine beetle activity in Arizona and New Mexico, 1994 – 2004.**

## Ips Beetles

*Ips* spp.
Primary hosts: Ponderosa pine, piñon pine

**Ponderosa pine mortality** caused by *Ips* beetles decreased significantly from 695,130 in 2003 to 84,595 acres in 2004. Almost all of this 2004 acreage is in Arizona where several species of *Ips* have been found attacking ponderosa pine. The list includes *I. lecontei*, *I. pini*, *I. calligraphus*, *I. latidens*, *I. knausi*, and *I. integer*. Frequently, multiple *Ips* species have been identified from a single infested tree and/or in combination with western pine beetle and other *Dendroctonus* species.

In Arizona, ponderosa pine mortality due to *Ips* beetles was reported on the Apache-Sitgreaves (11,445 acres), Coconino (11,050 acres), Coronado (630 acres), Kaibab (29,805 acres), Prescott (8,850 acres) and Tonto (6,365 acres) National Forests; Grand Canyon National Park (3,195 acres), Saguaro National Monument (10 acres), Walnut Canyon National Monument (15 acres), and BLM lands (2,835 acres); Fort Apache (7,450 acres), Haulapai (195 acres), Navajo (420 acres) and San Carlos (55 acres) Indian Reservations; and 2,250 acres of State and private lands.

In New Mexico, *Ips*-caused ponderosa pine mortality was detected on the Gila National Forest (25 acres).

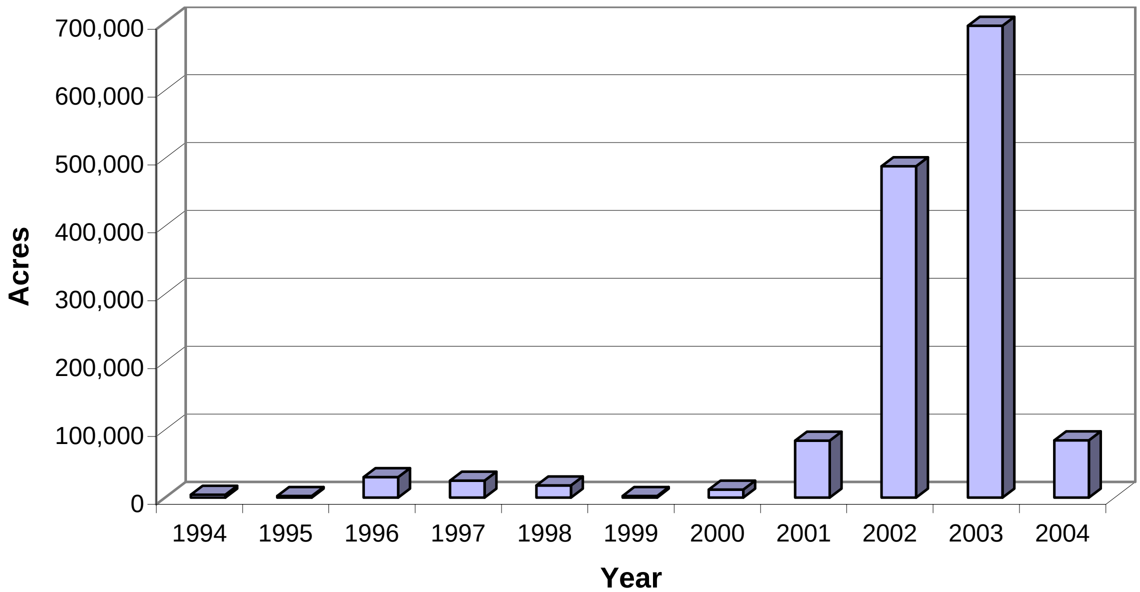



**Figure 6. *Ips* beetle activity in ponderosa pine in Arizona and New Mexico, 1994 – 2004.**

**Piñon mortality**, caused primarily by *Ips confusus*, was detected on 146,150 acres regionwide in 2004. This figure is not directly comparable to the 1,914,345 acres reported in 2003 because less acreage was flown in Arizona during 2004 aerial detection surveys. However, the New Mexico numbers are comparable because the same areas were flown.

In Arizona, piñon ips-caused tree mortality was recorded on the Apache-Sitgreaves (2,975 acres), Coconino (750 acres), Coronado (65 acres), Kaibab (6,920 acres) and Tonto (25 acres) National Forests; 160 acres of BLM land; and Fort Apache (70 acres), Haulapai (180 acres), Hopi (15 acres), Navajo (10,280 acres), Navajo-Hopi JUA (5 acres) and San Carlos (30 acres) Indian Reservations; and 2,295 acres of State and private land.

Supplemental aerial surveys conducted in New Mexico in 2003 for piñon were continued in 2004. Piñon ips-caused tree mortality was recorded on the Carson (33,265 acres), Cibola (8,120 acres), Gila (975 acres), and Santa Fe (21,165 acres) National Forests; Bureau of Land Management lands (19,910 acres); Isleta Pueblo (265 acres), Jemez Pueblo (35 acres), Jicarilla Apache (20 acres), Mescalero Apache (1,240 acres), Nambe Pueblo (2,540 acres), Picuris Pueblo (30 acres), Sandia Pueblo (20 acres), Santa Clara Pueblo (1,785 acres), Taos Pueblo ( 2,140 acres), Tesuque Pueblo (50 acres), Zuni Pueblo (725 acres) and other (5 acres) tribal lands; and 30,085 acres of State and private lands.

## Douglas-fir Beetle

*Dendroctonus pseudotsugae*
Host: Douglas-fir

Douglas-fir beetle mortality in the Southwest tripled from 28,955 in 2003 to 87,965 acres in 2004. In addition to *D. pseudotsugae*, this mortality can be due to a complex of factors including Douglas-fir dwarf mistletoe, armillaria root disease, *Scolytus monticolae*, and *Pseudohylesinus nebulosus*. These agents and their importance vary by location and stand conditions.

Figure 7. Dwarf mistletoe infected Douglas-fir attacked by Douglas-fir beetle.

In Arizona, Douglas-fir mortality was recorded on the Apache-Sitgreaves (5,645 acres), Coconino (4,365 acres), Coronado (980 acres), Kaibab (615 acres), Prescott (45 acres) and Tonto (685 acres) National Forests; Grand Canyon National Park (10 acres), Walnut Canyon National Monument (15 acres), and 145 acres of BLM lands; Fort Apache (90 acres) and Navajo (5 acres) Indian Reservations; and 160 acres of State and private land.

In New Mexico, Douglas-fir mortality was detected on the Carson (15,815 acres), Cibola (3,630 acres), Gila (7,310 acres), Lincoln (1,115 acres), and Santa Fe (23,075 acres) National Forests; Valles Caldera National Preserve (1,060 acres), Bandelier National Monument (1,815 acres) and 235 acres of BLM land; Jicarilla Apache (1,795 acres), Mescalero Apache (650 acres), Picuris Pueblo (75 acres), Santa Clara Pueblo (1,445 acres), Taos Pueblo (760 acres) and 30 acres of other tribal lands; and 16,395 acres of State and private lands.

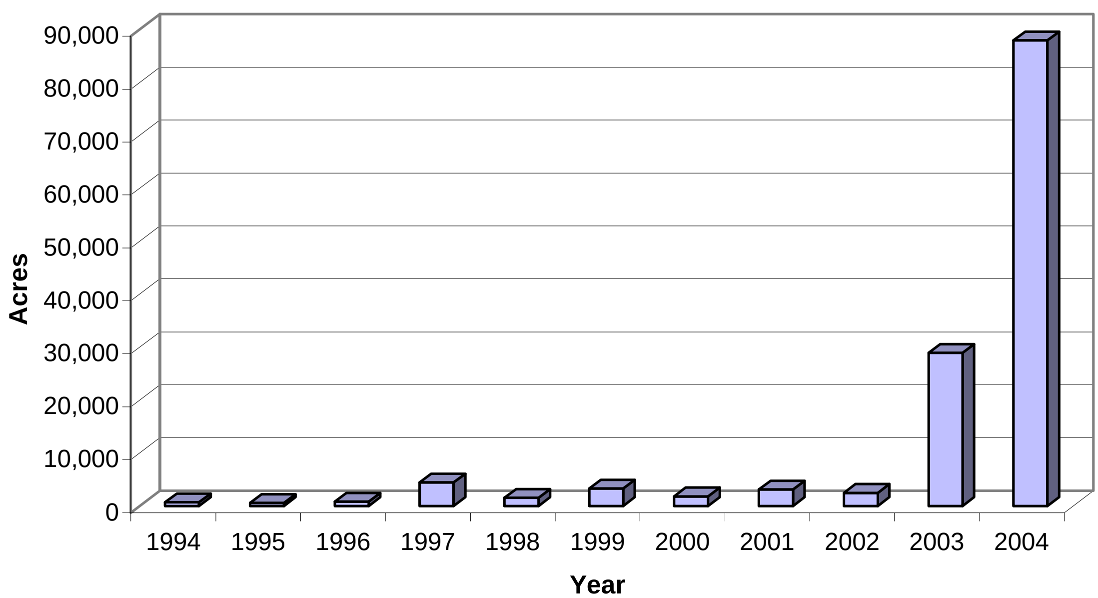



**Figure 8. Douglas-fir beetle activity in Arizona and New Mexico, 1994 – 2004.**

## Spruce Beetle

*Dendroctonus rufipennis*
Host: Spruce

Spruce beetle-caused tree mortality decreased slightly from 24,435 acres in 2003 to 21,205 acres in 2004. In Arizona, spruce beetle mortality occurred on the Apache-Sitgreaves (3,895 acres) and Coconino (265 acres) National Forests and the Fort Apache (2,255 acres) and Navajo (120 acres) Indian Reservations. Ground surveys detected additional spruce beetle activity in the Pinaleño Mountains on Coronado National Forest.

In New Mexico, spruce beetle related tree mortality occurred on the Carson (3,905 acres), Cibola (225 acres), Lincoln (35 acres), and Santa Fe (1,620 acres) National Forests; the Valles Caldera National Preserve (40 acres); Mescalero Apache (65 acres) and Taos Pueblo (435 acres) tribal lands; and 8,345 acres of State and private lands.

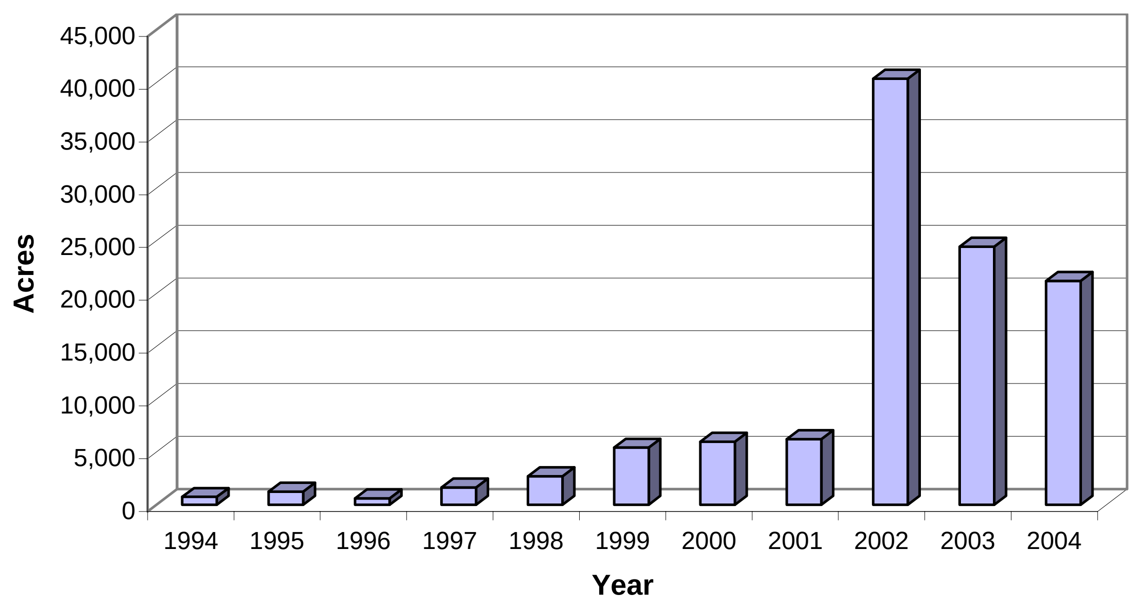



**Figure 9. Spruce beetle activity in Arizona and New Mexico, 1994 – 2004.**

## True Fir Beetles

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

True fir beetle mortality more than doubled in 2004 to 25,700 acres vs. 11,715 acres in 2003. The largest increases occurred in national forests in New Mexico. In Arizona, fir mortality was recorded on the Apache-Sitgreaves (2,450 acres), Coconino (1,715 acres), and Kaibab (1,065 acres) National Forests; Grand Canyon National Park (140 acres) and 45 acres of BLM lands; Fort Apache (25 acres) and Navajo (60 acres) Indian Reservations; and 5 acres of State and private lands.

In New Mexico, fir mortality was reported on the Carson (165 acres), Cibola (6,440 acres), Gila (85 acres), Lincoln (9,315 acres), and Santa Fe (90 acres) National Forests; Jicarilla Apache (10 acres), Mescalero Apache (3,360 acres), and Santa Clara Pueblo (15 acres) tribal lands; and 715 acres of State and private lands.

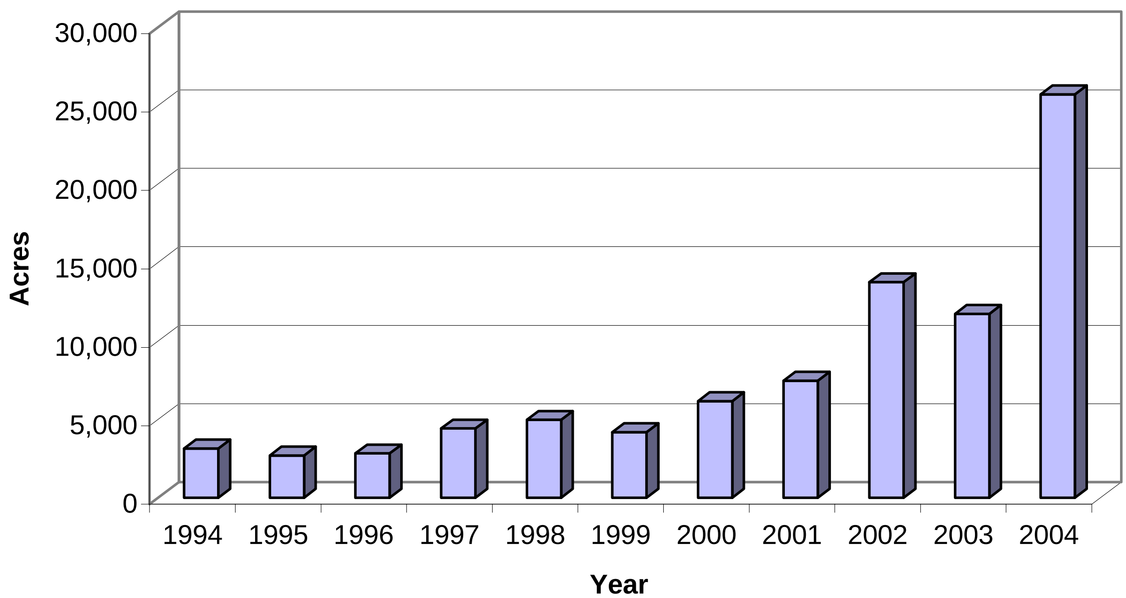



**Figure 10. Fir engraver and western balsam bark beetle activity in Arizona and New Mexico, 1994 – 2004.**

## Cedar (Juniper) and Cypress Bark Beetles

*Phloeosinus* spp.

Juniper mortality caused by cedar bark beetles was recorded on 3,045 acres in New Mexico in 2004. Mortality was recorded on the Gila National Forest (2,885 acres) and 160 acres of State and private land. Although no aerial survey acres were reported for Arizona, this beetle is observed across the range of juniper. Mortality started in fringe habitat near grasslands during 2003 and is now found in piñon-juniper woodlands.

**Figure 11. Cedar bark beetle gallery on Utah juniper**

Extensive mortality of Arizona cypress has occurred in both central and southeastern Arizona the past 3 years. *Phloeosinus* spp. have also attacked landscape Leyland cypress in both Arizona and New Mexico.

**Figure 12. Arizona cypress mortality caused by *Phloeosinus* spp. near Clifton, AZ.**

## Douglas-fir Engraver

*Scolytus* sp.

**Figure 13. Douglas-fir engraver beetle gallery.**

Engraver beetles caused significant amounts of Douglas-fir mortality in the Sacramento Mountains of southern New Mexico in 2004. These were first detected and brought to our attention by Mescalero Agency silviculturist Bill Hornsby. Dr. Anthony Cognato (Texas A&M University) has tentatively identified this insect as *Scolytus monticolae* (=*S. tsugae*). This appears to be the first report of this species in the Southwest. Unlike the more common fir engraver, *Scolytus ventralis*, which primarily attacks white fir and constructs horizontal egg galleries, *S. monticolae* constructs vertical galleries approximately 2.5 inches long. Examination of some recent Douglas-fir mortality on the Santa Fe National Forest also revealed similar galleries, indicating that this insect may have a wide distribution in the region, at least in New Mexico. Typically, these beetles attacked the boles of pole-size Douglas-fir and the branches of larger trees. The galleries of these beetles may be confused with the Douglas-fir pole beetle, *Pseudohylesinus nebulosus*, which also attacks smaller diameter Douglas-fir.

# Defoliators

## Western Spruce Budworm

*Choristoneura occidentalis*
Hosts: True firs, Douglas-fir, spruce

Western spruce budworm defoliation increased from 167,325 acres in 2003 to 248,895 acres in 2004. In Arizona, western spruce budworm defoliation was recorded on the Apache-Sitgreaves National Forest (10 acres) and the Navajo Indian Reservation (10,700 acres). In New Mexico, western spruce budworm defoliation continues to be chronic on the Carson (114,990 acres) and Santa Fe (68,720 acres) National Forests. Other affected areas include the Cibola (300 acres), Gila (695 acres), and Lincoln (770 acres) National Forests; Valles Caldera National Preserve (5,390 acres); Jicarilla Apache (1,760 acres) and Taos Pueblo (3,640 acres) tribal lands; and on approximately 41,920 acres of State and private lands.

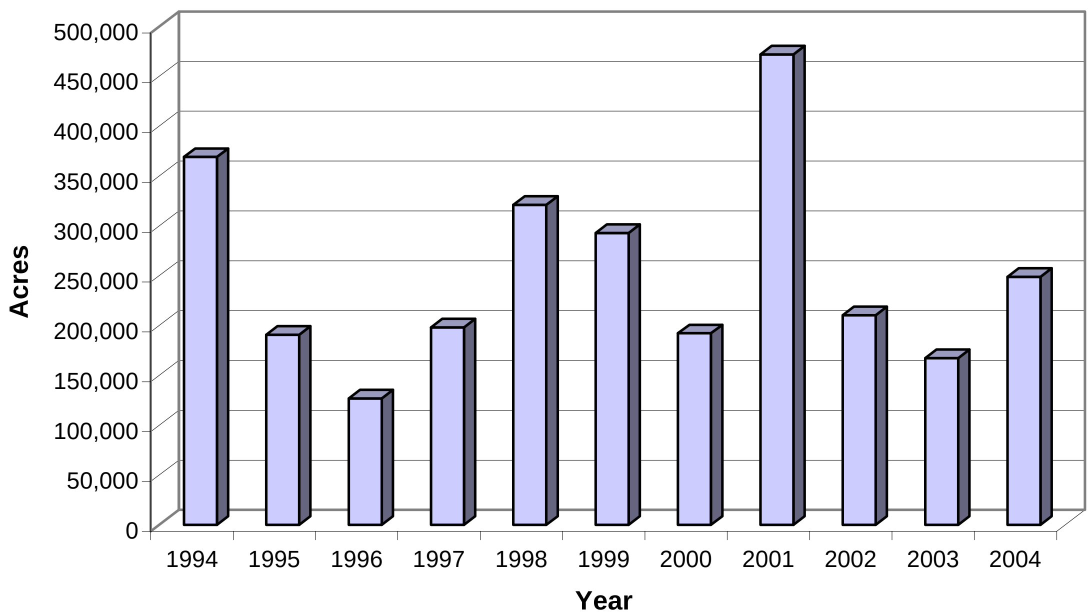



**Figure 14. Western spruce budworm activity in Arizona and New Mexico, 1994 – 2004.**

## Douglas-fir Tussock Moth

*Orgyia pseudotsugata*
Hosts: White fir, Douglas-fir, spruce

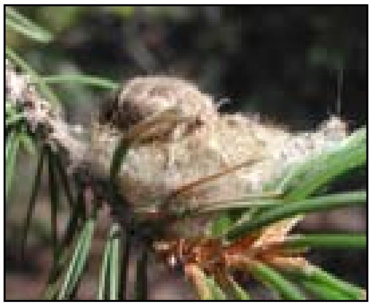


Figure 15. Flightless female Douglas-fir tussock moth on cocoon.

Douglas-fir tussock moth activity was detected in 2004 in New Mexico. An outbreak was observed on 295 acres in Pino Canyon of the Sandia Ranger District, Cibola National Forest. The last outbreak of Douglas-fir tussock moth in this area occurred during 1977-1979. During the 1970s period, three outbreak centers were recorded in the canyons directly north (Cañon de Domingo Baca) and south (Bear Canyon) of Pino Canyon as well as further north in the Sandia Mountains in Cañon del Agua. In the peak of this outbreak in 1978, defoliation was found on 1,000 acres in Bear Canyon, 200 acres in Cañon de Domingo Baca and 300 acres in Cañon del Agua. The heavy defoliation in Bear Canyon resulted in some areas of high levels of tree mortality. The level of resultant mortality in the current outbreak in Pino Canyon is yet unknown.

Figure 16. Egg mass on cocoon.

## New Mexico Fir Looper

*Galenara consimilus*
Hosts: Douglas-fir and white fir

New Mexico fir looper activity decreased in the Sacramento Mountains in 2004 to 5,915 acres of defoliation detected vs. 7,205 acres in 2003. All defoliated acres were detected on the Sacramento Ranger District of the Lincoln National Forest.

## Spruce Aphid

*Elatobium abietinum*
Host: Spruce

Defoliation by spruce aphid decreased significantly from 121,060 acres in 2003 to 28,730 acres in 2004. In Arizona, spruce aphid defoliation was recorded on the Apache-Sitgreaves National Forests (5,185 acres); Fort Apache Indian Reservation (23,515 acres); and 30 acres of State and private land. No spruce aphid defoliation was recorded in New Mexico.

## Ponderosa Pine Needle Miner

*Coleotechnites ponderosae*

No needle miner activity was detected in Arizona or New Mexico in 2004.

## Piñon Needle Scale

*Matsucoccus acalyptus*

Scale is a chronic defoliator of piñon at several locations in the woodlands of Arizona and New Mexico. In Arizona, moderate to heavy defoliation of piñon was observed on the Prescott, Coconino, and Apache-Sitgreaves National Forests. In New Mexico, activity was observed on federal lands in the San Mateo and Datil mountains; in Lincoln County near the Capitan Mountains; and in small pockets south of Capitan. An outbreak of piñon needle scale was also observed along James Canyon west of Mayhill, NM. Other woodlands with reported damage include private lands south of Willard, east of El Rito, south of Corona, and east of Silver City.

## Aspen Dieback/Defoliation

**Weather-related Damage**
**Western Tent Caterpillar**, *Malacosoma* californicum
**Cytospora canker**, *Cytospora chrysosperma*

Aspen dieback and defoliation was detected on 66,725 acres in 2004, a decrease from the 77,420 acres reported in 2003. There are differences in type of damage between the two states. In Arizona, aspen have continued to dieback due to severe drought in 2002. In New Mexico, trees defoliated across several forests by the western tent caterpillar are expected to recover.

In Arizona, acres of aspen dieback included Apache-Sitgreaves (5,330 acres), Coconino (2,290 acres), Kaibab (17,780 acres) and Tonto (70 acres) National Forests; Grand Canyon National Park (5,740 acres); Fort Apache (4,820 acres) and Navajo (5,090 acres) Indian Reservations; and 220 acres of State and private land.

In New Mexico, aspen defoliation was observed on the Carson (7,570 acres), Cibola (1,380 acres), Gila (3,555 acres), Lincoln (105 acres), and Santa Fe (2,070 acres) National Forests; Valles Caldera National Preserve (325 acres), Bandelier National Monument (185 acres) and BLM lands (45 acres); Jicarilla Apache (585 acres), Mescalero Apache (110 acres), Santa Clara Pueblo (60 acres) and Taos Pueblo (1,005 acres) tribal lands; and 8,390 acres of State and private lands.

# Miscellaneous Insects

An outbreak of **cottonwood leaf beetle** (*Chrysomela scripta*) was observed on San Ildefonso tribal lands in northern New Mexico in late August. Crowns of several dozen narrow-leaf cottonwoods (*Populus angustifolia*) in Las Alamos Canyon were severely discolored by this leaf skeletonizer. Adjacent Rio Grande cottonwoods (*P. deltoides*) were unaffected.

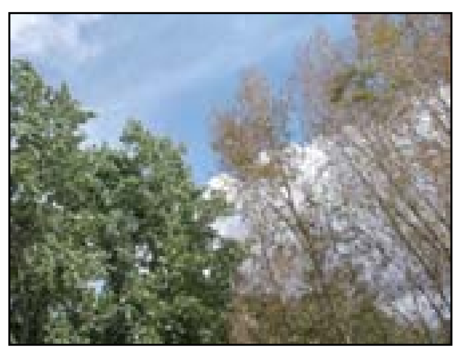


**Figure 17. The cottonwood leaf beetle prefers narrow-leaf cottonwood (right) to Rio Grande Cottonwood (left).**

A significant outbreak of **tent caterpillar** (*Malacosoma sp.*) was observed on mountain mahogany (*Cercocarpus montanus*) at Capulin Volcano National Monument in northern New Mexico in late June.

Figure 18. Tent caterpillar on mountain mahogany.

Populations of the winter feeding **bull pine sawfly** larvae, *Zadiprion townsendii*, continued at low levels in localized infested trees of Santa Fe. These insects have also been reported from Las Vegas, Cedar Crest and Mountainair and likely occur throughout the range of ponderosa pine. This insect is usually found where ponderosa pine interfaces with piñon woodlands.

Landscape pines, particularly ponderosa pine, continue to be severely damaged by several **tip moth species of the genus *Rhyacionia***. **Nantucket pine tip moth** and **western pine tip moth** appear to be causing the most severe injury to ornamental pines. Several other tip moth species are routinely caught in pheromone traps.

Figure 19. Twig beetle kills branch tips and is often associated with dwarf mistletoe infection.

Extensive outbreaks of **twig beetle** in association with other bark beetles, especially *Ips* spp. occur in piñon woodlands in Arizona and New Mexico. In Arizona, **twig beetle** populations began to noticeably increase in the younger age classes of piñon pine in 2003 and expanded to all age classes in 2004. In particular, areas near Flagstaff, Heber/Overgaard, and Springerville had twig beetle damage. In New Mexico, high populations have been observed statewide with the most notable areas being near Santa Fe, Ojo Caliente, Pecos and the eastern slopes of the Sandia and Manzano mountains. Landscape pine damage continues to be extensive due to water stress. Trees under stress due to dry rocky slopes, overcrowded stands, heavy dwarf mistletoe infection, and construction injury are most frequently attacked. Twig beetles are a common cause of tree mortality in transplanted pines.

**Bagworms**, *Thyriodopteryx* spp., continue to be an aesthetic problem in the Albuquerque area on junipers, cypress and a number of hardwood trees.

# Status of Diseases

## Mistletoes

### 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, and Douglas-fir—are found throughout most of the ranges of their respective hosts, while the other species have more limited distributions. Regionally, over one-third of the ponderosa pine type, and up to one-half of the mixed conifer type, has some level of infection.

**Figure 20. Southwestern dwarf mistletoe shoots.**

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. In most years, dwarf mistletoe infestation represents far more loss to timber resources in the Southwest than do insects. Extensive dwarf mistletoe infestation also increases overall forest flammability. On the other hand, as a natural part of the forest, dwarf mistletoes 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 on juniper throughout the region, and are locally abundant in desert woodlands and lower elevation riparian areas. Heavy infection contributes toward host mortality, especially during periods of drought.

## Root Diseases

Root diseases are often associated with mortality caused by bark beetles and other agents. They can also predispose trees to windthrow, a concern in higher elevation recreation 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. Previous 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 occasionally 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

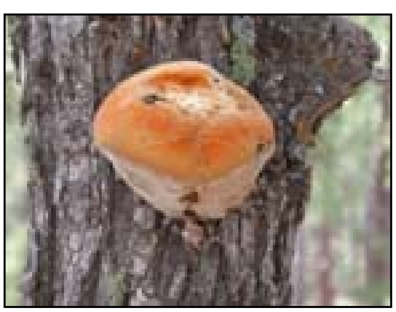


**Figure 21. *Inonotus dryophilus*, a heartrot of oak.**

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 many 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 tinctorium*, on white fir; **aspen trunk rot**, *Phellinus tremulae*; and *Inonotus dryophilus* on oak.

## 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

Blister rust occurs throughout most of the range of southwestern white pine in the Sacramento Mountains, the adjoining White Mountains, and the nearby Capitan Mountains of southern New Mexico. This area includes two districts of the Lincoln National Forest and the Mescalero Apache Indian Reservation. An estimated 40 percent of the white pines are currently infected within this area, based on a set of representative plots. The disease has been detected more recently on Gallinas Peak, Cibola National Forest, about 80 miles north of the main outbreak area. Blister rust has not yet been detected in northern New Mexico or in Arizona.

### 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 and Manzano Mountains of central New Mexico and at a few other locations. Damage from these easily recognized diseases has not been well quantified; however, infection can result in topkill, particularly in spruce. 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 parts 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. This disease is uncommon in New Mexico.

### Comandra Blister Rust

*Cronartium comandrae*
Host: Pines

This disease has caused extensive branch dieback and mortality of nonnative Mondell/Afghan pine (*Pinus eldarica*) in the Prescott, Payson, and Sedona areas of central Arizona. It occasionally infects native ponderosa pines in this area, but has caused minimal damage to this species.

### Western Gall Rust

*Peridermium (Endocronartium) harknessii*
Host: Pines

This is an occasional disease of ponderosa pine in the Southwest where it is usually found as the white spored form, rather than the orange spored form. New infestations of gall rust were detected in the San Francisco Peaks of northern Arizona in 2004 and the Jemez Mountains in New Mexico.

**Figure 22. Gall on a ponderosa pine branch.**

## Foliage Diseases

(see also “Aspen Defoliation” in “Status of Insects” section)

**Figure 23. Sycamore anthracnose vein-associated leaf blight lesion.**

### Sycamore Anthracnose

*Apiognomonia venata*

Defoliation and shoot dieback of Arizona sycamore, caused by sycamore anthracnose, was observed along several riparian areas in central Arizona in May of 2004. Trees were almost completely defoliated. Fungal spore dispersal was aided by an unusual weeklong period of wet, cool spring conditions. The disease occurs in three phases: bud and twig formation, shoot blight, and leaf blight. New leaves and shoots emerge from previously dormant buds within a month.

### Ponderosa Pine Needle Cast

*Lophodermella cerina* and other species

Only 245 acres of needle cast were detected in 2004, and it occurred on private lands in Colfax and Mora Counties of New Mexico.

## Abiotic Damage

### Drought

Discoloration of ponderosa pine attributed to drought was mapped on 39,320 acres in 2004. Affected areas include the Coconino (18,210 acres), Coronado (845 acres), Kaibab (14,685 acres), Prescott (1,860 acres), and Tonto (200 acres) National Forests; Grand Canyon (5 acres) and Saguaro (565 acres) National Parks; and Walnut National Monument (315 acres); and 2,635 acres of State and private lands.

Several hundred acres of drought induced shrub and woodland discoloration were mapped on the Coronado, Kaibab, and Prescott National Forests.

Table 1. Prominent 2004 forest insect and disease activity (acres) in Arizona and New Mexico.

| Agent | State | National Forest | Tribal Lands | Other Federal | State & Private | Total |
|---|---|---|---|---|---|---|
| Western pine beetle | AZ | 545 | 315 | 0 | 5 | 865 |
| | NM | 47,810 | 2,100 | 290 | 7,095 | 57,295 |
| Roundheaded pine beetle | AZ | 315 | 0 | 210 | 0 | 525 |
| *Ips* beetle (ponderosa pine) | AZ | 68,145 | 8,120 | 6,055 | 2,250 | 84,570 |
| | NM | 25 | 0 | 0 | 0 | 25 |
| *Ips* beetle (piñon pine) | AZ | 10,735 | 10,580 | 160 | 2,295 | 23,770 |
| | NM | 63,525 | 8,860 | 19,910 | 30,085 | 122,380 |
| Douglas-fir beetle | AZ | 12,335 | 95 | 170 | 160 | 12,760 |
| | NM | 52,005 | 4,755 | 2,050 | 16,395 | 75,205 |
| Spruce beetle | AZ | 4,160 | 2,375 | 0 | 0 | 6,535 |
| | NM | 5,825 | 500 | 0 | 8,345 | 14,670 |
| True fir beetles | AZ | 5,230 | 85 | 185 | 5 | 5,505 |
| | NM | 16,095 | 3,385 | 0 | 715 | 20,195 |
| Western spruce budworm | AZ | 10 | 10,700 | 0 | 0 | 10,710 |
| | NM | 190,865 | 5,400 | 0 | 41,920 | 238,185 |
| Spruce aphid | AZ | 5,185 | 23,515 | 0 | 30 | 28,730 |
| New Mexico fir looper | NM | 5,915 | 0 | 0 | 0 | 5,915 |
| Aspen defoliation | AZ | 25,470 | 9,910 | 5,740 | 220 | 41,340 |
| | NM | 15,005 | 1,760 | 230 | 8,390 | 25,385 |
| Drought effects on ponderosa pine | AZ | 35,800 | 0 | 885 | 2,635 | 39,320 |
| 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. 2004 Bark beetle incidence by site (in acres) from aerial detection surveys.

| | 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 |
|---|---|---|---|---|---|---|---|---|---|
| Apache-Sitgreaves NFs | 230 | | | 11,445 | 2,975 | 5,645 | 3,895 | 2,450 | 26,640 |
| Coconino NF | 305 | | | 11,050 | 750 | 4,365 | 265 | 1,715 | 18,450 |
| Coronado NF | 5 | | 315 | 630 | 65 | 980 | | | 1,995 |
| Kaibab NF | 5 | | | 29,805 | 6,920 | 615 | | 1,065 | 38,410 |
| Prescott NF | | | | 8,850 | | 45 | | | 8,895 |
| Tonto NF | | | | 6,365 | 25 | 685 | | | 7,075 |
| Grand Canyon NP | | 5 | | 3,195 | | 10 | | 140 | 3,350 |
| Chiricahua NM | | | 210 | | | | | | 210 |
| Saguaro NM | | | | 10 | | | | | 10 |
| Walnut Canyon NM | | | | 15 | | 15 | | | 30 |
| BLM | | | | 2,835 | 160 | 145 | | 45 | 3,185 |
| Fort Apache Tribal | 145 | | | 7,450 | 70 | 90 | 2,255 | 25 | 10,035 |
| Hualapai Tribal | | | | 195 | 180 | | | | 375 |
| Navajo Tribal | 110 | | | 420 | 10,280 | 5 | 120 | 60 | 10,995 |
| San Carlos Tribal | 60 | | | 55 | 30 | | | | 145 |
| Hopi Tribal | | | | | 15 | | | | 15 |
| Nav-Hopi JUA | | | | | 5 | | | | 5 |
| State & Private | 5 | | | 2,250 | 2,295 | 160 | | 5 | 4,715 |
| **Arizona Total** | **865** | **5** | **525** | **84,570** | **23,770** | **12,760** | **6,535** | **5,505** | **134,535** |
| Carson NF | 1,345 | | | | 33,265 | 15,815 | 3,905 | 165 | 54,495 |
| Cibola NF | 1,180 | | | | 8,120 | 3,630 | 225 | 6,440 | 19,595 |
| Gila NF | 35,375 | | | 25 | 975 | 7,310 | | 85 | 43,770 |
| Lincoln NF | 6,160 | | | | | 1,115 | 35 | 9,315 | 16,625 |
| Santa Fe NF | 3,735 | | | | 21,165 | 23,075 | 1,620 | 90 | 49,685 |
| Valles Caldera NP | 15 | | | | | 1,060 | 40 | | 1,115 |
| BLM | 130 | | | | 19,910 | 235 | | | 20,275 |
| Bandelier NM | 160 | | | | | 1,815 | | | 1,975 |
| Acoma Pueblo | 20 | | | | | | | | 20 |
| Isleta Pueblo | 260 | | | | 265 | | | | 525 |
| Jemez Pueblo | | | | | 35 | | | | 35 |
| Jicarilla Apache Tribal | | | | | 20 | 1,795 | | 10 | 1,825 |
| Mescalero Apache | 1,595 | | | | 1,240 | 650 | 65 | 3,360 | 6,910 |
| Nambe Pueblo | | | | | 2,540 | | | | 2,540 |
| Navajo Tribal | | | | | 5 | | | | 5 |
| Other Tribal | 170 | | | | 5 | 30 | | | 205 |
| Picuris Pueblo | | | | | 30 | 75 | | | 105 |
| Sandia Pueblo | | | | | 20 | | | | 20 |
| Santa Clara Pueblo | | | | | 1,785 | 1,445 | | 15 | 3,245 |
| Taos Pueblo | 55 | | | | 2,140 | 760 | 435 | | 3,390 |
| Tesuque Pueblo | | | | | 50 | | | | 50 |
| Zuni Pueblo | | | | | 725 | | | | 725 |
| State & Private | 7,095 | | | | 30,085 | 16,395 | 8,345 | 715 | 62,635 |
| **New Mexico Total** | **57,295** | **0** | **0** | **25** | **122,380** | **75,205** | **14,670** | **20,195** | **289,770** |
| **SW Region Total** | **58,160** | **5** | **525** | **84,595** | **146,150** | **87,965** | **21,205** | **25,700** | **424,305** |

Table 3. 2004 Defoliation incidence by site (in acres) from aerial detection surveys.

| | Western Spruce Budworm | Spruce Aphid | Aspen Damage | NM Fir Looper | Needle Cast | Douglas-fir Tussock Moth | Drought | Defoliation Total |
|---|---|---|---|---|---|---|---|---|
| Apache-Sitgreaves NFs | 10 | 5,185 | 5,330 | | | | | 10,525 |
| Coconino NF | | | 2,290 | | | | 18,210 | 20,500 |
| Coronado NF | | | | | | | 845 | 845 |
| Kaibab NF | | | 17,780 | | | | 14,685 | 32,465 |
| Prescott NF | | | | | | | 1,860 | 1,860 |
| Tonto NF | | | 70 | | | | 200 | 270 |
| Grand Canyon NP | | | 5,740 | | | | 5 | 5,745 |
| Chiricahua NM | | | | | | | | 0 |
| Saguaro NM | | | | | | | 565 | 565 |
| Walnut Canyon NM | | | | | | | 315 | 315 |
| BLM | | | | | | | | 0 |
| Fort Apache Tribal | | 23,515 | 4,820 | | | | | 28,335 |
| Hualapai Tribal | | | | | | | | 0 |
| Navajo Tribal | 10,700 | | 5,090 | | | | | 15,790 |
| San Carlos Tribal | | | | | | | | 0 |
| Hopi Tribal | | | | | | | | 0 |
| Nav-Hopi JUA | | | | | | | | 0 |
| State & Private | | 30 | 220 | | | | 2,635 | 2,885 |
| **Arizona Total** | **10,710** | **28,730** | **41,340** | **0** | **0** | **0** | **39,320** | **120,100** |
| Carson NF | 114,990 | | 7,570 | | | | | 122,560 |
| Cibola NF | 300 | | 1,380 | | | 295 | | 1,975 |
| Gila NF | 695 | | 3,555 | | | | | 4,250 |
| Lincoln NF | 770 | | 105 | 5,915 | | | | 6,790 |
| Santa Fe NF | 68,720 | | 2,070 | | | | | 70,790 |
| Valles Caldera NP | 5,390 | | 325 | | | | | 5,715 |
| BLM | | | 45 | | | | | 45 |
| Bandelier NM | | | 185 | | | | | 185 |
| Acoma Pueblo | | | | | | | | 0 |
| Isleta Pueblo | | | | | | | | 0 |
| Jemez Pueblo | | | | | | | | 0 |
| Jicarilla Apache Tribal | 1,760 | | 585 | | | | | 2,345 |
| Mescalero Apache | | | 110 | | | | | 110 |
| Nambe Pueblo | | | | | | | | 0 |
| Navajo Tribal | | | | | | | | 0 |
| Other Tribal | | | | | | | | 0 |
| Picuris Pueblo | | | | | | | | 0 |
| Sandia Pueblo | | | | | | | | 0 |
| Santa Clara Pueblo | | | 60 | | | | | 60 |
| Taos Pueblo | 3,640 | | 1,005 | | | | | 4,645 |
| Tesuque Pueblo | | | | | | | | 0 |
| Zuni Pueblo | | | | | | | | 0 |
| State & Private | 41,920 | | 8,390 | | 245 | | | 50,555 |
| **New Mexico Total** | **238,185** | **0** | **25,385** | **5,915** | **245** | **295** | **0** | **270,025** |
| **SW Region Total** | **248,895** | **28,730** | **66,725** | **5,915** | **245** | **295** | **39,320** | **390,125** |

# Biological Evaluations and Technical Assistance

Our staff provides 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.

## Arizona Zone

1. Bark beetle activity on the Santa Catalina Mountains; 1/28/04.
2. Insect activity on the San Carlos Reservation; 2/09/04.
3. Technical assistance visit to the Dragoon and Santa Catalina Mountains; 3/04/04.
4. Bark beetle risk surrounding Eager Biomass Plant; 8/12/04.
5. Dwarf mistletoe infection in the Jacob Ryan analysis area; 8/19/04.
6. Evaluation of the North Kaibab vegetation restoration project; 8/20/04.
7. Bark beetle activity at IMAX project area; 8/26/04.
8. Post treatment evaluation of MCH and spruce beetle activity, Pinaleño Mts.; 9/08/04.
9. Hazard tree assessment at Indian Gardens and Phantom Ranch, Grand Canyon National Park; 9/17/04.
10. Bark beetle activity on the Alpine RD; 10/05/04.
11. Bark beetle activity in recreation sites on the Lakeside RD; 10/15/04.
12. Bark beetle activity in recreation sites and Dogtown fuel reduction and forest health project on the Williams RD; 10/15/04.
13. Bark beetle activity in recreation sites on the Black Mesa RD, Apache-Sitgreaves NFs; 10/19/04.
14. Spruce beetle at Snowbowl Ski Area; 10/20/04.
15. Bark beetle activity in forest health projects on Payson RD; 10/20/04.
16. Douglas-fir beetle activity in the Rodeo-Chediski Fire; 10/22/04.
17. Bark beetle activity on the Bradshaw RD; 10/22/04.
18. Proposed FY 2005 Big Saddle forest vegetation restoration implementation project, North Kaibab Ranger District; 10/25/04.
19. Douglas-fir beetle and squirrel midden survey, Safford RD, Coronado NF; 10/25/04.
20. Bark beetle activity in Clifton RD WUI Projects; 10/25/04.
21. Proposed FY 2005 Williams followup mistletoe treatments; 10/26/04.

22. Southwestern dwarf mistletoe infection of ponderosa pine in the Dye thinning project area, Black Mesa RD; 11/12/04.

## New Mexico Zone

1. Douglas-fir tussock moth trapping results, 2000-2003, Lincoln National Forest and Mescalero Apache Indian Reservation; 1/30/04.
2. Douglas-fir tussock moth trapping results, 2000-2003, Sandia Ranger District, Cibola National Forest; 2/05/04.
3. Proposed bark beetle prevention project in Jemez Falls campground, Jemez Ranger District, Santa Fe National Forest; 5/7/04.
4. Monitoring of the Santa Fe Watershed thinning project, Española Ranger District, Santa Fe National Forest; 6/2/04.
5. Evaluation of juniper dieback, Bandelier National Monument; 6/2/04.
6. Hazard tree survey, Cuba Ranger District, Santa Fe National Forest, 7/2/04.
7. Proposed FY 2005 dwarf mistletoe control/thinning project, Jicarilla Apache Indian Reservation; 7/9/04.
8. Proposed FY 2005 dwarf mistletoe suppression project, Mescalero Apache Indian Reservation; 7/14/04.
9. Pest management recommendations for the Rendija Canyon thinning project, Española Ranger District, Santa Fe National Forest; 7/22/04.
10. Proposed FY 2005 dwarf mistletoe control/thinning project, Jemez Pueblo; 7/30/04.
11. Insect and disease survey, Sacramento Ranger District, Lincoln National Forest; 8/13/04.
12. Ground examination of dead piñons and junipers on the Guadalupe Ranger District, Lincoln National Forest; 8/26/04.
13. Proposed white pine blister rust resistant candidate protection project, Sacramento Ranger District, Lincoln National Forest; 8/27/04.
14. Potential FY 2005 forest health projects, El Rito Ranger District, Carson National Forest; 9/21/04.
15. Proposed FY 2005 forest health project, Coyote Ranger District, Santa Fe National Forest; 10/13/04.
16. Proposed FY 2005 forest health project, Cuba Ranger District, Santa Fe National Forest; 10/13/04.
17. Proposed FY 2005 forest health project, Tres Piedras Ranger District, Carson National Forest; 10/18/04.

18. Proposed Jarita Ranch forest health project, El Rito Ranger District, Carson National Forest; 10/19/04.

19. Proposed Los Griegos II forest health project, Jemez Ranger District, Santa Fe National Forest; 10/20/04.

20. Proposed American Springs forest health project, Española Ranger District, Santa Fe National Forest; 10/25/04.

21. Insect and disease conditions and silvicultural recommendations, Pecos-Las Vegas Ranger District, Santa Fe National Forest; 12/22/04.

22. Fifth year Douglas-fir tussock moth monitoring results; Sacramento Ranger District, Lincoln National Forest; 12/23/04.

23. Douglas-fir tussock moth trapping results, Sandia Ranger District, Cibola National Forest; 12/23/04.

# Publications

Conklin, D. A. 2004. Development of the white pine blister rust outbreak in New Mexico. USDA Forest Service, Southwestern Region, R3-04-01. 15 pp.

# Entomology and Pathology Activities in 2004

## Monitoring Aspen Dieback in Arizona

**Figure 24. Aspen dieback is extensive across Northern Arizona.**

An accelerated dieback of aspen communities has occurred across northern Arizona, following two defoliation events and several years of drought. We began evaluating and monitoring affected aspen stands on the Coconino National Forest (NF) in 2003, followed by the Apache-Sitgreaves NFs in 2004. These monitoring projects describe mortality levels, regeneration condition, and stand and site variables that are influencing dieback. Preliminary results show that elevation, which varies from 6,800 to 9,300 feet, is a key factor in both tree species composition and severity of decline. Lower elevation sites (<7,500 feet) are on northerly aspects and are dominated by aspen with a ponderosa pine and/or oak component. In some sites, more than half the overstory aspen died in the past 3 years and more mortality is expected as many trees have only 10 to 30 percent of the original crown left. Higher elevation sites were on various aspects with a mix of conifer species and a higher ratio of live to dead aspen. Since the decline appears to be progressive, remeasurements will determine detrimental levels of crown dieback. Aspen regeneration is low to nonexistent, especially at lower elevations, due to rampant ungulate browsing. The large dieoff of mature aspen trees in many lower elevation sites coupled with browsing by ungulates is expected to result in type conversion of many ecologically unique and important sites across the state.

*Contact Mary Lou Fairweather for additional information*

## White Pine Blister Rust Monitoring and Resistance Work

We have continued to monitor the incidence and effects of blister rust in southern New Mexico using a small set of permanent plots. Five plots—three on the Sacramento Ranger District and two on the Smokey Bear Ranger District—were remeasured in 2004. Following the recent discovery of blister rust in southern Colorado, we conducted intensive scouting for the disease in the Sangre de Cristo Mountains of northern New Mexico in 2004. No blister rust was detected. Seed was collected from 15 “resistant candidates” on the Lincoln National Forest in 2004 and sent to the Institute of Forest Genetics in Placerville, California for testing. Tests conducted in previous years have indicated that several of our candidate southwestern white pines have major gene resistance. Eventually we may be able to develop resistant planting stock and/or encourage natural regeneration of resistant parent trees.

*Contact Dave Conklin for additional information*

## Update on Piñon Ips Monitoring in New Mexico Using Pheromone Traps

In March of 2003, Lindgren funnel traps were placed in five locations throughout New Mexico to obtain a better understanding of how the initial emergence dates and numbers of generations per year vary by latitude for the piñon ips bark beetle, *Ips confusus*. Initial trapping sites included the Burro Mountains, Magdalena, Capitan, Santa Fe, and La Madera. Because of expanding beetle activity, four sites were added in November 2003: Cimarron, Las Vegas, the Manzanita Mountains, and a second, higher elevation site in Santa Fe. A three-component lure made up of Ipsdienol, cis-Verbenol, and Ipsenol, each in a bubble cap emitter, was used in the traps. Trapping was continued through the winter months to determine potential for beetle emergence during unusually warm periods. Initial spring emergence dates have proved useful in planning preventive spray treatments. In both 2003 and 2004, peak flights in the northern half of the State were recorded in mid-April and mid-October. Catches persisted into November in 2003 but dropped to nearly nothing in November of 2004. Both years there was an absence of catches through the summer months in the northern populations. It is unclear if the lack of catches is a function of aestivation - competition from natural pheromone - or lack of dispersal behavior during the warm months. In 2003, the Capitan traps in the southeastern quadrant of the State exhibited three distinct flight periods, producing a summer flight not detected in the northern locations; however, 2004 catches at this site were so reduced as not to produce distinctive peaks after April. The traps in the Burro Mountains in the southwestern quadrant of the State exhibited asynchronous overlapping flights in both 2003 and 2004. Overall catches across the State were much lower in 2004 than in 2003, perhaps reflecting a declining population trend. We are indebted to our field cooperators which included the City of Santa Fe, New Mexico Forestry Division, and Carson, Gila, and Cibola National Forests. Monitoring concluded at the end of December 2004 for all locations except the two sites in Santa Fe, which the City of Santa Fe wishes to continue monitoring through 2005.

*Contact Deb Allen-Reid for additional information*

## Monitoring *Ips confusus* Development in Piñon Bolts in New Mexico

Because the number of generations produced per year could not be determined by the results of the 2003 *Ips confusus* trapping, a companion project was developed to monitor turnaround time from attack to offspring emergence. Beginning in March 2004, freshly cut green piñon bolts were placed at the Manzano Mountains trapping site where they were monitored for signs of attack (fresh sawdust in the cracks and crevices of the bark) and then caged using mesh screening. The bolts were periodically examined, and when adult offspring were observed in the mesh, the bark was removed from the bolt to confirm successful colonization and completed development. New green bolts then replaced the used bolts and the process was repeated. By October, five generations had completed development. Because of the asynchronous developmental behavior of this species, it is difficult to know how many

**Figure 25. Screened piñon bolts are used to monitor adult emergence.**

consecutive generations can be produced; more work is needed to track descendents. However, this project demonstrates that there is time over the course of a season for up to five developmental cycles to be completed. Observations made during bark removal confirmed asynchrony of development and revealed that some adults remain under the bark and feed for several weeks during the summer.

*Contact Terry Rogers for additional information*

## Piñon Mortality Assessment in New Mexico

In response to the extensive drought-driven piñon ips (*Ips confusus*) epidemic, special aerial surveys covering much of the piñon-juniper woodland type were initiated in New Mexico in 2003 and continued in 2004. Priority survey areas were decided upon with input from the BIA, BLM, New Mexico Forestry Division district offices, and national forest ranger districts. These priority piñon-juniper woodlands were surveyed in 2003 and again in July, August and September of 2004. In all, 6.6 million acres (about 70 percent of the host type in NM) were surveyed each year by New Mexico Zone Staff and the New Mexico Forestry Division across all land ownerships. The amount of new mortality detected substantially decreased from the 770,800 acres in 2003 to 122,380 acres in 2004. Aerial observers estimate more than 50 million piñon trees died in 2003 and 2004. Additionally, work has continued on the ground plots established in 2003 across the distribution of piñon in New Mexico. These plots will help us understand the proportion of piñon that has been affected across the landscape.

*Contact Daniel Ryerson for additional information*

## Pine Bark Beetle Documentary

During 2004, work was initiated on a film documenting the 2002-2004 bark beetle epidemics in Arizona and New Mexico. Interviews, field footage, and historic photos will describe the interaction of stand conditions, drought, and bark beetles, which resulted in the death of millions of piñon and ponderosa pines. Historic human influences and contemporary ecological and social impacts are also discussed. The 30-minute film is expected to be completed in early 2005.

*Contact Deb Allen-Reid or Doug Parker for additional information*

## Effects of Prescribed Fires on Dwarf Mistletoe Infection

In 2004 we remeasured several plots previously installed in areas prescribe burned between 1995 and 1999 in northern and central New Mexico. Reductions in plot dwarf mistletoe ratings (DMRs) were demonstrated on all plots that received significant amounts of crown scorch. In areas that received little or no crown scorch, dwarf mistletoe appeared to intensify at the same rate as in unburned stands.

*Contact Dave Conklin for additional information*

## Aerial Detection Survey Technology Updates

Advancements in technology have changed how we conduct our aerial detection surveys as well as improving the safety of the flights. Our 2004 surveys were the first to have widespread use of two new systems, both of which utilize GPS (Global Positioning System) technology.

*Digital Aerial Sketchmapping System*

Until recently, most of our surveys were recorded by the observer onto paper maps, typically either Forest Service visitor maps or USGS 1:100,000 scale topographic maps. Over the past couple of years, we began using a digital sketchmapping system for occasional and special surveys. In 2004, however, we used the system more extensively, conducting 25 percent of the surveys in Arizona and 80 percent of the surveys in New Mexico with a digital system.

These digital systems are comprised of a portable computer, with either an external or built in touchscreen, a GPS unit and customized GIS software. The GPS unit provides real time locations of the aircraft on the screen over a digital base map. The surveyor can use a variety of maps, including digital versions of the Forest Service and USGS maps, but now has options that were not practical in paper such as satellite imagery and orthophotography. Over the digital map, we can overlay important additional information such as roads, streams, prior surveys, and survey area boundaries. These additional data provide critical information to the observer for mapping the affected areas. As the survey is conducted, areas of defoliation or mortality are drawn directly onto the touchscreen and into a database file.

This system has several benefits including greater positional accuracy of the surveys, better coverage of survey areas and faster processing of the data following the survey. Prior hardcopy mapping required transferring the surveys to mylar and then conversion to a digital format. The digital system removes this step and should allow us to process the survey information more efficiently and distribute the results sooner.

*Automated Flight Following*

One of the challenges of conducting low altitude aerial surveys safely is the constant monitoring of the aircraft's location in case of an emergency. Traditionally the pilot or surveyor would contact the local dispatch office by radio every 15 minutes to relay their position and heading. This technique, however, requires constant attention by either the pilot or observer and does not offer a precise location. In 2004, we greatly improved the safety of our surveys with the use of automated flight following (AFF) systems.

The AFF systems incorporate a GPS receiver that provides the aircraft's current position and transmits the information through a satellite phone network to a secure site on the Internet. The information on the aircraft's location is updated as often as every 2 minutes. The local dispatch office monitors a display with the aircraft's location and receives an alert if contact with the aircraft is lost. This technology greatly reduces the search area in the event of an accident and relieves the pilot and surveyor of making constant radio contact. Additionally, by reducing radio traffic, it improves communication for other emergency information.

*Contact Daniel Ryerson (New Mexico) or Bobbe Fitzgibbon (Arizona) for additional information*

## Impacts of *Ips* and *Dendroctonus* Bark Beetles in Northern Arizona Pine Types

Forest Health Monitoring, Evaluation Monitoring funds are being used to: (1) quantify the impact, extent and severity of bark beetles on ponderosa and piñon pine at the stand level through an extensive plot network on a portion of Arizona's northern national forests; (2) describe the forest conditions in areas that have experienced moderate to high levels of mortality induced by recent drought and bark beetles; and (3) look for correlations between stand and site conditions and pine mortality.

A GIS approach was used to populate sample points for each national forest and forest type. The Prescott, Kaibab, and Coconino were sampled in 2003, and the Apache-Sitgreaves and Tonto were sampled in 2004. A total of 191 clusters (573 single plots) and 206 single point plots have been installed in the ponderosa pine type across Arizona. A total of 99 clusters (297 single plots) and 105 single point plots have been installed in the piñon-juniper type across Arizona. Site and stand data are collected along with bark beetle occurrence. In addition to this “on-the-ground” work, we have collaborated with the Forest Health Technology Enterprise Team (FHTET), the Remote Sensing Application Center (RSAC), and ITT Industries to analyze different remote sensing applications for the extent and severity of piñon mortality across the Southwest. Satellite and multispectral imagery were collected from the same areas where we have installed our ground plots.

*Contact John Anhold for additional information*

## Effects of Chipping Fresh Slash on Bark Beetle Attraction

A relatively new method for treating green thinning slash is to chip or shred the material onsite. Although bark beetles cannot use wood chips as food, anecdotal information and a preliminary study suggest that they can be attracted to volatiles emanating from fresh chips, resulting in increased residual tree mortality. To examine these relationships further, the Arizona Zone FHP staff and Chris Fettig of the Pacific Southwest Research Station designed a study to determine: (1) the effects of slash management treatments (chipping versus lop-and-scatter) on bark beetle-caused ponderosa pine mortality; (2) the effects of timing (spring, summer) of thinning and stand density on bark beetle-caused ponderosa pine mortality; (3) the effect of distance between chipped material and potential host trees on bark beetle-caused ponderosa pine mortality; and (4) the relationship between volatile terpenes emanating from chipped material and attraction to bark beetles. Slash treatments and controls were installed on replicated 1-acre plots at three study sites (two in Arizona and one in California) in August and September 2003. The same treatments were repeated in the spring of 2004. Preliminary findings from the California site include (1) several bark beetle species are attracted to recently chipped sites; (2) beetle activity was generally higher in the spring chip treatments compared with late summer/fall treatments; (3) raking chips away from tree bases may reduce the amount of bark beetle attacks; and (4) based on GS-FID analysis (gas chromatography-flame-ionization detection) of terpenes aerated from fresh chips and fresh cut bolts, there is a dramatic difference in the quantity of terpenes emanating from the different treatments. Terpenes from the chipping treatment were 30 times higher than the slash treatment 1 day after treatment implementation. This study, funded through the FHP Special Technology Development Program, will help us develop guidelines for mitigating unwanted tree mortality associated with chipping slash.

*Contact Joel McMillin for additional information*

## Insect and Disease Management Workshops

Annually we offer a 3-day workshop on forest insect and disease identification, biology and management. In 2004 the workshop was held in September in Ruidoso, NM. These sessions are typically 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 emphasizing hazard tree management. This type of workshop was held in Albuquerque in May 2004. We also offer more informal training upon request, particularly for field crews.

# Visit Us Online

In an effort to better serve the Internet user, we continue to expand our online information base. The Forest Service Southwestern Region hosts a Forest Health Web site at http://www.fs.fed.us/r3/resources/health. 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 Web site at http://www.fs.fed.us/foresthealth/ which includes program overviews as well as excellent publications links.

# Appendix

## Instructions for Submitting Insect and Disease Specimens for Identification

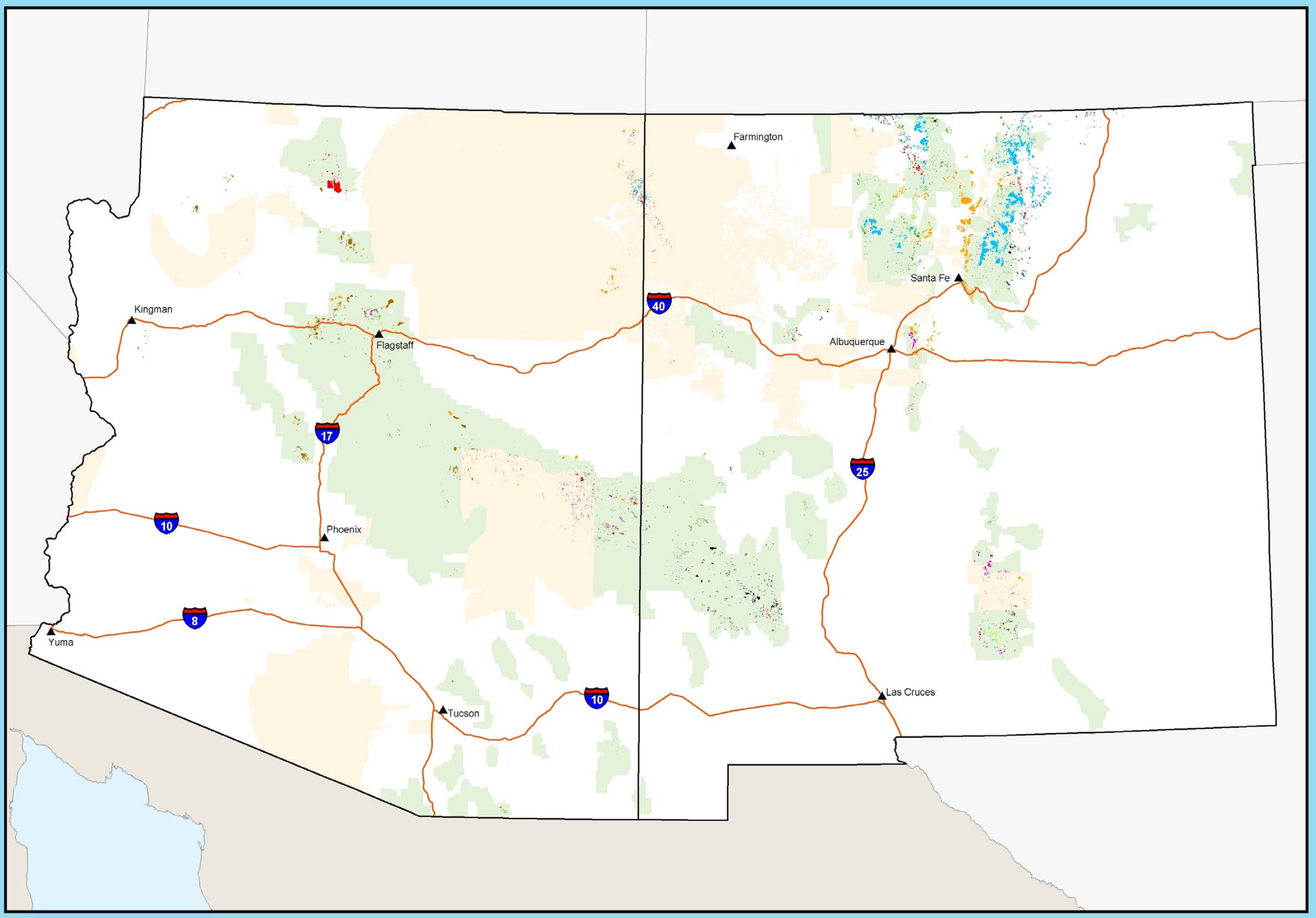
Both zone offices are equipped to receive forest insect or disease specimens submitted from the field for identification. Specimens may be shipped to the appropriate zone office as listed on the title page of this report. The following procedures for collecting and shipping specimens should be used.

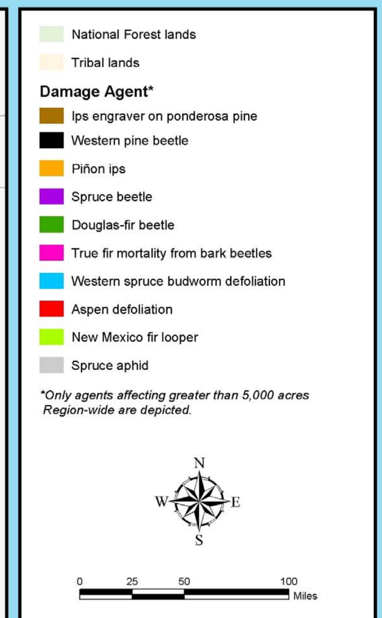
### Collecting

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.)
   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.




The insect and disease activity depicted here is based on aerial detection surveys and should only be used as a general indicator of incidence. This map represents the mortality and defoliation that has occurred since the previous surveys in 2003. Depending upon the timing of survey, the entire extent of some insect and disease activity may not have been detected. In addition, most diseases cause gradual declines in tree health that are not typically detectable during aerial surveys. Intensity of damage is variable, thus not all trees within a mapped area are dead or defoliated. Caution should be used in interpreting these results due to the subjective nature of aerial sketch mapping and the scale of mapping. Areas of particular concern should be ground-checked for precise determination of location and causal agent.

**Arizona**

Survey conducted July through September, 2004, by Steve Dudley and Bobbe Fitzgibbon, Forest Health, Arizona Zone Office, Southwestern Region, USDA Forest Service; Tom DeGomez, University of Arizona, Arizona Forest Health Program.

**New Mexico**

Survey conducted June through August, 2004 by Richard Norris and Daniel Ryerson, Forest Health, New Mexico Zone Office, Southwestern Region, USDA Forest Service; Stephani Sandoval, New Mexico State University Cooperative Extension Service. Additional surveys for piñon mortality conducted August through October by Terry Rogers and Daniel Ryerson, Forest Health, New Mexico Zone Office, Southwestern Region, USDA Forest Service; Todd Haines, New Mexico Forestry Division; Stephani Sandoval, New Mexico State University Cooperative Extension Service.

# Significant Forest Mortality and Defoliation Detected through Aerial Survey

## Southwestern Region - 2004

Forest Health Staff
Southwestern Region
USDA Forest Service
1 March 2005