United States
Department of
Agriculture

Forest
Service

**Southwestern
Region**

Forestry and
Forest Health

August 2010
PR-R3-16-6

# Forest Insect and Disease Conditions in the Southwestern Region, 2009

**Cover photo: White pine blister rust branch infection in Arizona's White Mountains, 2009.**

# Forest Insect and Disease Conditions in the Southwestern Region, 2009


## Southwestern Region
## Forest Health

Allen White, Pesticide Specialist

**Arizona Zone**
John Anhold, Zone Leader
Mary Lou Fairweather, Pathologist
Ryan Hanavan, Entomologist
Joel McMillin, Entomologist
Steve Dudley, Biological Technician

2500 South Pine Knoll Drive
Flagstaff, AZ 86001

**New Mexico Zone**
Debra Allen-Reid, Zone Leader
Terrence Rogers, Entomologist
David Conklin, Pathologist
Daniel Ryerson, Forest Health/GIS Specialist
Crystal Tischler, Forest Health Coordinator

333 Broadway Blvd., SE
Albuquerque, NM 87102

http://www.fs.fed.us/r3/resources/health

## State Insect and Disease Specialists

Arizona: Robert Celaya (bobcelaya@azstatefire.org)

New Mexico: Stephani Sandoval (resigned March 2010)

# Contents



## List of Tables

# Conditions in Brief

Bark beetle activity in the Southwestern Region continued to decrease in 2009, while defoliator activity increased. Western spruce budworm activity expanded in both northern New Mexico, where this insect has been chronic for decades, and in the Sacramento Mountains of southern New Mexico, where an outbreak has now been active 4 to 5 years. A major die-off of corkbark fir, largely attributed western balsam bark beetle, continued for the seventh consecutive year, although the bulk of the 2009 mortality was limited to northern New Mexico. Aspen defoliation and decline continued to be a concern in parts of the region. Significant new outbreaks observed in 2009 included sawflies and a fungal blight affecting ponderosa pine in the Zuni Mountains of New Mexico, piñon tip moth in north-central New Mexico, and pine sawflies near the San Francisco Peaks in northern Arizona. Perhaps the most notable pest event in 2009 was the detection of white pine blister in the White Mountains of Arizona, the first report of this nonnative invasive disease in that State.

Aerial detection surveys mapped bark beetle activity on 38,600 acres regionwide in 2009 compared to 111,000 acres the previous year. Only about 9,300 acres of ponderosa pine were affected, well below the 49,000 acres of 2008. In mixed conifer forests, mortality was mapped on about 8,800 acres vs. 19,300 acres in 2008, most of it attributed to Douglas-fir beetle. In the spruce-fir type, mortality was mapped on about 20,300 acres, also less than in 2008 (43,500 acres); nearly all the damage was to corkbark fir in northern New Mexico. Relatively little piñon mortality (170 aces) was recorded in the woodland type in 2009.

Western spruce budworm defoliation was mapped on about 560,000 acres in 2009, up from 362,000 acres in 2008. Most of the activity again occurred in northern New Mexico, which has the greatest share of the region's host type. An ongoing budworm outbreak in the Sacramento Mountains expanded, with activity mapped on about 46,100 acres compared to 24,700 acres in 2008. Needle cast fungi remained active in northern Arizona with about 3,500 acres of ponderosa pine affected in 2009. Defoliation in the White Mountains was observed from feeding by mountain girdle in combination with spruce aphid. Aspen defoliation was detected on 53,400 acres in New Mexico and 9,400 acres in Arizona. Aspen decline and dieback was recorded on 36,950 acres in Arizona and 34,850 acres in New Mexico.

Dwarf mistletoes continue to be the most common and widespread pathogens in the Southwest. Over one-third of the ponderosa pine acreage and about one-half of the mixed conifer acreage has some level of infection. Bark beetle activity is often associated with severe dwarf mistletoe infection. Root diseases are also widely distributed across the region, especially in higher elevation forests. White pine blister rust continues to cause severe damage to southwestern white pine in the Sacramento Mountains of southern New Mexico, and has been found in several other parts of New Mexico the past few years. A new outbreak of blister rust, detected in the White Mountains of eastern Arizona in 2009, already extends over several thousands of acres of mixed conifer forest.

**Table 1. Prominent 2009 forest insect and disease activity (acres) in Arizona and New Mexico*.**

| Agent | State | National Forest | Tribal Lands | Other Federal | State & Private | Total |
|---|---|---|---|---|---|---|
| Bark beetles in ponderosa pine | AZ | 630 | 140 | 60 | 30 | 850 |
| | NM | 6,700 | 300 | 30 | 1,420 | 8,450 |
| Douglas-fir beetle | AZ | 620 | 20 | 60 | < 5 | 700 |
| | NM | 2,020 | 1,470 | 20 | 2,580 | 6,080 |
| True fir beetles | AZ | 220 | 260 | < 5 | < 5 | 480 |
| | NM | 15,750 | 200 | -- | 6,730 | 22,690 |
| Western spruce budworm | AZ | 130 | 900 | 200 | 40 | 1,270 |
| | NM | 380,740 | 43,650 | 1,890 | 132,760 | 559,030 |
| Aspen damage*** | AZ | 30,250 | 15,900 | 70 | 120 | 46,350 |
| | NM | 48,230 | 6,100 | 50 | 29,310 | 83,690 |
| 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 |

* Values rounded to the nearest 10; sum of individual values may differ from totals due to rounding.

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

*** Aspen damage includes a combination of insect defoliation (primarily in New Mexico) and other biotic and abiotic factors causing aspen decline resulting in mortality. See text for additional information.

-- No acreage detected.

**Table 2. Bark beetle incidence by site (acres) from aerial detection surveys in 2009*.**

| | Western Pine Beetle | Mountain Pine Beetle | Round-headed Pine Beetle | Ponderosa Ips | Pinyon Ips | Douglas-fir Beetle | Spruce Beetle | True Fir Beetles | Cypress & Cedar Bark Beetles | Bark Beetle Totals |
|---|---|---|---|---|---|---|---|---|---|---|
| Apache-Sitgreaves NFs | 120 | | | 70 | < 5 | 10 | | 100 | | 310 |
| Coconino NF | 10 | | | 110 | | 420 | | 50 | | 540 |
| Coronado NF | < 5 | | 40 | < 5 | | 80 | | 10 | | 120 |
| Kaibab NF | 20 | | | 200 | < 5 | 90 | | 60 | < 5 | 300 |
| Prescott NF | < 5 | | | 60 | < 5 | 10 | | | | 70 |
| Tonto NF | | | | < 5 | | 10 | | | | 10 |
| Canyon de Chelly NM | | | | | < 5 | | < 5 | < 5 | | < 5 |
| Grand Canyon NP | < 5 | | | 50 | < 5 | 60 | | < 5 | | 110 |
| Lake Mead NRA | < 5 | | | < 5 | < 5 | | | | | < 5 |
| Saguaro NP | | | < 5 | | | | | | | < 5 |
| Walnut Canyon NM | | | | | | < 5 | | | | < 5 |
| BLM | < 5 | | | < 5 | < 5 | | | | | < 5 |
| DOD | | | | < 5 | < 5 | | | < 5 | | < 5 |
| Fort Apache Tribal | 30 | | | 30 | < 5 | 20 | | 260 | | 340 |
| Hualapai Tribal | < 5 | | | < 5 | < 5 | | | | < 5 | 10 |
| Navajo Tribal | 10 | | | 10 | < 5 | < 5 | < 5 | < 5 | | 20 |
| San Carlos Tribal | 10 | | | 40 | < 5 | < 5 | | < 5 | | 50 |
| Navajo-Hopi JUA | | | | | < 5 | | | | | < 5 |
| State & Private | 10 | | < 5 | 20 | | < 5 | | < 5 | | 30 |
| **Arizona Total** | **220** | **0** | **40** | **590** | **10** | **700** | **< 5** | **480** | **< 5** | **1,920** |
| Carson NF | 20 | | | < 5 | | 400 | | 12,420 | | 12,850 |
| Cibola NF | 70 | | | 910 | 20 | 20 | < 5 | 1,270 | | 2,290 |
| Gila NF | 1,250 | | | 4,450 | 10 | < 5 | | < 5 | | 5,430 |
| Lincoln NF | < 5 | | | 200 | < 5 | < 5 | | 30 | 10 | 240 |
| Santa Fe NF | 80 | | | < 5 | < 5 | 1,590 | < 5 | 1,970 | | 3,640 |
| Valles Caldera NP | < 5 | | | | | 10 | | 50 | | 70 |
| BLM | 10 | | | < 5 | < 5 | 20 | | | 20 | 50 |
| Bandelier NM | 20 | | | | | < 5 | | | | 20 |
| El Malpais NM | < 5 | | | | | | | | | < 5 |
| Other Federal | | | | < 5 | | | | | 70 | 70 |
| Acoma Pueblo | < 5 | | | < 5 | < 5 | | | | | < 5 |
| Isleta Pueblo | < 5 | | | < 5 | < 5 | | | | | < 5 |
| Jemez Pueblo | < 5 | | | | | | | | | < 5 |
| Jicarilla Apache | 20 | | | | < 5 | 1,100 | | 170 | | 1,300 |
| Mescalero Apache | < 5 | | | 260 | < 5 | | | 20 | | 280 |
| Navajo Tribal | 10 | | | < 5 | | < 5 | < 5 | < 5 | | 10 |
| Other Tribal | < 5 | | | | | | | | | < 5 |
| Picuris Pueblo | | | | | | < 5 | | | | < 5 |
| Santa Clara Pueblo | < 5 | | | | | 100 | | | | 100 |
| Taos Pueblo | | | | | | 270 | | 10 | | 280 |
| Zia Pueblo | < 5 | | | | | | | | | < 5 |
| Zuni Pueblo | | | | < 5 | < 5 | | | | | < 5 |
| State & Private | 960 | | | 470 | 130 | 2,580 | | 6,730 | | 10,050 |
| **New Mexico Total** | **2,450** | **0** | **0** | **6,280** | **170** | **6,080** | **< 5** | **22,690** | **100** | **36,670** |
| **SW Region Total** | **2,670** | **0** | **40** | **6,870** | **170** | **6,790** | **< 5** | **23,170** | **100** | **38,600** |

* Values rounded to the nearest 10; sum of individual values may differ from totals due to rounding. Multiple counting of acres may occur between damage agents if an area is observed to have simultaneous multiple damage agents. Totals represent the "footprint" or affected area on the ground with no multiple counting. Values for Federal administrative units include only federally owned lands (state and private inholdings summarized in "State & Private").

**Table 3. Defoliation incidence by site (acres) from aerial detection surveys in 2009*.**

| | Western Spruce Budworm | Aspen Damage** | Sawflies | Loopers (*Enypia* & *Nepytia*) | Needle Cast | Drought | Defoliation Total*** |
|---|---|---|---|---|---|---|---|
| Apache-Sitgreaves NFs | 130 | 22,260 | | 180 | | | 22,570 |
| Coconino NF | | 2,250 | 210 | | 2,600 | 1,540 | 6,600 |
| Coronado NF | | | | 210 | | | 210 |
| Kaibab NF | | 5,740 | 1,130 | | 620 | 1,180 | 8,670 |
| Prescott NF | | | | | | | |
| Tonto NF | | | | | | | < 5 |
| Canyon de Chelly NM | 200 | < 5 | | | | | 200 |
| Grand Canyon NP | | | | | | | |
| Lake Mead NRA | | | | | | | |
| Saguaro NP | | < 5 | | | | | < 5 |
| Walnut Canyon NM | | | | | | | |
| BLM | | 60 | | | | | 60 |
| DOD | | | | < 5 | | | < 5 |
| Fort Apache Tribal | 210 | 14,020 | | 480 | | | 14,710 |
| Hualapai Tribal | | | | | | | |
| Navajo Tribal | 690 | 1,890 | | | | | 2,580 |
| San Carlos Tribal | | | | | | | |
| State & Private | 50 | 120 | 20 | | 250 | 70 | 540 |
| **Arizona Total** | **1,330** | **46,350** | **1,370** | **870** | **3,460** | **2,790** | **56,150** |
| Carson NF | 211,190 | 32,980 | | | | | 232,910 |
| Cibola NF | 6,950 | 3,910 | | | | | 17,710 |
| Gila NF | | 780 | | | | | 780 |
| Lincoln NF | 25,180 | 1,650 | | | | | 26,830 |
| Santa Fe NF | 103,270 | 7,630 | | | | | 110,500 |
| Valles Caldera NP | 34,160 | 1,280 | | | | | 35,430 |
| BLM | 420 | 50 | | | | | 470 |
| Bandelier NM | 1,470 | | | | | | 1,470 |
| El Malpais NM | | | | | | | |
| Other Federal | | | | | | | |
| Acoma Pueblo | | | | | | | |
| Isleta Pueblo | | | | | | | |
| Jemez Pueblo | 50 | | | | | | 50 |
| Jicarilla Apache | 1,900 | 80 | | | | | 1,980 |
| Mescalero Apache | 15,550 | 550 | | | | | 16,100 |
| Navajo Tribal | 630 | 4,120 | | | | | 4,750 |
| Other Tribal | 290 | 230 | | | | | 340 |
| Picuris Pueblo | 590 | 10 | | | | | 610 |
| Santa Clara Pueblo | 6,770 | | | | | | 6,770 |
| Taos Pueblo | 17,850 | 1,050 | | | | | 18,900 |
| Zia Pueblo | | | | | | | |
| Zuni Pueblo | | 60 | | | | | 60 |
| State & Private | 132,760 | 29,310 | | | | | 161,260 |
| **New Mexico Total** | **559,030** | **83,690** | **0** | **0** | **0** | **0** | **636,900** |
| **SW Region Total** | **560,360** | **130,040** | **1,370** | **870** | **3,460** | **2,790** | **693,050** |

* Values rounded to the nearest 10; sum of individual values may differ from totals due to rounding. Multiple counting of acres may occur between damage agents if an area is observed to have simultaneous multiple damage agents. Totals represent the "footprint" or affected area on the ground with no multiple counting. Values for Federal administrative units include only federally owned lands (state and private inholdings summarized in "State & Private").

** Aspen damage includes a combination of insect defoliation (primarily in New Mexico) and other biotic and abiotic factors causing aspen decline resulting in mortality. See text for additional information.

*** Defoliation total includes agents not shown in the table; see text for additional agents.

# Status of Major Insects

## Bark Beetles

Conifer mortality mapped during aerial survey is often attributed to bark beetles. While bark beetles are primary tree killers in the region, mortality is often a result of multiple factors, which may include disease, other insects, and abiotic factors—especially drought. An additional consideration in interpreting aerial survey results is that the acreages reported represent areas where significant tree mortality occurred; the mortality within these areas can be scattered. The proportion of host trees actually killed within each area varies from site to site.

Several different bark beetles attack ponderosa pine in the Southwest. In recent years, most of the pine mortality in Arizona has been attributed to *Ips* engraver beetles; in New Mexico, western pine beetle. Since both *Ips* and western pine beetle (and others, including roundheaded pine beetle) are often active in the same area and frequently attack the same tree, the "mortality agent" attributed to a particular area is often a matter of interpretation. The narratives which follow describe overall conditions and trends; site and landowner information is summarized in tables 2 and 3. In addition to reporting damage estimates for individual bark beetle species, we include summaries and recent trends by major forest type.

### Western Pine Beetle

*Dendroctonus brevicomis*
Primary host: Ponderosa pine

Tree mortality attributed to western pine beetle declined to its lowest level in over a decade, with only about 2,700 acres with activity mapped in 2009. As in 2008, the majority of the damage occurred on the Gila National Forest (1,250 acres) and State and private lands (960 acres) in New Mexico.

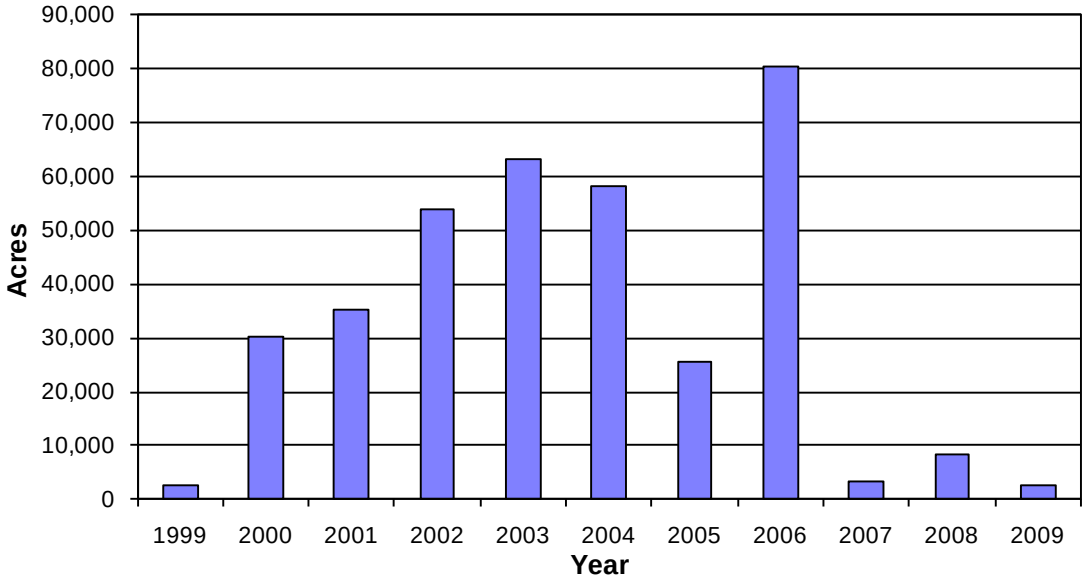



**Figure 1. Western pine beetle activity in Arizona and New Mexico, 1999-2009.**

## Mountain Pine Beetle

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

No mountain pine beetle activity was detected during aerial surveys in 2009. Historically, this insect has had much less impact in the Southwest than in other western regions. It has occasionally reached outbreak levels on the Kaibab Plateau in northern Arizona, and is observed infrequently in other parts of the region.

Limited mountain pine beetle activity was observed (during ground surveys) in the summer of 2009 within a recently burned area (2007 Chitty wildfire) on the Apache-Sitgreaves National Forests. Attacks were limited to southwestern white pine. No mortality was observed outside the burned area. Scattered white pine mortality from this beetle also occurred in the Pinaleño Mountains of the Coronado National Forest in 2009.

**Figure 2. Recent southwestern white pine mortality from attack by mountain pine beetle, Apache-Sitgreaves National Forests.**

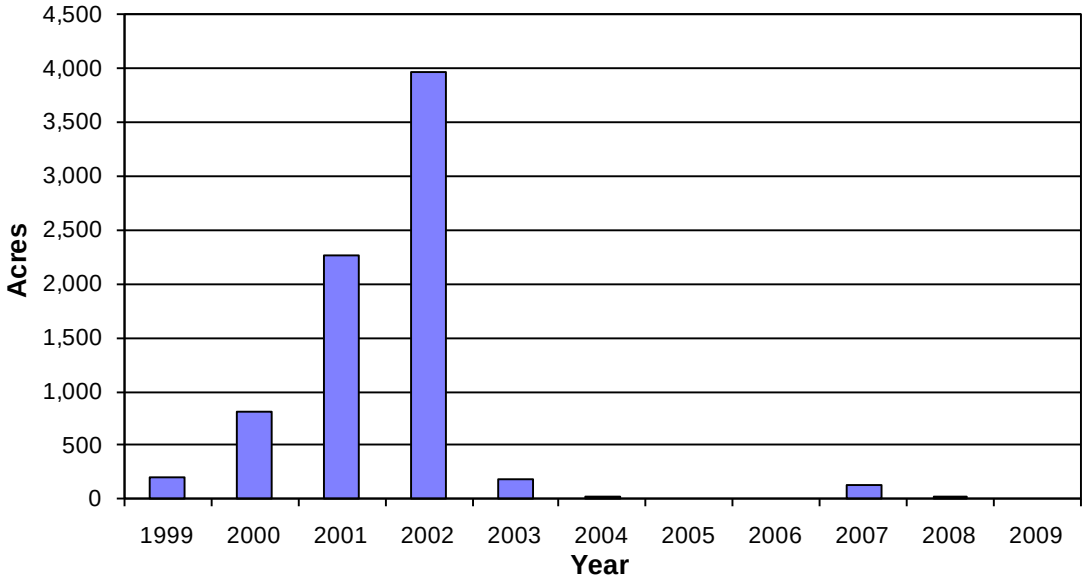



**Figure 3. Mountain pine beetle activity in Arizona and New Mexico, 1999-2009.**

## Roundheaded Pine Beetle

*Dendroctonus adjunctus*
Primary host: Ponderosa pine

Roundheaded pine beetle activity remained at very low levels in 2009; about 40 acres with activity were observed, similar to 2008. All affected areas were in southeastern Arizona, including the Coronado National Forest and Saguaro National Park (Rincon Mts.).

This insect has a fairly wide distribution in the region, is often associated with other bark beetles, and may be active in areas where mortality is attributed to other species. Historically, most activity has been in southeastern Arizona and the Sacramento Mountains of southern New Mexico.

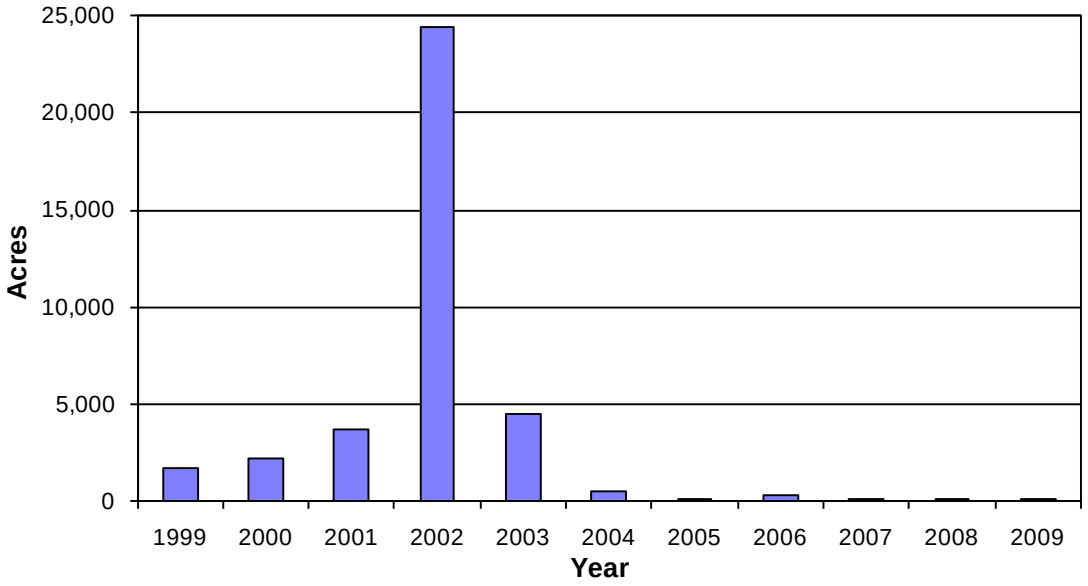



**Figure 4. Roundheaded pine beetle activity in Arizona and New Mexico, 1999-2009.**

## Ips Beetles


**Figure 5. Top-kill of ponderosa pine caused by ips attacks, Payson, Arizona, September 2009.**

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

**Ponderosa pine mortality** attributed to *Ips* decreased considerably in 2009 to about 6,900 acres with activity mapped regionwide vs. 42,000 acres in 2008. As in the previous year, the majority the activity occurred on the Gila National Forest in New Mexico, where it was scattered and often within recently burned areas.

*Ips* and *Dendroctonus* beetles frequently occur in the same area and often attack the same tree. In recent years, several species of *Ips* have been found attacking ponderosa pine in Arizona, including *I. lecontei*, *I. pini*, *I. calligraphus*, *I. latidens*, and *I. knausi*.

**Piñon mortality**, caused primarily by *Ips confusus*, was mapped on only about 170 acres regionwide in 2009, compared to 770 acres in 2008. Most of the detected activity was on State and private lands in New Mexico. Note that aerial surveys typically include only limited portions of the woodland type, so these figures probably underestimate the total area affected.

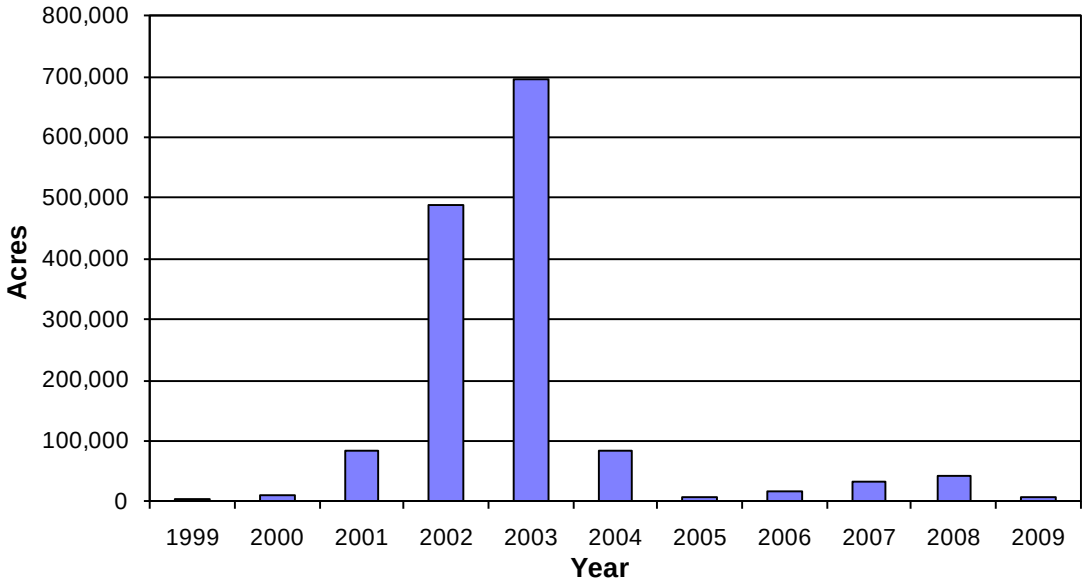



**Figure 6. Ips beetle activity in ponderosa pine in Arizona and New Mexico, 1999-2009.**

## Douglas-fir Beetle

*Dendroctonus pseudotsugae*
Host: Douglas-fir

Douglas-fir beetle activity decreased regionwide in 2009, with about 6,800 acres mapped compared to 12,400 acres the previous year. However, activity remained relatively high throughout much of northern New Mexico and on portions of the Coconino National Forest in Arizona.

Note that while Douglas-fir beetle activity clearly peaked between 2003 and 2005, some of the area mapped during this period (as depicted in the graph below) was later determined to represent fir engraver beetle (white fir mortality) rather than Douglas-fir beetle.

**Figure 7. Douglas-fir bark beetle activity adjacent to recent fires, Apache-Sitgreaves National Forests.**

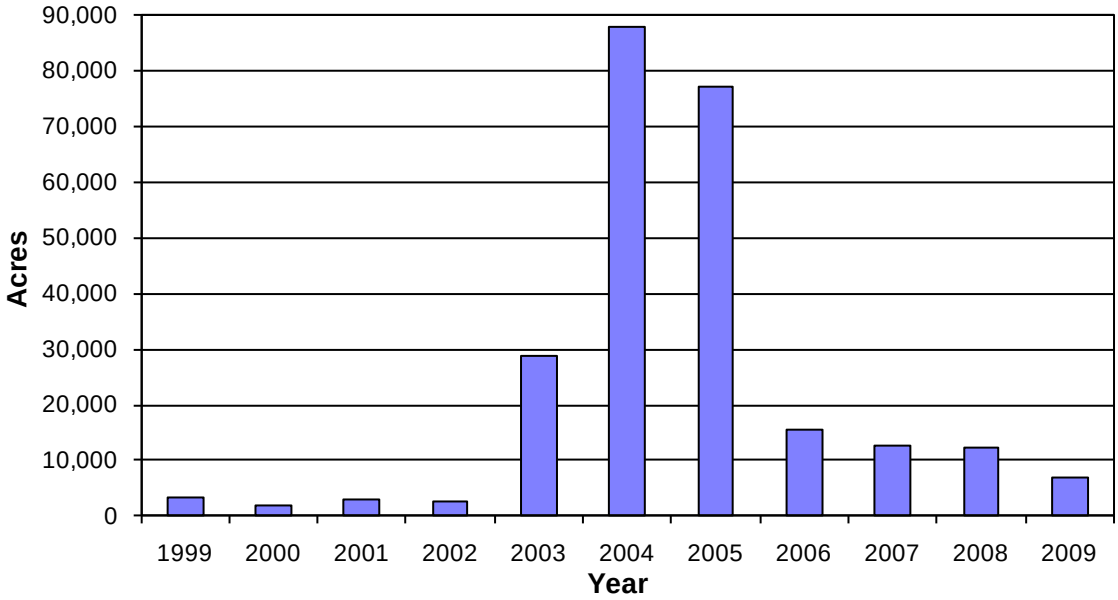



**Figure 8. Douglas-fir beetle activity in Arizona and New Mexico, 1999-2009.**

## True Fir Beetles

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

True fir mortality continued to decrease regionwide in 2009, with about 23,000 acres affected compared to 50,000 acres in 2008. Most of the 2009 damage involved corkbark fir in northern New Mexico. Western balsam bark beetle, affecting corkbark fir, was mapped on 12,300 acres of the Carson National Forest and on 4,860 acres of State and private lands in northern New Mexico. Fir engraver beetle activity reached its lowest level in several years, with only about 2,900 acres of white fir mortality mapped in 2009, most of it in northern New Mexico. Mortality of true firs is often associated with root disease.

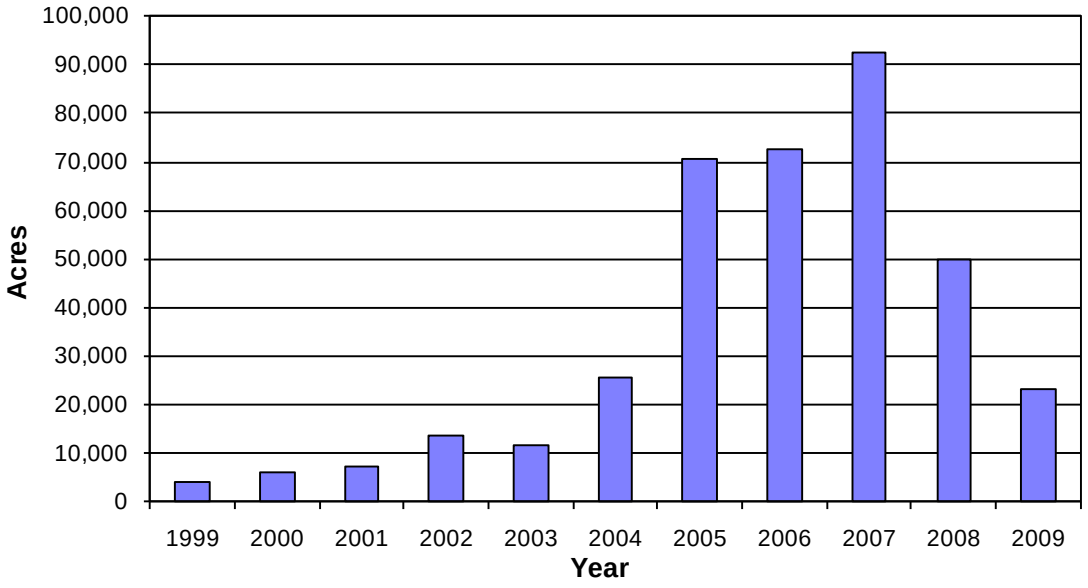



**Figure 9. Fir engraver and western balsam bark beetle activity in Arizona and New Mexico, 1999-2009.**

## Spruce Beetle

*Dendroctonus rufipennis*
Host: Spruce

Less than 5 acres with spruce beetle activity was detected in the Southwest by aerial survey in 2009. Note that some of the damage mapped in previous years (see figure 10) was later determined to have been corkbark fir mortality rather than spruce mortality.

To date, no significant spruce beetle activity has been detected following a large 2007 windthrow event in the Pecos Wilderness of northern New Mexico. Activity on the San Francisco Peaks in northern Arizona following another 2007 windthrow event may have been minimized by a suppression project implemented in 2008-2009.

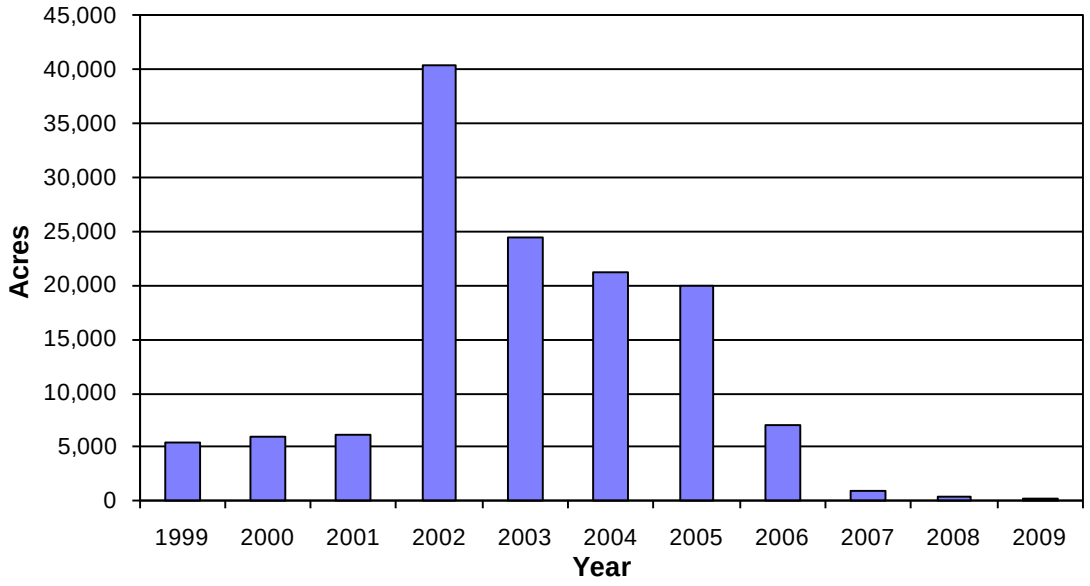



**Figure 10. Spruce beetle activity in Arizona and New Mexico, 1999-2009.**

## Summary by Major Forest Types

Tree mortality/bark beetle activity is summarized here by major forest type, which overcomes some of the difficulties inherent in identifying tree (and associated bark beetle) species from the airplane. In comparing the acres affected and trends within and among forest types, one should keep in mind the relative proportion of land within each type. In the Southwest, these are approximately: 70 percent ponderosa pine, 25 percent mixed conifer, and 5 percent spruce-fir. Clearly 1,000 acres of damage in the mixed conifer or spruce-fir type represents greater relative damage (a higher mortality rate) than 1,000 acres in the ponderosa pine type.

**Ponderosa pine.** Only about 9,300 acres of ponderosa pine mortality was mapped across the region in 2009, well below the 49,000 acres observed the previous year. Pine bark beetle activity has thus subsided to its lowest level in several years, following a peak of 763,000 acres in 2003. As in the past few years, the majority of the 2009 mortality occurred on the Gila National Forest, where it was often widely scattered and associated with recent fires.

**Mixed conifer:** Tree mortality has continued to decrease, with about 8,800 acres of the region's mixed conifer forest affected in 2009 compared with 19,300 acres in 2008. Years 2003–2007 witnessed the most mortality ever recorded in the mixed conifer forests of the Southwest, with a peak of about 141,000 acres in 2005.

Most of the 2009 mortality occurred in New Mexico, which has the greater share of the region's mixed conifer forests. As in 2008, more mortality was recorded in Douglas-fir than in white fir. Between 2003 and 2007, white fir sustained more damage than Douglas-fir in most locations.

**Spruce-fir:** Mortality was mapped on about 20,300 acres of spruce-fir type in the region in 2009, a decrease from 2008 when about 43,500 acres were affected. Nearly all the observed damage in

2009 was to corkbark fir in northern New Mexico. A very significant die-off of corkbark fir has occurred in both Arizona and New Mexico the past several years. Spruce mortality has generally been light and widely scattered in recent years, and has often not been detected by aerial survey.

# Defoliators

## Western Spruce Budworm

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

Budworm activity increased regionwide to about 560,000 acres with defoliation mapped in 2009 compared with 362,000 acres in 2008. The bulk of the activity again occurred in northern New Mexico, which has the largest share of the region's host type and where budworm has been chronic for decades. An ongoing outbreak in the Sacramento Mountains of southern New Mexico expanded, with 46,145 acres of damage mapped vs. 24,710 acres in 2008 (these figures include all ownerships). An outbreak on Navajo tribal lands (Chuska Mountains) continued to decline, with damage detected on 1,520 acres compared to 2,160 acres the previous year.

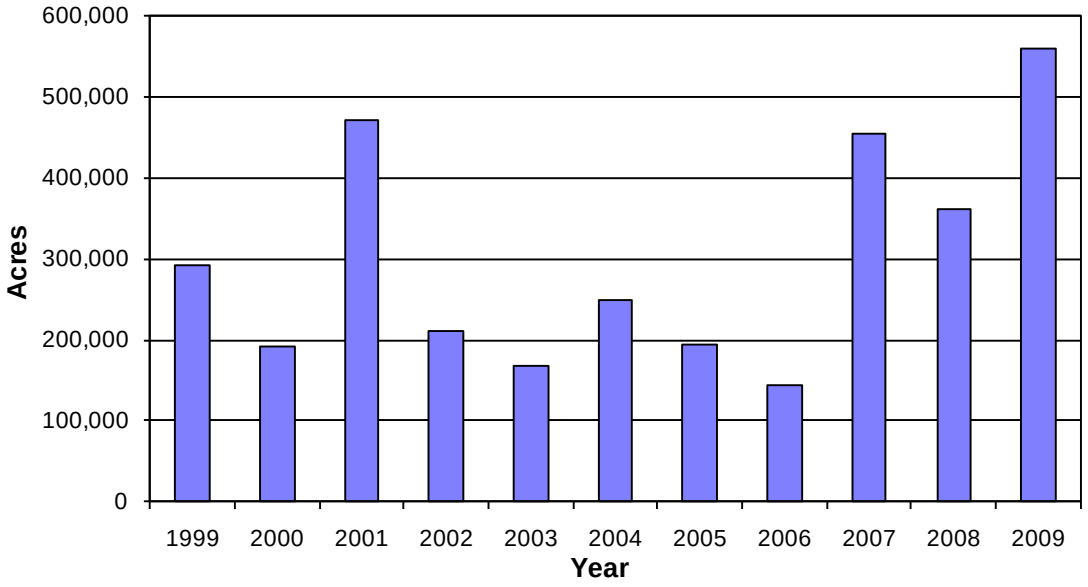



**Figure 11. Western spruce budworm activity in Arizona and New Mexico, 1999-2009.**

## Douglas-fir Tussock Moth

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

No tussock moth defoliation was detected in 2009. Recent outbreaks on the Tonto National Forest in Arizona and the Cibola National Forest and the Santa Clara Pueblo in New Mexico all appear to have collapsed after 2007.

Trap collections from the Coronado National Forest indicate a potential increase in tussock moth on the west peak of the Pinaleño Mountains. The levels were slightly below an average of 25 adults per trap (the outbreak indicator threshold). A spring egg mass survey will be conducted to monitor the population more closely.

### *Nepytia janetae*

Hosts: Douglas-fir, white fir

No *Nepytia*-caused defoliation was detected in 2009. The defoliation on Mt. Baldy and the Pinaleño Mountains appears to have collapsed in recent years.

## Mountain Girdle

*Enypia griseata*
Host: Engelmann spruce

A combination of mountain girdle and spruce aphid defoliation was recorded on Mt. Baldy during 2009. A total of 660 acres of defoliation was recorded on the Apache-Sitgreaves National Forests, White Mountain Apache Tribal Lands, and adjacent State and private land.

## Spruce Aphid

*Elatobium abietinum*
Host: Spruce

No spruce aphid activity was detected via aerial survey in 2008 or 2009, following a notable upswing in 2007. However, ground surveys found some activity in combination with mountain girdle in the White Mountains of Arizona (see above section). Spruce aphid was also detected on the North Kaibab Ranger District of the Kaibab National Forest during a field visit. The true fir had noticeable top-kill from repeated western spruce budworm defoliation. Additional ground surveys will occur during 2010 to determine the extent of spruce aphid on the North Rim of the Grand Canyon.

## Ponderosa Pine Needle Miner

*Coleotechnites ponderosae*

For the second year in a row, no needle miner activity was detected by aerial survey in Arizona or New Mexico. A limited amount of activity was observed, from the ground, in the Zuni Mountains in 2009.

## Pine Sawflies

*Neodiprion* spp., *Zadiprion* spp.

Pine sawflies affecting ponderosa pine have been active in several locations since 2007. Notable outbreaks have been observed on the Apache-Sitgreaves National Forests (visible along Highway 260 between Pinedale and Overgaard) and on San Carlos tribal lands. Aerial survey mapped

about 1,400 acres with pine sawfly defoliation in the Kendrick Mountain area of the Kaibab and Coconino National Forests in 2009.

A new outbreak affecting an estimated 700 acres was observed in the Zuni Mountains (Cibola National Forest) in late 2009. While primarily damaging ponderosa pine, feeding was also observed on a few piñon within this area. Because defoliation was not detected during aerial survey in July, these are assumed to be late summer feeding sawflies.

**Figure 12. Pine sawfly defoliation of ponderosa pine, Kaibab National Forest.**

## Piñon Needle Scale

*Matsucoccus acalyptus*

Needle scale is a chronic defoliator of piñon at several locations in the woodlands of Arizona and New Mexico, with intensities varying from year to year. Aerial surveys in 2009 mapped about 7,100 acres of scale damage on the Magdalena Ranger District of the Cibola National Forest and nearby private lands, vs. 12,800 acres in these areas in 2008.

In Arizona, scale distribution continued to expand in the Payson area, with an estimated 1,300 acres of woodlands now affected based on ground observation. Scale has been widespread in the Prescott area for many years, where it has been associated with significant host mortality.

**Figure 13. Piñon needle scale egg mass.**

## Pandora moth

*Coloradia pandora*

Adult moths were detected in large numbers near Tusyan, Arizona in 2009 by a crew of forest technicians and verified by an Arizona Zone entomologist. Low levels of defoliation and larvae were observed in 2008 and defoliation could intensify in 2010.

## Piñon tip moth

An extensive outbreak of a tip moth (probably *Dioryctria albovittella*) occurred throughout much of woodland type in north-central New Mexico in 2009. Activity was first noticed in late June on the Santo Domingo pueblo, and was later observed (from the ground) in several other locations, including the Santa Fe and Abiquiu areas.

## Aspen Defoliation and Decline

Drought-related damage
Western Tent Caterpillar, *Malacosoma californicum*
Other Insects and Diseases

Aspen damage was detected on about 142,000 acres regionwide in 2009, somewhat less than in 2008 (176,000 acres). Damage mapped in 2009 decreased substantially in Arizona, but increased in New Mexico.

Drought related aspen mortality has been severe over the last decade throughout central and northern Arizona. Although several years ago it was difficult to distinguish drought related aspen mortality from insect defoliation, aerial surveyors are now better able to distinguish the difference because aspen stands defoliated by insects and diseases still maintain a greenish cast to the overall crown and have vibrant white bark, while stands with mortality have grey stems from bark

sloughing, and there is an absence of green foliage. Aerial surveyors don't typically map in the same areas of mortality from one year to the next, but since we needed better estimates of aspen mortality over the past decade, 46,000 acres of cumulative mortality was mapped across the White Mountain Apache Reservation and Apache-Sitgreaves National Forests. We plan to get better estimates of cumulative aspen mortality from other parts of Arizona in 2010.

In New Mexico, the 2009 damage includes western tent caterpillar defoliation on 53, 410 acres and 34,850 acres where significant aspen mortality was observed. Tent caterpillar defoliation was more extensive than in 2008, and was especially severe on the Canjilon Ranger District of the Carson National Forest. Defoliation and mortality were both observed in some areas, particularly areas that have been repeatedly defoliated over recent years. Although the numbers suggest that aspen mortality increased in New Mexico in 2009, much of the increase is due to the inclusion of areas with more scattered mortality than were mapped in previous years. Additional areas with high concentrations of mortality actually decreased by about 30 percent in 2009.

**Figure 14. Decline and dieback of lower-elevation aspen in northern Arizona.**

# Status of Diseases

## Mistletoes

### Dwarf Mistletoes

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

**Figure 15. Severe dwarf mistletoe infection on blue spruce, Apache-Sitgreaves National Forests.**

Dwarf mistletoes are the most widespread and damaging forest pathogens (disease-causing organisms) in the Southwest. There are eight species in the Southwest, 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.

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, so overall incidence changes little from year to year. Because of their slow rate of spread, the *distribution* of dwarf mistletoes on the landscape is probably similar to that in the 1800s. The *abundance* of dwarf mistletoe has probably increased considerably since the 1800s, largely due to increases in tree densities.

Damage from dwarf mistletoes includes growth reduction, deformity—especially the characteristic witches' brooms, and decreased longevity. Infected areas often have much higher mortality rates than uninfected areas. Infection is often a major factor in mortality attributed to other damaging agents. For example, severely infected trees are often attacked by bark beetles. As a natural part of the forest, dwarf mistletoes have an ecological role and appear to benefit many species.

### True Mistletoes

*Phoradendron* spp.
Hosts: Junipers, various hardwoods

Several species of true mistletoe occur in the Southwest. *P. juniperinum* on juniper is probably the most widespread and abundant mistletoe (true or dwarf) in the region. Mistletoes are common on oaks in southern portions of the region and are locally abundant in desert woodlands and lower

elevation riparian areas. Heavy infection reduces host longevity, especially during periods of drought.

## Root Diseases

Root diseases are fairly common in the forests of the Southwest, and are often associated with mortality attributed to bark beetles. They can also predispose trees to windthrow, an obvious concern in campgrounds and other heavily used areas. Root diseases are usually more common in mixed conifer and spruce-fir forests than in ponderosa pine forests. Like dwarf mistletoes, root diseases spread slowly, so overall incidence changes little from year to year. Root disease is often described as a "disease of the site," and can be exacerbated by certain activities.

### 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 associated mortality in the region. All size classes can be affected. Previous surveys on the North Kaibab Ranger District found the fungus on about 30 percent of standing live trees.

Armillaria was observed girdling the root collar of dead and dying subalpine fir trees in the Pinaleño Mountains of southern Arizona in 2009. Samples from the Pinaleño Mountains and White Mountains of eastern Arizona were identified as *Armillaria solidipes* (synonym *A. ostoyae*), the same species found in the northern mountains of New Mexico.

In addition to causing disease, this fungus is a common decayer of dead woody material (a saprophyte).

### Annosus Root Disease

*Heterobasidion annosum* and *H. parviporum*
Hosts: Most conifers

**Figure 16. *Ganoderma applanatum* conk, Carson National Forest. This fungus often leads to failure of mature aspen.**

Annosus root disease is probably the second most common root disease in the Southwest. Based on recent genetic work, two species are now recognized in the western U.S.: *H. annosum*, which infects ponderosa pine, and *H. parviporum* (formerly known as the "S type" of *H. annosum*), which mostly infects true firs and spruces. In the Southwest, *H. parviporum* appears to be much more common than *H. annosum*, with annosus root disease most often observed on true firs. 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**, *Onnia tomentosus* (*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 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**, *Porodaedalea pini* (*Phellinus pini*), affecting most conifers; **rust-red stringy rot**, *Echinodontium tinctorium*, on white fir; **aspen trunk rot**, *Phellinus tremulae*; and *Inonotus dryophilus* on oak.

### Fungal Blight

Scattered ponderosa pines with branch flagging were observed throughout much of the host type in the Zuni Mountains in 2009. About 1,600 acres of affected area were mapped during aerial survey, and additional damage was observed from the ground. Symptoms were similar to those of Dothistroma needle blight, which to our knowledge has not previously been reported in the Southwest. Specific identification of the causal agent has not been determined. An unusually wet period in June may have precipitated this outbreak.

**Figure 17. Fungal blight on ponderosa pine, Zuni Mountains, August 2009.**

## 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 was detected in several locations in the White Mountains of Arizona in 2009, the first report of this non-native disease in that State. The oldest cankers found indicate that blister rust arrived in this area at least 18 years ago. More recent waves of infection have greatly expanded the distribution and severity of this outbreak. In 2009, ground surveys revealed white pine blister rust infection is distributed over at least 35 square miles but infected southwestern white pines were fairly restricted to high hazard sites, like moist canyon bottoms. Some branch and whole tree mortality of seedlings and saplings was apparent. Damage to white pines in the White Mountains will become increasingly evident in the coming years.

Blister rust continues to cause heavy damage to white pines in the Sacramento Mountains of southern New Mexico, where it has now been established for about 40 years (see the “Other Entomology and Pathology Activities in 2009” section for a description of monitoring activities and a summary of results to date). Blister rust has been detected in several other locations of northern and western New Mexico the past few years.

## Broom Rust

*Melampsorella caryophyllacearum*
Host: True firs

*Chrysomyxa arctostaphyli*
Host: Spruces

Broom rusts are found at low levels throughout most of their host’s ranges in the Southwest. High concentrations of fir broom rust occur in the Sandia and Manzano Mountains of central New Mexico and a few other locations. Damage from this easily recognized disease has not been well quantified; however, infection can result in topkill, especially 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 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.

Overall, limb rust is less common in New Mexico than in Arizona. However, this disease has been observed frequently in the Jemez Mountains of northern New Mexico in recent years, following a wave of infection.

### Comandra Blister Rust

*Cronartium comandrae*
Host: Pines

Relatively little damage from this native blister rust has been observed in recent years. In the past, it has caused extensive branch dieback and mortality of nonnative Mondell/Afghan pine (*Pinus eldarica*) in the Prescott, Payson, and Sedona areas of central Arizona. Young native ponderosa pines in these areas are also occasionally infected. Abundant infections were observed on bastard toadflax, the alternate host, in the Prescott area in 2009.

**Figure 18. Commandra blister rust infection on toadflax near Prescott, Arizona, Sept. 2009**

### 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 common in other parts of the West.

## Foliage Diseases

### Piñon Needle Cast

No new piñon needle cast was detected during the 2009 aerial surveys.

### Ponderosa Pine Needle Cast

*Lophodermella cerina* and other species

**Figure 19. Damage from de-icing salts, Coconino County, Arizona.**

About 6,000 acres of needle-cast were detected on the Coconino and Kaibab National Forests and adjacent private lands in northern Arizona, in 2009. About 8,000 acres of activity had been detected in this same vicinity the previous year. No consistent fungal fruiting structure has been observed on affected needles, so the causal fungus has yet to be identified. It is likely that needles of drought stressed trees are affected by a fungus that is not typically an aggressive pathogen. This outbreak has gone on for several years, resulting in branches with only current year's needles.

Needle cast was also observed from the ground on the Alpine Ranger District of the Apache-Sitgreaves National Forests in 2009. No needle cast was detected in New Mexico during aerial surveys in 2009.

## Abiotic Damage

### Salt

De-icing salts continue to damage roadside trees (especially ponderosa pines) along many high-elevation highways in Arizona and New Mexico. Additional damage from dust abatement salts was also observed in 2009, mostly in eastern Arizona.

### Drought

Discoloration and damage to ponderosa pine and other vegetation attributed to drought was mapped on 2,790 acres in northern Arizona in 2009, an increase from the previous year (1,870 acres).

# Other Forest Insect and Disease Reports

**Aspen blotchminer,** (*Lithocolletis tremuloidiella*) was observed feeding on aspen regeneration on Stable Mesa (Jemez Mountains) in 2009.

**Figure 20. Aspen blotchminer damage, Santa Fe National Forest, July 2009.**

**Cypress/juniper bark beetle** (*Phloeosinus* spp.) activity was generally low across the Southwest in 2009. The most notable activity observed was along the southern end of the Sacramento Mountains, where about 100 acres of damage were recorded during aerial surveys.

**Figure 21. *Gymnosporangium speciosum* on Rocky mountain juniper, Sandia Mountains, June 2009.**

**Juniper rust** (*Gymnosporangium* spp.) was dramatic in many locations of the Southwest during a wet period in June 2009. Notable outbreaks were observed on Arizona cypress in the Catalina Mountains, on junipers in the Payson and Prescott areas and in the Sandia Mountains, and on common juniper in the Sangre de Cristo Mountains of New Mexico and White Mountains of Arizona.

**Fall webworm** (*Hyphantria cunea*) defoliation was noted on several different host trees in Arizona in 2009, especially in Gila County. New hosts include Arizona sycamore, Arizona alder, English walnut, chokecherry, and birch. In New Mexico, notable webworm activity continues to be observed on riparian hardwoods and landscape trees in many areas throughout the State.

**Walnut anthracnose** (*Gnomonia leptostyla*) infections were notable for the fourth consecutive year in central Arizona, especially in the Prescott area.

**Walnut leafhopper** increased dramatically in Arizona in 2009. Extensive “leafhopper-burn” of walnuts was observed in the Payson, Star Valley, and Pine-Strawberry areas. Damage was also noted in lower Oak Creek Canyon and the Hualapai mountains.

**Figure 22. Fall webworm on willow, Gila County, Arizona, September 2009.**

# Biological Evaluations and Technical Assistance

## Arizona Zone

1. Forest insect and pathogen activity in the Hart Prairie Fuels Reduction and Forest Health Restoration Project, Peaks Ranger District, Coconino National Forest; 2/27/09.
2. FHP site visit report, Santa Catalina Ranger District, Coronado National Forests; 6/18/09.
3. Mountain pine beetle activity in Chitty Fire Salvage Sale and Bear Wallow Wilderness, Alpine Ranger District, Apache-Sitgreaves National Forests; 7/15/09.
4. Elden Pueblo Forest Health Project, Mormon Lake and Peaks Ranger Districts, Coconino National Forest; 9/2/09.
5. Insect and disease assessment of blue spruce tree, Alpine Ranger District, Apache-Sitgreaves National Forests; 10/28/09.
6. Assessing aspen health in Navajo National Monument; 11/4/09.
7. Forest health projects on Mogollon Rim Ranger District, Coconino National Forest; 11/6/09.
8. Scott Vegetation Management Project, Tusayan Ranger District, Kaibab National Forest; 11/6/09.
9. The Piñaleno Ecosystem Restoration Project, Safford Ranger District, Coronado National Forest; 11/24/09.
10. Dry Park timber sale visit, North Kaibab Ranger District, Kaibab National Forest; 12/18/09.
11. Proposed forest health project on Pleasant Valley Ranger District, Tonto National Forest; 12/30/09.

## New Mexico Zone

1. Douglas-fir tussock moth male moth 2008 trapping survey, Sacramento Ranger District, Lincoln National Forest; 1/08/09.
2. Forest health projects, Jicarilla Apache Reservation; 7/1/09.
3. Potential forest health project, Santo Domingo Pueblo; 7/14/09.
4. Blue Water forest health project, Mount Taylor Ranger District, Cibola National Forest; 7/16/09.
5. Status of western spruce budworm at nine campgrounds on the Sacramento Ranger District, Lincoln National Forest; 7/21/09.
6. Potential FY 2010 forest health project, Jemez Pueblo; 7/30/09.
7. Evaluation of linden looper damages and box elder bugs, Sulphur Canyon Picnic Area, Sandia Ranger District, Cibola National Forest; 8/3/09.
8. Potential FY 2010 forest health project, Cuba Ranger District, Santa Fe National Forest; 8/10/09.

9. Occurrence of aspen defoliation on the Carson National Forest and adjacent lands 2009, Canjilon and Tres Piedras Ranger Districts, Carson National Forest; 8/28/09.
10. Forest insects and diseases of the Valles Caldera National Preserve; 9/1/09.
11. Forest health projects in Los Griego WUI, Jemez Ranger District, Santa Fe National Forest; 9/03/09.
12. Proposed FY 2010 Wet Burnt Forest Health project, Sacramento Ranger District, Lincoln National Forest; 9/16/09.
13. Santa Rosa State Park bark beetle prevention project, Santa Rosa State Park; 9/29/09.
14. Thompson Ridge Forest Health projects, Jemez Ranger District, Santa Fe National Forest; 9/30/09.
15. Proposed FY 2010 forest health project, Coyote Ranger District, Santa Fe National Forest; 10/5/09.
16. Proposed FY 2010 forest health project, Mountainair Ranger District, Cibola National Forest; 11/9/09.
17. Sacramento RD 2009 Douglas-fir tussock moth trapping results, Sacramento Ranger District, Lincoln National Forest; 12/10/09.
18. Sandia RD 2009 Douglas-fir tussock moth trapping results, Sandia Ranger District, Cibola National Forest; 12/10/09.
19. Santa Clara 2009 Douglas-fir tussock moth trapping results, Santa Clara Pueblo; 12/10/09.

# Publications

Conklin, D.A. 2009. Southwestern white pine. Nutcracker Notes 17: 8.

Conklin, D.A.; Fairweather, M.L.; Ryerson, D.E.; Geils, B.W.; Vogler, D.R. 2009. White pines, blister rust, and management in the Southwest. USDA Forest Service, R3-FH-09-01. 16pp.

McMillin, J.D. & C.J. Fettig. 2009. Bark beetle responses to vegetation management treatments. pp. 23–38. In: (J. Hayes, ed.) Healthy Forests and Watersheds – The Western Bark Beetle Research Group - A Unique Collaboration with Forest Health Protection. *Proceedings of a Symposium at the Society of American Foresters Conference* 23-28 October 2007 Portland, OR. 134 p.

Negrón, J.F.; McMillin, J.D.; Anhold, J.A.; Coulson, D. 2009. Bark beetle-caused mortality in a drought-affected ponderosa pine landscape in Arizona, USA. *Forest Ecology and Management* 257: 1353–1362.

Williams, K.; McMillin, J.D.; DeGomez, T.E. 2009. Relative and seasonal abundance of three bark beetle predators (Coleoptera: Trogositidae, Cleridae) across an elevation gradient in ponderosa pine forests of north-central Arizona. *Western North American Naturalist* 69: 351–363.

Worrall, J.J.; Fairweather, M.L. 2009 (revision). Decay and discoloration of aspen. USDA Forest Service, Forest Insect and Disease Leaflet 149. 7pp.

Worrall, J.J.; Harrington, T.C.; Blodgett, J.T.; Conklin, D.A.; Fairweather, M.L. 2010. *Heterobasidion annosum* and *H. pariviporum* in the southern Rocky Mountains and adjoining States. Plant Disease 94: 115-118.

# Other Entomology and Pathology Activities in 2009

## Monitoring Blister Rust in the Sacramento Mountains

We have continued to monitor the white pine blister rust outbreak in the Sacramento Mountains of southern New Mexico using a set of permanent plots. Here we summarize changes in rust incidence and damage since 2003 (the last time these data were analyzed) on the 12 oldest plots (n = 600 sample trees). These plots are distributed throughout the host type, on both the Lincoln National Forest and the Mescalero-Apache Reservation, and are thought to be fairly representative of the white pine population in the Sacramento Mountains.

The proportion of trees infected increased from 40 to 44 percent over this 6-year period. The proportion with stem cankers increased from 18 to 25 percent, and those experiencing rust topkill increased from 10 to 16 percent. Cumulative mortality from blister rust (since plot installation) increased from 2 percent (in 2003) to 9 percent (in 2009).

Four of 12 oldest plots (and 2 newer plots) had no visible blister rust when they were established. By 2009, all 14 of the plots in the Sacramento Mountains have at least some infection. Eight of the plots now have infection rates of 40 to 90 percent.

*For more information, contact Dave Conklin.*

## Aspen Monitoring in Arizona

Survey plots that were established in 2003 on the Coconino National Forest to monitor the decline of aspen were revisited in 2009. Preliminary results indicate mortality and crown decline continued in sites below 8,500 feet elevation. Regeneration counts continue to decline in most areas. Ninety-seven percent of regeneration is less than 1 foot in height after 7 years, due to browsing impacts, and the other three percent is under 3 feet. Most plots in this survey are located in areas not grazed by livestock.

*For more information, contact Mary Lou Fairweather.*

## Armillaria Root Disease

Armillaria root disease samples were collected from under the bark of infected subalpine fir and Douglas fir trees from the Apache-Sitgreaves and Coronado National Forests and sent to Rocky Mountain Research Station Research Pathologist, Ned Klopfenstein, who identified isolates using DNA sequencing. All isolates were identified as *Armillaria solidipes* (syn. *A. ostoyae*). This was the first time armillaria isolates in Arizona were identified other than at the morphological level.

*For more information, contact Mary Lou Fairweather.*

## Douglas-fir beetle MCH efficacy trials in the Sierra Madre Mts. of Mexico

Research to support the registration in Mexico of MCH as a Douglas-fir beetle (*Dendroctonus pseudotsugae*) antiaggregation pheromone is being lead by Dr. Guillermo Sánchez Martinez of INIFAP, Aguascalientes, Mexico, with technical assistance from the Forest Service (Pacific Southwest Research Station and Forest Health Protection). In April of 2008, Connie Mehmel (Forest Entomologist, R6) and Debra Allen-Reid were invited to help Dr. Sánchez Martinez and

staff in scouting potential study sites in the Sierrra Madre Mountains of Durango and Chihuahua States. In April of 2009, Connie and Debra returned to the State of Durango to assist Dr. Sánchez Martinez and crews with the field installation of four replicates of three MCH bubblecap application rates and a control. Lindgren funnel traps with baits were also installed in each block to monitor beetle pressure. Preliminary results indicate the established operational use rate of MCH in the U.S. is also the optimum rate for the Douglas-fir beetle in Mexico, and that successful beetle attacks were reduced. Plans are under way to continue the work using the pheromone flake formulation of MCH. Debra presented a bilingual (English-Spanish) poster on the work at the joint meeting of the Association of Mexican Forestry Professionals (Chihuahua Section) and the Society of American Foresters (Southwest Section) held in October, 2009 in Albuquerque. Travel funding for Connie and Debra was provided by the Forest Health Protection International Activities Team. A full trip report can be viewed at:

http://www.fs.fed.us/r6/nr/fid/iat/reports/mexico/2009-mehmel-mexico-dfb.pdf

*For additional information, please contact Debra Allen-Reid.*

## Workshops

Forest Health Protection staff offer two types of training sessions: (1) Identification, Effects, and Management of Forest Insects and Diseases in the Southwest and (2) Hazard Tree Detection, Evaluation, and Management in Recreation Areas. Both sessions are offered at least once a year, however, due to high interest in 2009 we held two insect and disease workshops and three hazard tree sessions. These were distributed throughout the region, including the Coconino, Coronado, and Gila National Forests, and the White Mountain and San Carlos Apache Reservations. We also hosted a 2-day aspen workshop in Flagstaff, Arizona, in conjunction with the Western Aspen Alliance (http://www.western-aspen-alliance.org).

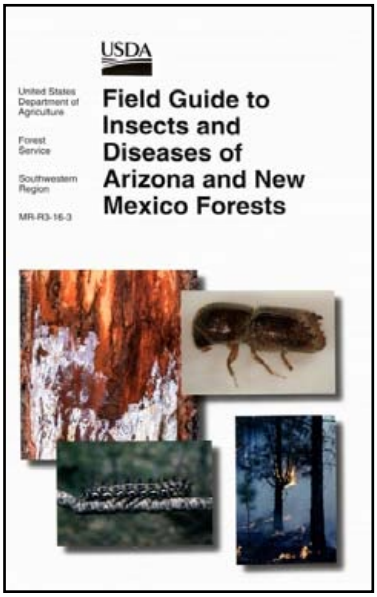
*For more information, contact John Anhold or Debra Allen-Reid.*

## Web Version of Insect and Disease Field Guide

A Web version of the "Field Guide to Insects and Diseases of Arizona and New Mexico Forests" is available on our Forest Health Web site: http://www.fs.fed.us/r3/resources/health

The Web version contains all of the photographs and information of the printed guide. Access to PDFs of individual sections of the guide is available for users to print sections of the guide.

*For more information, contact Mary Lou Fairweather.*



# Forest Health Staff

## Arizona Zone

### John Anhold (928) 556-2073

Supervisory entomologist, Arizona Zone leader since 2000. Duties include: supervisory and managerial duties for Arizona Zone staff, oversight of Arizona Cooperative Forest Health program of the State Forester's office, Region 3 representative for the National Forest Health Monitoring program. Interest in western bark beetle technology development and transfer. Previous work experience in Region 4 working with bark beetles and coordinator for the Utah gypsy moth eradication project, and in the Northeast Area working with state cooperators regarding defoliator issues.

### Steve Dudley (928) 556-2071

GIS program coordinator, Arizona Zone since 1990. Collection, processing, analysis and map production of current year forest insect and disease activity survey data remains the primary GIS task. Insect and disease detection aerial surveyor. Annual detection of mortality, defoliation and abiotic factors across Arizona.

### Mary Lou Fairweather (928) 556-2075

Plant pathologist, Arizona Zone since 1989. Provides technical assistance on forest diseases to land managers. Current focus: distribution and impacts of white pine blister rust; aspen diseases and browse impacts on aspen regeneration; dwarf mistletoe ecology and management; and hazard tree identification and mitigation.

### Ryan Hanavan (928) 556-2072

Forest entomologist with the AZ office since 2009. Primary responsibility is providing technical assistance on forest defoliators to land managers. Technology development interests include using remote sensing and GIS applications to improve early pest detection and prevention techniques, and for monitoring the impacts of climate change on insect pest activity.

### Joel McMillin (928) 556-2074

Forest entomologist, Arizona Zone since 2001. Primary responsibility is providing technical assistance on bark beetle management to land managers. Currently serving on Western Forest Insect Work Conference Executive Committee, Special Technology Development Program Steering Committee, and Asian Lymantriidae Monitoring Program team. Research and technology development interests include: short- and long-term impacts of bark beetles on forest condition, bark beetle semiochemicals, stand hazard rating systems for bark beetles, fire-bark beetle interactions, single tree protection against bark beetle attack, and slash management strategies for reducing bark beetle impacts.

## New Mexico Zone

### Debra Allen-Reid (505) 842-3286

Supervisory entomologist, New Mexico Zone leader since 1996. Aside from zone staff supervision and unit management, duties include administrative oversight for the New Mexico Cooperative Forest Health program; Region 3 representative to the STDP Insect Management Working Group; and Region 3 point-of-contact for the FHP International Activities program. Previous work experience in gypsy moth suppression, NEPA compliance, southern pine beetle management, and silviculture.

### Dave Conklin (505) 842-3288

Forest pathologist, New Mexico Zone since 1990. Key interests: dwarf mistletoe ecology and management, including effects of fire; white pine blister rust ecology and management; other forest diseases and insects; general forest management. Work experience includes dwarf mistletoe research and monitoring, and involvement in almost 200 forest management projects on National Forest and Tribal lands.

### Terry Rogers (retired January 2010)

Forest entomologist, New Mexico Zone since 1979. Primary responsibility is providing technical assistance for insect related forest health issues to all Federal land managers. Manages insect monitoring program through trapping and as a backup aerial detection surveyor. Special interests in plant pathology and fire effects.

### Daniel Ryerson (505) 842-3285

Forest health and GIS specialist, New Mexico Zone since 2003. Responsibilities include GIS program for New Mexico, aerial detection surveys, data analysis, technical support, and field assistance. Involved with the national insect and disease risk map project to model future risk of forest mortality from insect and disease activity.

### Crystal Tischler (505) 842-3284

Forest health coordinator & FH unit aviation officer, New Mexico Zone since September 2008. Responsibilities include aerial detection surveys, aviation safety and training coordination, and field assistance to staff. Involved with New Mexico Forestry Camp planning, outreach, and implementation. ICS-qualified as a Wildfire Incident GIS Specialist. Previous work experience in forest management, fuels reduction, timber sale administration and community wildfire protection planning.

# 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 this site includes annual forest insect and disease conditions reports, literature on pest biology and management, and general information on forest health in the Southwest. Additionally, our Forest Health Protection national office maintains a Web site at http://www.fs.fed.us/foresthealth/ which includes program overviews and 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.

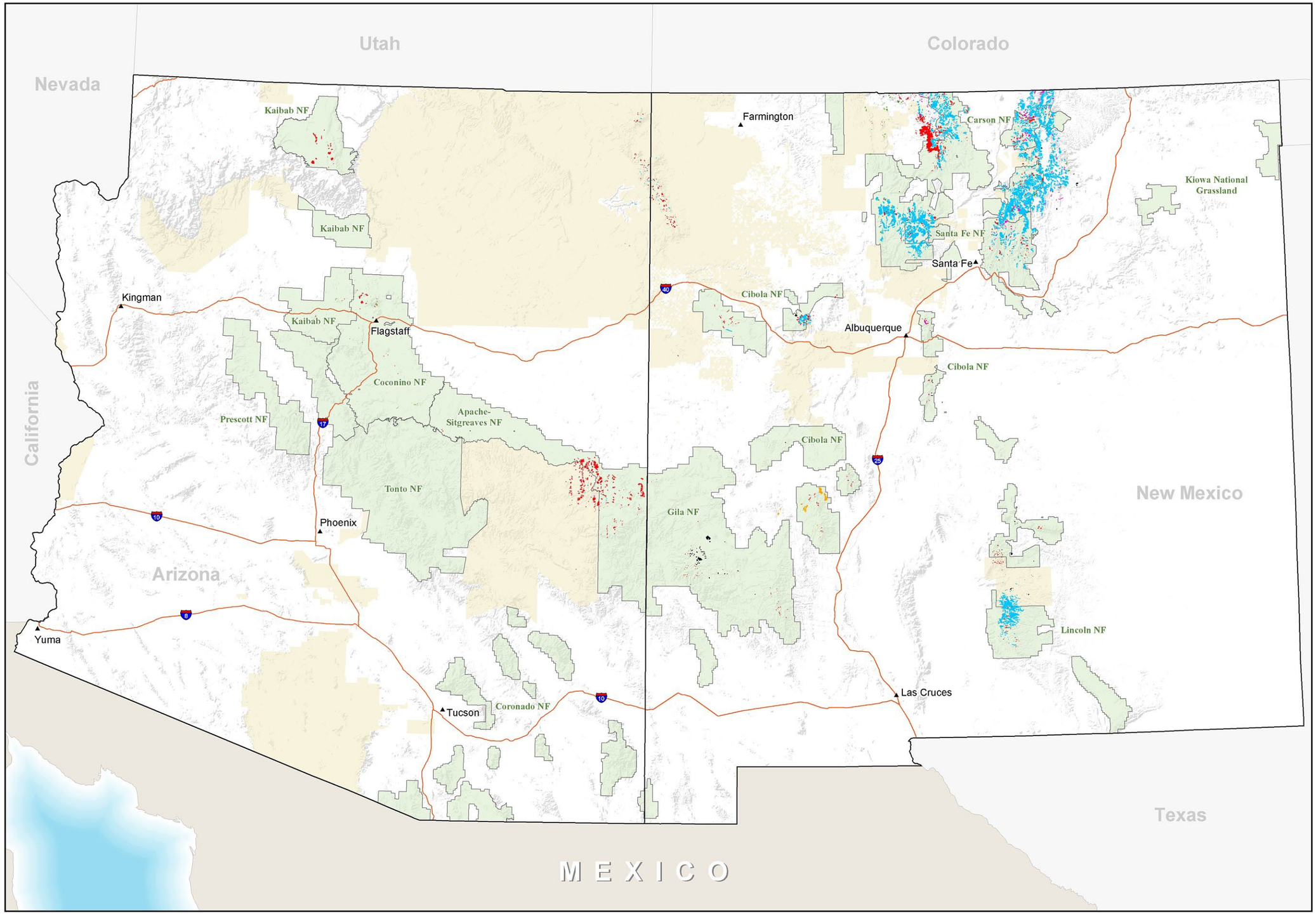
### Packing

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. Use only enough alcohol to fully immerse the specimens; shipping regulations limit the amount to 30 ml (2 tablespoons or about 1 ounce) per vial. Make sure lids are well sealed. Place all vials in a sealed plastic bag, using packing materials between vials to minimize movement. Ship in a sturdy box.

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.




National Forest

Tribal lands

## Damage Agent*

- Western spruce budworm defoliation
- Aspen defoliation and mortality
- True fir mortality from bark beetles
- Pine bark beetles
- Piñon needle scale
- Douglas-fir beetle

**Only agents affecting greater than 5,000 acres Region-wide are depicted. Additionally, individual small areas (< 2 acres) not visible at this scale.*

N
W E
S

0 25 50 100 Miles

**Aerial Detection Survey Data Disclaimer**

Forest Health Protection (FHP), Arizona State Forestry Division, and the New Mexico State University Cooperative Extension Service strive to maintain an accurate Aerial Detection Survey (ADS) Dataset, but due to the conditions under which the data are collected, FHP and its partners shall not be held responsible for missing or inaccurate data. ADS are not intended to replace more specific information. An accuracy assessment has not been done for this dataset; however, ground checks are completed in accordance with local and national guidelines:

*http://www.fs.fed.us/foresthealth/aviation/qualityassurance.shtml*

Maps and data may be updated without notice. Please cite "USDA Forest Service, Forest Health Protection, Arizona State Forestry Division, and New Mexico State University Cooperative Extension Service" as the source of this data in maps and publications.

This map represents the mortality and defoliation that has occurred since the previous surveys in 2008. 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 scale and subjective nature of aerial sketch mapping mapping.

**Arizona**

Surveys conducted July through September, 2009, by Steve Dudley, Bobbe Fitzgibbon, and Ryan Hanavan, Forest Health Office, Southwestern Region, US Forest Service; Aaron Green, Arizona State Land Department, Forestry Division.

**New Mexico**

Surveys conducted June through September, 2009 by Daniel Ryerson and Crystal Tischler, Forest Health Office, Southwestern Region, US Forest Service; Stephani Sandoval, New Mexico State University Cooperative Extension Service.

# Significant Forest Mortality and Defoliation Detected through Aerial Survey

## Region 3 - Southwestern Region - 2009

*5 February 2010*