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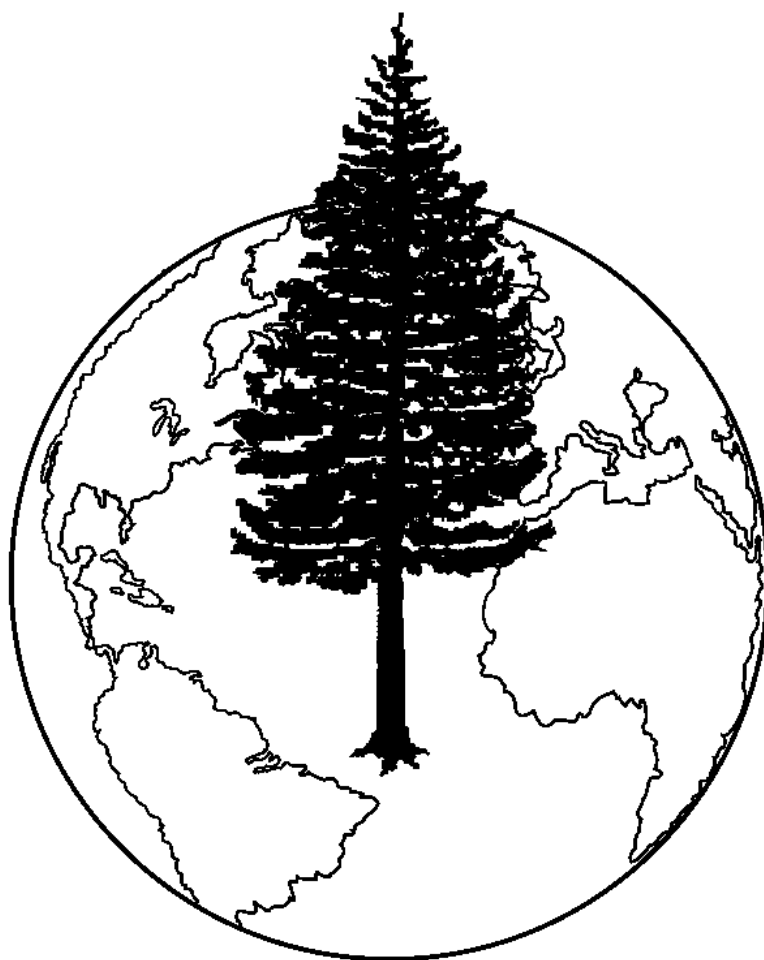
Forest Service

**Forest Health  
Protection**

June 2003

# Forest Insect and Disease Conditions in the United States 2002

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**Healthy Forests Make  
A World of Difference**



United States  
Department  
of Agriculture

Forest Service

**Forest Health  
Protection**

June 2003



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# PREFACE

This is the 52<sup>nd</sup> annual report prepared by the U.S. Department of Agriculture Forest Service (USDA Forest Service) of the insect and disease conditions of the Nation's forests. This report responds to direction in the Cooperative Forestry Assistance Act of 1978, as amended, to conduct surveys and report annually on insect and disease conditions of major national significance. Insect and disease conditions of local importance are reported in regional and State reports.

The report describes the extent and nature of insect- and disease-caused damage of national significance in 2002. As in the past, selected insect and disease conditions are highlighted in the front section of the report. Maps are provided for some pests showing affected counties in the East and affected areas in the West. Graphs are provided for some pests showing acreage trends over the last several years. Also provided are tables showing acreages affected for selected pests by State by year for the last 5 years.

The second section of the report brings together insect, disease, and abiotic agent damage from each affected region under the organism's or agent's name. The organisms and agents are arranged alphabetically in the appropriate section--

- insects--native;
- insects--nonnative;
- diseases--native;
- diseases--nonnative;
- diseases--origin unknown;
- declines and complexes;

- seed orchard insects and diseases;
- nursery insects and diseases; and
- abiotic damage.

These categories are listed in the table of contents; there is no index.

The information in this report is provided by the Forest Health Protection Program of the USDA Forest Service. This program serves all Federal lands, including the National Forest System and the lands administered by the Departments of Defense and the Interior. Service is also provided to tribal lands. The program provides assistance to private landowners through the State foresters. A key part of the program is detecting and reporting insect and disease epidemics and the effects of wind, air pollution, floods, droughts, and other agents. Detection surveys are conducted on a regular basis by State and USDA Forest Service program specialists.

For additional information about conditions, contact the USDA Forest Service office listed on the next page (see map for office coverage) or your State forester.

The USDA Forest Service also prepared "America's Forests: 2003 Health Update," which highlights major forest health concerns. The report deals with exotic (nonnative) pests, the rural-urban-wildland interface, and the effects of weather and air pollution on forests.

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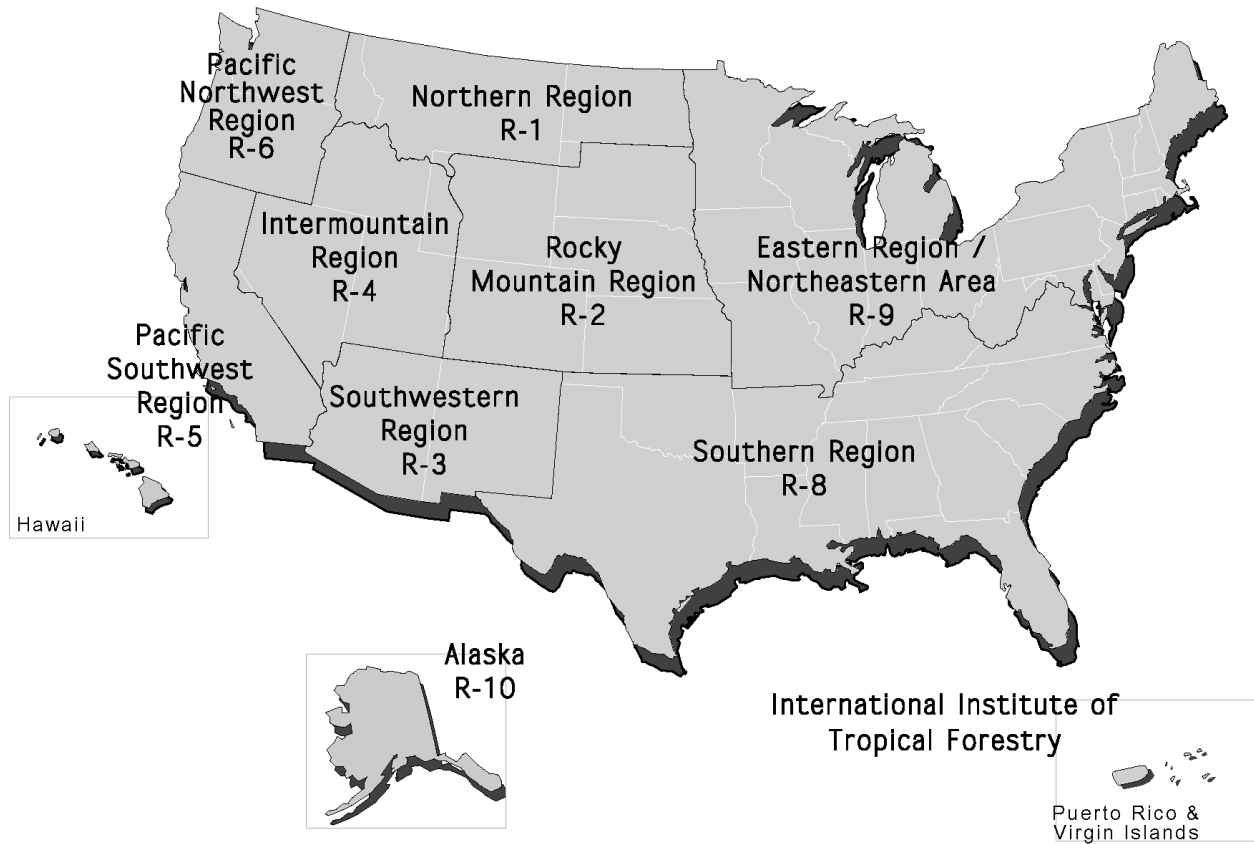
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## USDA Forest Service Regions and Area



Copies of this report are available from:

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This report is also available on the Internet at:

[www.fs.fed.us/foresthealth/annual\\_i\\_d\\_conditions/index.html](http://www.fs.fed.us/foresthealth/annual_i_d_conditions/index.html)

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# EXECUTIVE SUMMARY

## Introduction

About one-third of the Nation's land area, 736.7 million acres, is forested; 380.3 million acres in the East and 356.4 million acres (including Alaska) in the West. Nationwide, these forests provide economic, social, and environment benefits. Native and nonnative (exotic) insects and diseases, as well as abiotic influences, affect the health and productivity of the forests.

Highlighted below are some of the major native insects and diseases of concern. Also highlighted are some nonnative insects and diseases that have been introduced into the United States. These pests either are causing serious damage or have the potential to do so.

## Insects: Native

**Southern pine beetle** – affected acreage remained at a high level as one of the worst southern pine beetle outbreaks ever recorded continued. However, in 2002, beetle activity moved south and west. Over 13.5 million acres were affected in 2002 compared to about 12.3 million acres in 2001.

**Mountain pine beetle** – affected acreage dramatically increased from 849,300 acres in 2001 to 1,564,600 acres in 2002. Infested acres more than doubled in California, Idaho, Montana, and Oregon.

**Spruce budworm** – activity remained at a very low level in 2002 throughout the United States, except in Minnesota, where acres defoliated increased from 19,000 in 2001 to 80,300 in 2002.

**Western spruce budworm** – overall, the number of acres defoliated declined in 2002. However, defoliation increased in some States and decreased in others.

**Spruce beetle** – spruce beetle activity continued to increase in Arizona, Colorado, Montana, Utah, and Wyoming. Population levels have dropped in Alaska to normal levels.

## Insects: Nonnative

**Asian longhorned beetle** – eradication efforts continue in New York and Chicago. The beetle still occurs in both areas and has also been found in New Jersey, across the Hudson River from New York City.

**Gypsy moth (European)** – acres defoliated by gypsy moth decreased substantially from 1,706,000 acres in 2001 to 410,700 acres in 2002.

**Common European pine shoot beetle** – this beetle, first found in Ohio 10 years ago, was found in six States from Maine to Wisconsin. No significant impact has yet been reported in the United States.

**Hemlock woolly adelgid** – populations of this very serious pest are still present in 11 Eastern States, threatening almost the entire range of eastern hemlock.

**Pink hibiscus mealybug** – first discovered in Grenada in 1994, this insect has since spread to the U.S. Virgin Islands and Puerto Rico. Three counties in Florida now have infestations and are closely monitored; biocontrol efforts are used to try to control the spread and impacts of this insect.

### **Diseases: Native**

**Fusiform rust** – is the most damaging disease of pines in the South, causing greater than 10 percent mortality on an estimated 13.9 million acres of loblolly and slash pines. In Georgia, 49 percent of the host type is affected. Genetic improvement efforts continue to offer the best hope for control of fusiform rust.

**Dwarf mistletoes** – are native parasitic plants that occur on a wide range of conifers and are the most serious diseases of trees in the West. Tree species most affected include ponderosa pine, Douglas-fir, lodgepole pine, western hemlock, western larch, and true firs. Dwarf mistletoes are usually host-specific and have patchy distributions within stands and across larger landscapes. An estimated 28.8 million acres have some level of infection.

### **Diseases: Nonnative**

**Beech bark disease** – introduced into North America about 1890, this disease is killing beech trees from Maine to Pennsylvania, with outlying areas of infection in Ohio, Michigan, Virginia, West Virginia, North Carolina, and Tennessee.

**White pine blister rust** – introduced around the turn of the 20<sup>th</sup> century, it now occurs throughout most of the ranges of five-needled pines and has caused extensive tree mortality. Some areas of the West, notably Arizona, Utah, and portions of California, Nevada, Colorado, and New Mexico, remain rust free.

### **Diseases: Origin Unknown**

**Butternut canker** – the fungus that causes this disease was identified in the late 1970s and can be found throughout most of the natural range of butternut. The pathogen kills large trees, saplings, and regeneration causing multiple cankers under the bark that merge and kill the tree. This disease is a serious threat to the survival of the species.

**Sudden oak death** – caused by *Phytophthora ramorum*, this recently recognized disease is killing oaks and other plant species in California and a small portion of southwestern Oregon. First reported in 1995, the disease has been confirmed in 12 coastal counties

north and south of San Francisco and in one county in southwestern Oregon. The outbreak in Oregon is under an eradication program.

### **Part 1: National Highlights**

Part 1 contains more information on selected insects and diseases, including some maps, tables, and graphs.

### **Part 2: Conditions by Damage Agent by Region**

Part 2 provides more detailed information about the insects and diseases discussed here as well as others. The report also describes abiotic factors, such as wind and drought, that damage forests. Abiotic factors often predispose the trees to insect and disease buildups.





# **Part 1: National Highlights**

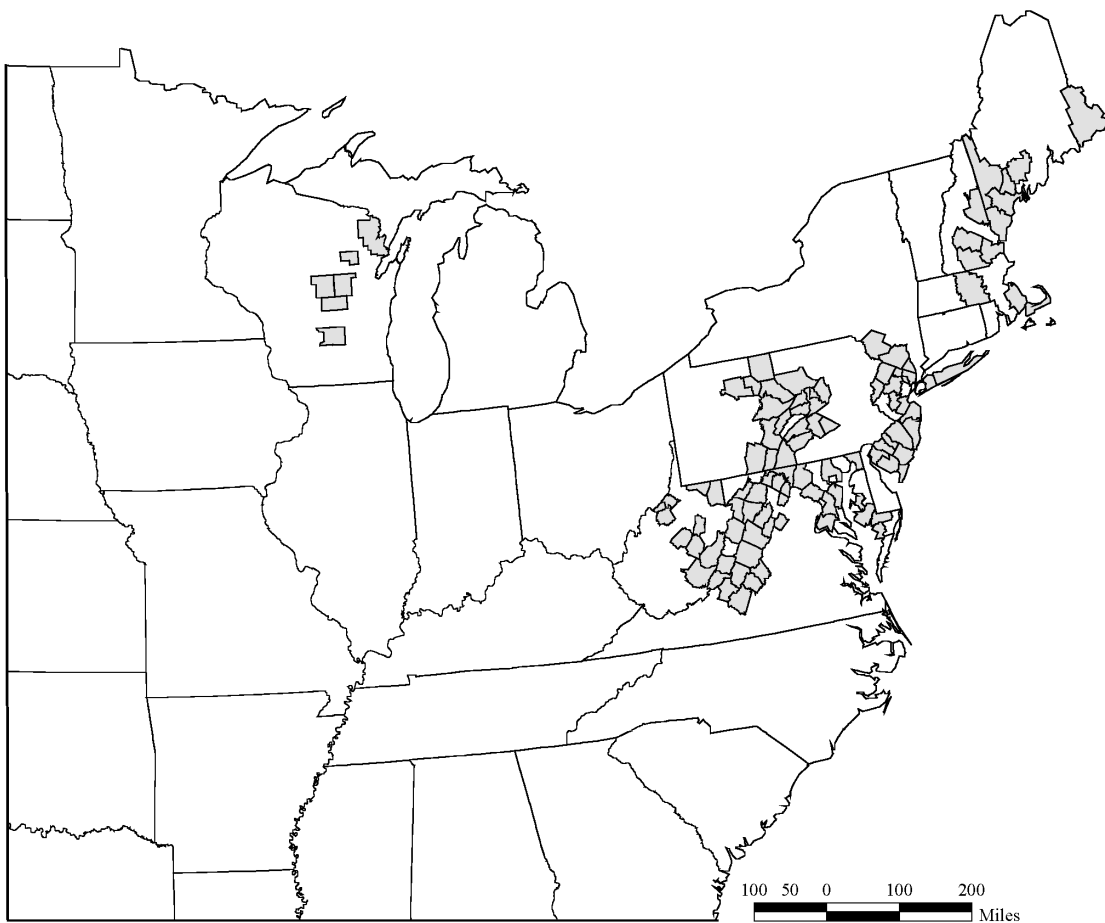
# Insect Conditions Highlights

## Gypsy moth

*Lymantria dispar* was intentionally brought into the Boston, Massachusetts, area from France in 1869 to start a silk industry. The moth escaped and continues to spread south and west. In 2002, all or parts of 15 States and the District of Columbia were considered infested. The infested States extend from Maine to Virginia, West Virginia, Ohio, and Michigan.

Defoliation in the East decreased from 1,706,100 acres in 2001 to 410,700 acres in 2002. Slow The Spread and other Suppression/Eradiation Projects appear to be successful in 12 Eastern and Southern States. Arkansas, Connecticut, Georgia, Maine, Massachusetts, New Hampshire, New York, North Carolina, Rhode Island, Tennessee, Vermont, and Virginia all report fewer acres of defoliation by gypsy moth.

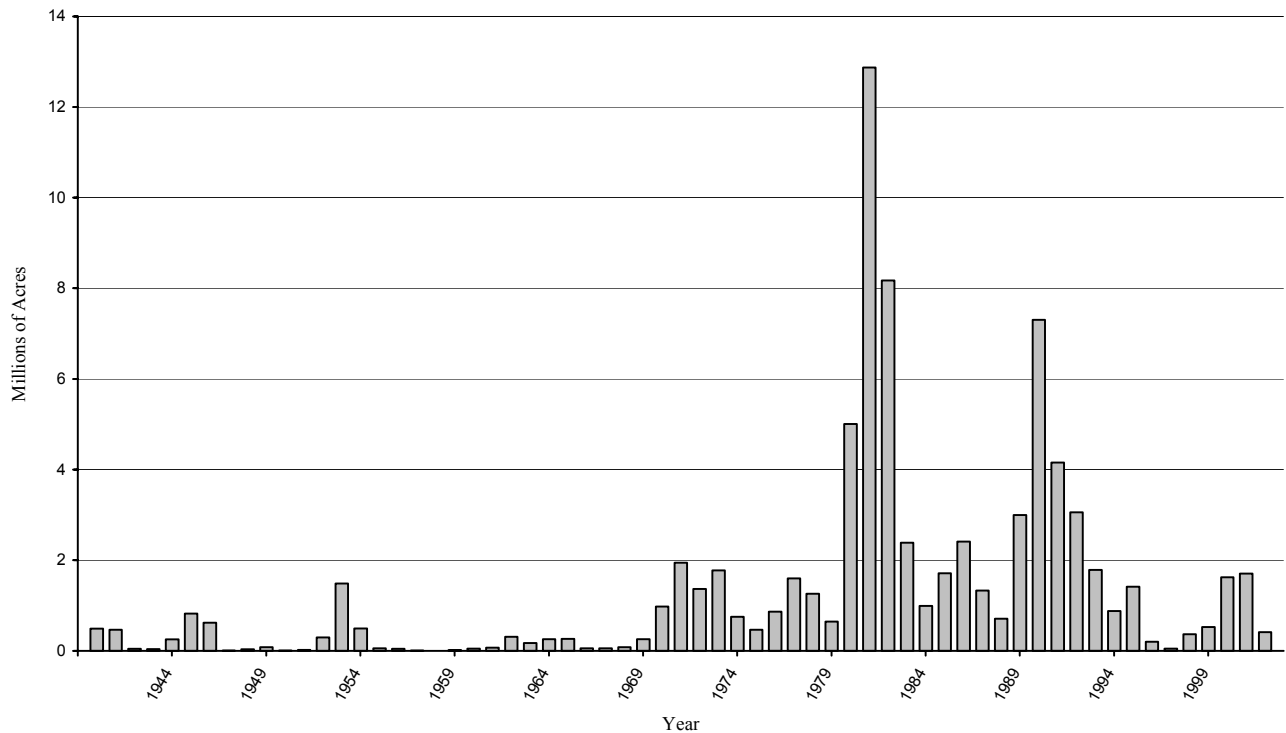
Eastern Counties Where Gypsy Moth (European) Defoliation Was Reported, 2002



Acres of Aerially Detected Gypsy Moth (European) Defoliation, 1998-2002

State	1998	1999	2000	2001	2002
Connecticut	0	0	200	400	0
Delaware	0	0	0	0	0
Maine	0	0	2,500	29,500	51,500
Maryland	500	1,200	23,200	46,200	14,000
Massachusetts	12,900	9,800	64,100	48,000	4,700
Michigan	301,700	176,600	106,300	0	0
New Hampshire	0	0	100	8,500	11,800
New Jersey	1,800	1,400	133,300	140,800	41,900
New York	9,400	6,000	27,500	50,900	7,100
Ohio	1,600	48,200	23,600	42,500	2,500
Pennsylvania	31,600	281,600	843,000	283,700	55,800
Rhode Island	3,000	0	5,500	8,000	0
Vermont	0	0	0	100	0
Virginia	0	0	71,000	440,000	51,900
Washington, DC	0	0	0	0	0
West Virginia	800	0	323,100	603,800	132,100
Wisconsin	0	0	100	3,700	37,400
<b>Total</b>	<b>363,300</b>	<b>524,800</b>	<b>1,623,500</b>	<b>1,706,100</b>	<b>410,700</b>

Gypsy Moth (European) Defoliation, 1940-2002



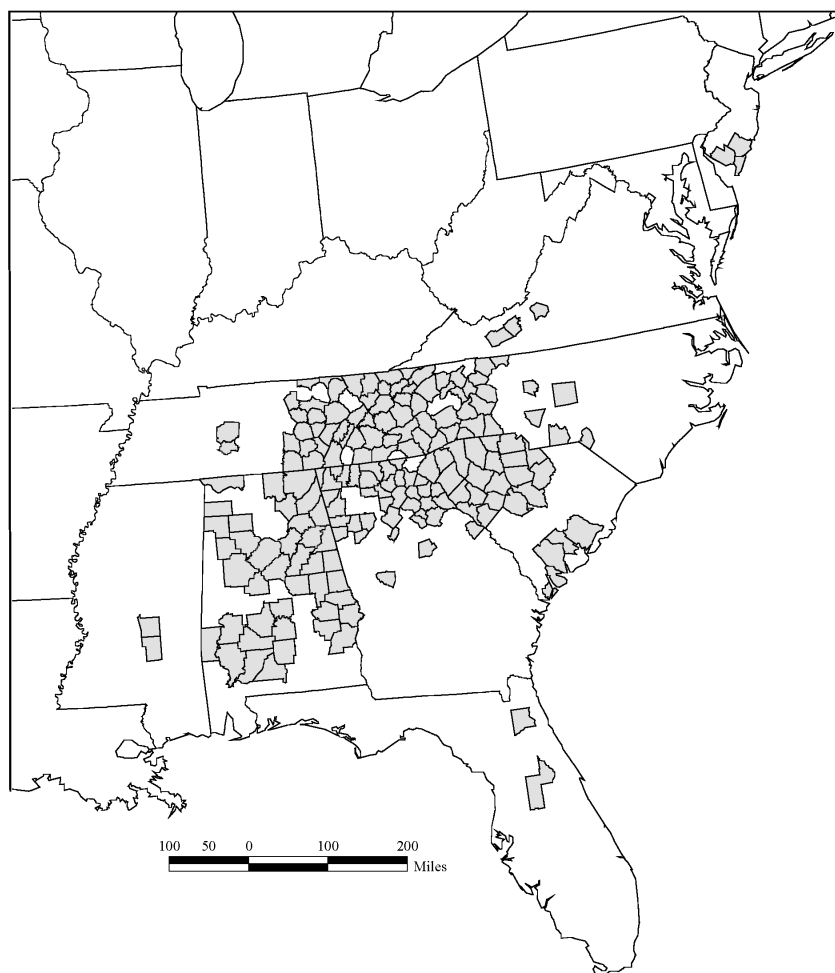
## Southern pine beetle

*Dendroctonus frontalis*, a native insect, is the most destructive of the eastern species of bark beetles. Southern pine beetle populations are epidemic in some parts of the South almost every year. Infestations usually start in trees weakened by disease, lightning strikes, excessive age, storm damage, or other stress factors. Populations can build quickly as there are three to seven generations per year. Shortleaf, loblolly, Virginia, and pitch pines are preferred hosts.

Southern pine beetle activity remained at very high levels over much of the South in 2002 with the affected acreage increasing from 12,191,000 acres in 2001 to 13,455,900 in 2002. Much of the increasing activity of this beetle shifted to South Carolina, Georgia, and Mississippi. South Carolina reported 25 counties with beetle outbreaks that have destroyed over \$250 million in timber products. Alabama, North Carolina, Tennessee, and Virginia are still experiencing epidemic levels of infestations by southern pine beetle.

\*Outbreak level is defined as having one or more multi-tree infestations per 1,000 acres of host type.

## Counties Where Southern Pine Beetle Outbreaks Were Reported, 2002

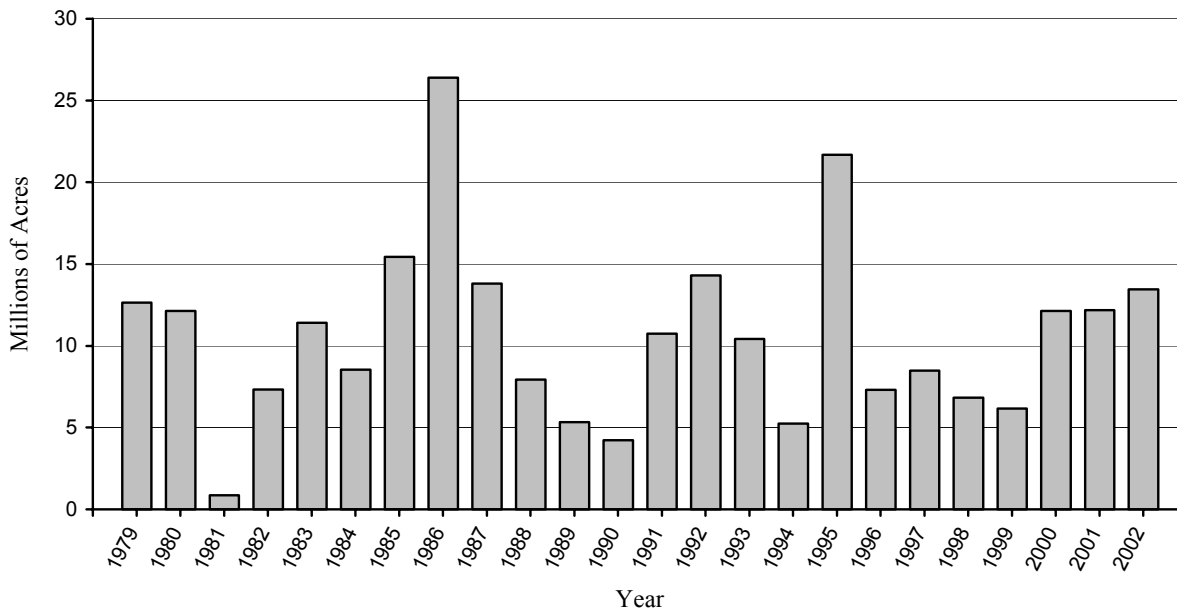


Acres (in thousands) of Southern Pine Beetle Outbreaks, 1998-2002\*

State	1998	1999	2000	2001	2002
Alabama	5,241.3	5,002.0	6,936.1	4,876.0	5,077.0
Arizona	0.0	0.0	11.6	0.0	0.0
Arkansas	0.0	0.0	0.0	0.0	0.0
Florida	0.0	40.0	321.3	916.0	916.0
Georgia	65.0	171.0	1,067.0	1,407.0	2,424.0
Kentucky	0.0	0.0	220.6	767.0	0.0
Louisiana	228.0	0.0	0.0	0.0	0.0
Mississippi	73.0	0.0	210.6	0.0	265.0
New Jersey	0.0	0.0	0.0	0.0	1.9
North Carolina	234.0	252.0	437.9	797.0	935.0
Oklahoma	0.0	0.0	0.0	0.0	0.0
South Carolina	944.0	8.7	1,218.3	1,727.0	2,574.0
Tennessee	35.0	685.0	1,441.0	1,425.0	1,197.0
Texas	0.0	0.0	0.0	0.0	0.0
Virginia	0.0	0.0	268.0	276.0	66.0
<b>Total</b>	<b>6,820.3</b>	<b>6,158.7</b>	<b>12,132.4</b>	<b>12,191.0</b>	<b>13,455.9</b>

\* Acres of outbreak are acres of host type having one or more multi-tree spots per 1,000 acres.

Southern Pine Beetle Outbreaks, 1979-2002



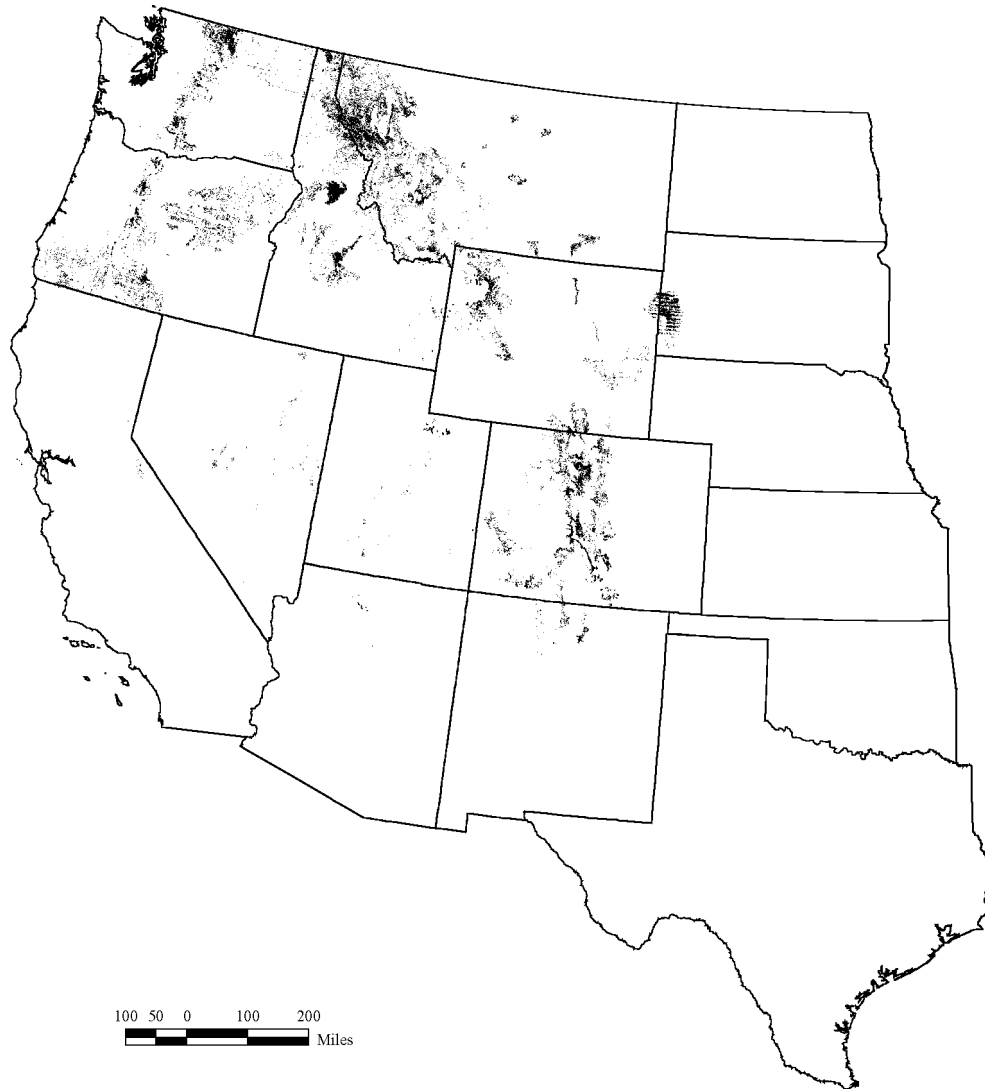
## Insect Conditions Highlights

### Mountain pine beetle

*Dendroctonus ponderosae* is a native bark beetle that attacks lodgepole, ponderosa, sugar, western white, whitebark, and limber pines. The beetle ranges throughout western pine forests from Canada into Mexico. Beetles infest mature, dense stands of pines.

Mountain pine beetle populations increased in every State throughout the West with affected acreage increasing from 849,300 acres in 2001 to 1,564,600 acres in 2002. Several areas with large mountain pine beetle outbreaks and epidemics are Arizona, Colorado, Idaho, Montana, Oregon, South Dakota, and Wyoming. Beetle populations were particularly higher in white pine sites of California, Idaho, Montana, Oregon, Washington, and Wyoming.

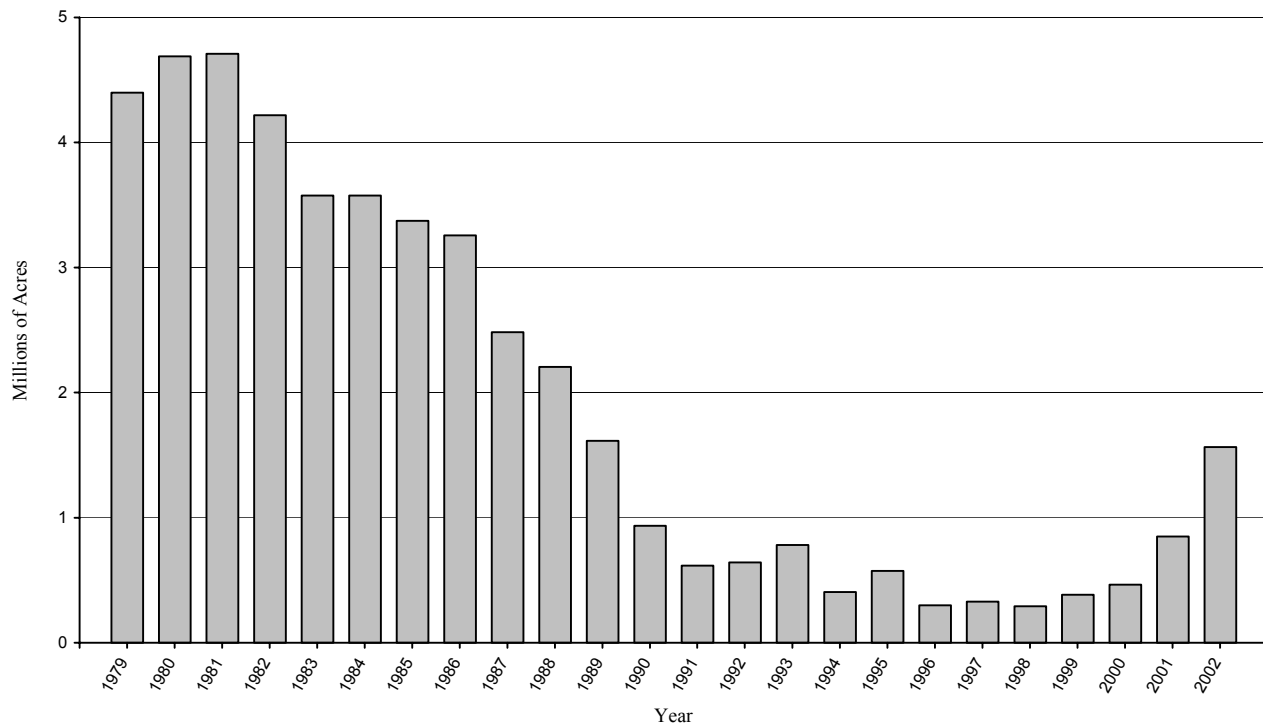
### Mountain Pine Beetle Outbreak Areas, 2002



Acres (in thousands) of Mountain Pine Beetle Outbreak, 1998-2002

State	1998	1999	2000	2001	2002
Arizona	7.4	0.0	0.0	0.0	0.0
California	26.8	9.7	30.4	29.6	186.8
Colorado	23.1	71.8	139.5	151.2	209.6
Idaho	81.6	84.3	122.3	170.0	339.3
Montana	39.2	77.4	40.6	111.7	249.5
Nevada	0.0	1.4	0.8	1.2	2.6
New Mexico	0.0	0.0	0.0	0.0	3.8
Oregon	65.5	46.2	43.6	76.3	182.3
South Dakota	10.0	19.0	13.9	102.2	102.9
Utah	4.5	3.7	2.2	17.3	26.7
Washington	30.3	65.0	63.1	134.8	173.1
Wyoming	2.5	6.2	9.5	55.0	88.0
<b>Total</b>	<b>290.9</b>	<b>384.7</b>	<b>465.9</b>	<b>849.3</b>	<b>1,564.6</b>

Mountain Pine Beetle Outbreaks, 1979-2002



## Insect Conditions Highlights

### Spruce budworm

*Choristoneura fumiferana* is a native insect found in northern New England, New York, Pennsylvania, the Great Lakes Region, and Alaska. Balsam fir is the preferred host, but the insect also feeds on white, red, and black spruce. Topkill and tree mortality may result from budworm feeding. Outbreaks generally begin in extensive and continuous areas of mature and overmature balsam fir.

Populations of spruce budworm in 2002 were all low in the Eastern States. However, defoliation was noticeable in three Minnesota counties, the Upper Peninsula of Michigan, and on national forest land in Wisconsin. Damage by this insect appears to be dramatically increasing in Minnesota from 18,900 acres infested in 2001 to over 80,300 acres in 2002.

### Eastern Counties Where Spruce Budworm Defoliation Was Reported, 2002





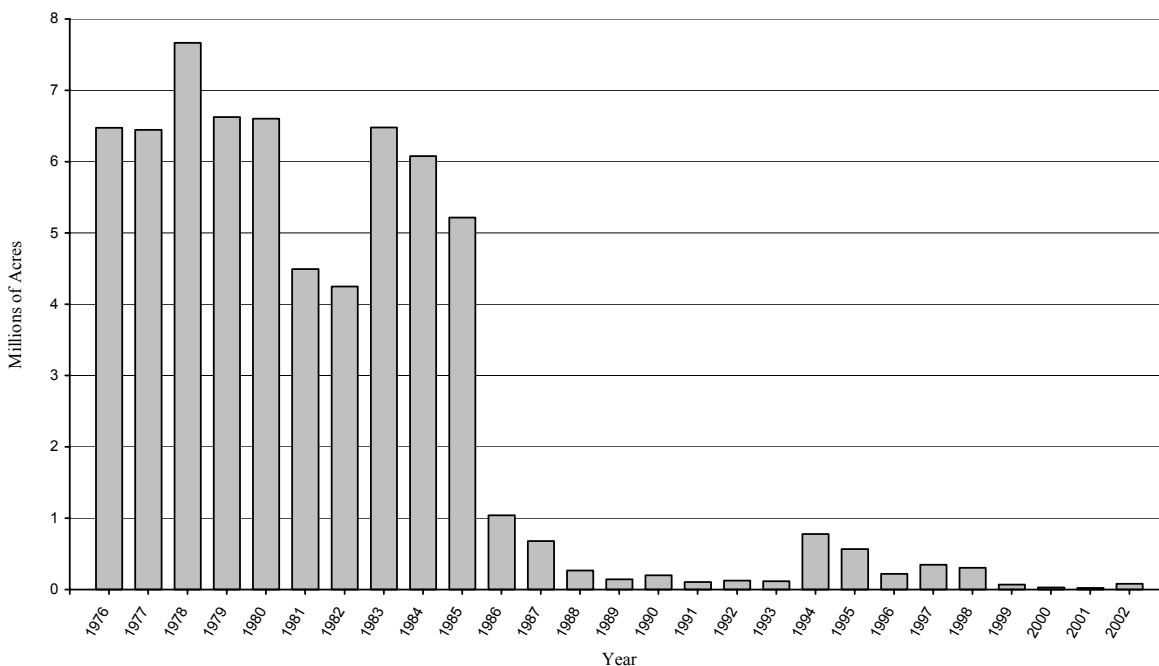
### Acres (in thousands) of Aerially Detected Spruce Budworm Defoliation in the Eastern United States, 1998-2002

State	1998	1999	2000	2001	2002
Maine	0.0	0.0	0.0	0.0	0.0
Michigan	33.0	0.0	0.0	3.3	0.5
Minnesota	256.4	70.0	28.5	18.9	80.3
New Hampshire	0.0	0.0	0.0	0.0	0.0
New York	0.0	0.0	0.0	0.0	0.0
Pennsylvania	0.0	0.0	0.0	0.0	0.0
Vermont	0.0	0.0	0.0	0.0	0.0
Wisconsin	16.1	0.0	0.0	0.8	0.4
<b>Total</b>	<b>305.5</b>	<b>70.0</b>	<b>28.5</b>	<b>23.0</b>	<b>81.2</b>

### Acres (in thousands) of Aerially Detected Spruce Budworm Defoliation in Alaska, 1998-2002

State	1998	1999	2000	2001	2002
Alaska	87.8	0.7	0.0	0.0	0.0

### Spruce Budworm Defoliation in the Eastern United States, 1976-2002



## Insect Conditions Highlights

### Western spruce budworm

*Choristoneura occidentalis* is a native insect occurring in the Rocky Mountains from Arizona and New Mexico north to Idaho and Montana and also in Washington and Oregon. The insect causes topkill, growth loss, and some tree mortality. The budworm feeds primarily on Douglas-fir and true firs.

Many of the Western States had minimal impacts from low population levels of western spruce budworm. Overall, acres of defoliation were down from 783,700 acres in 2001 to 617,200 acres in 2002. However, Colorado, Idaho, and Montana reported seeing increases in acres with budworm defoliation. With much of the West experiencing warm and drier weather conditions, western spruce budworm populations are expected to increase.

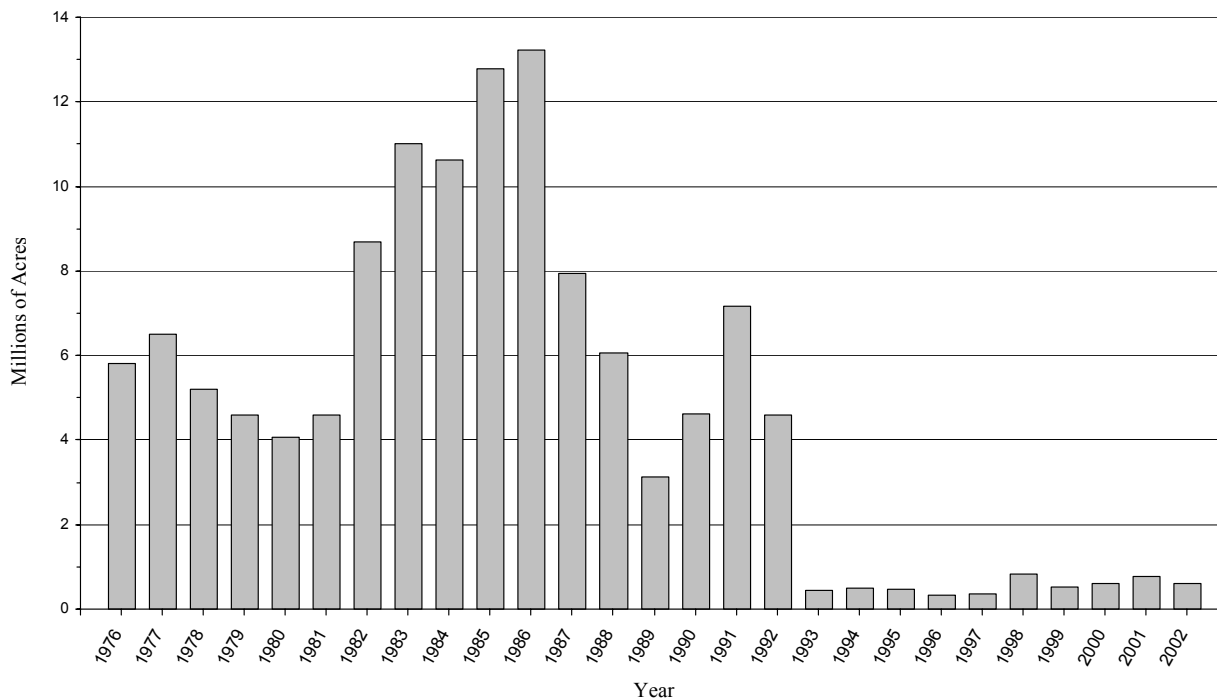
### Western Spruce Budworm Defoliation Areas, 2002



### Acres (in thousands) of Aerially Detected Western Spruce Budworm Defoliation, 1998-2002

State	1998	1999	2000	2001	2002
Arizona	10.1	10.2	25.8	14.1	11.3
California	0.0	0.0	0.0	0.0	0.0
Colorado	15.8	41.0	20.6	35.8	131.1
Idaho	0.0	3.6	4.4	4.2	22.6
Montana	0.0	0.0	0.4	1.2	52.4
New Mexico	310.5	282.6	165.0	445.3	198.8
Oregon	0.0	0.0	0.9	0.2	1.9
Utah	19.9	1.2	16.7	10.2	7.0
Washington	486.8	189.7	383.7	271.9	57.5
Wyoming	0.0	0.6	0.8	0.8	134.6
<b>Total</b>	<b>843.1</b>	<b>528.9</b>	<b>618.3</b>	<b>783.7</b>	<b>617.2</b>

### Aerially Detected Western Spruce Budworm Defoliation, 1976-2002



## Hemlock woolly adelgid

*Adelges tsugae* was introduced into the east coast near Richmond, Virginia, in 1950. The adelgid poses a serious threat to eastern hemlock and Carolina hemlock; tree mortality usually occurs 3 to 5 years after attack. By the early 1990s, the adelgid had spread into 11 States from North Carolina to Massachusetts, causing extensive hemlock decline and tree mortality. The adelgid continues to spread in the North with new townships and counties added to the list of those with

infested hemlock. The influence of northward-migrating songbirds helps in the spread of this insect to new sites in the Southeast. Shipments of infested hemlocks can be linked to other infestations in the North Eastern States.

The adelgid was introduced into the west coast from Asia in 1924 and is now found in British Columbia, Washington, Oregon, and California. The adelgid appears to be innocuous in the West as little damage is reported.

### Eastern Counties Where Hemlock Woolly Adelgid Was Reported, 2002



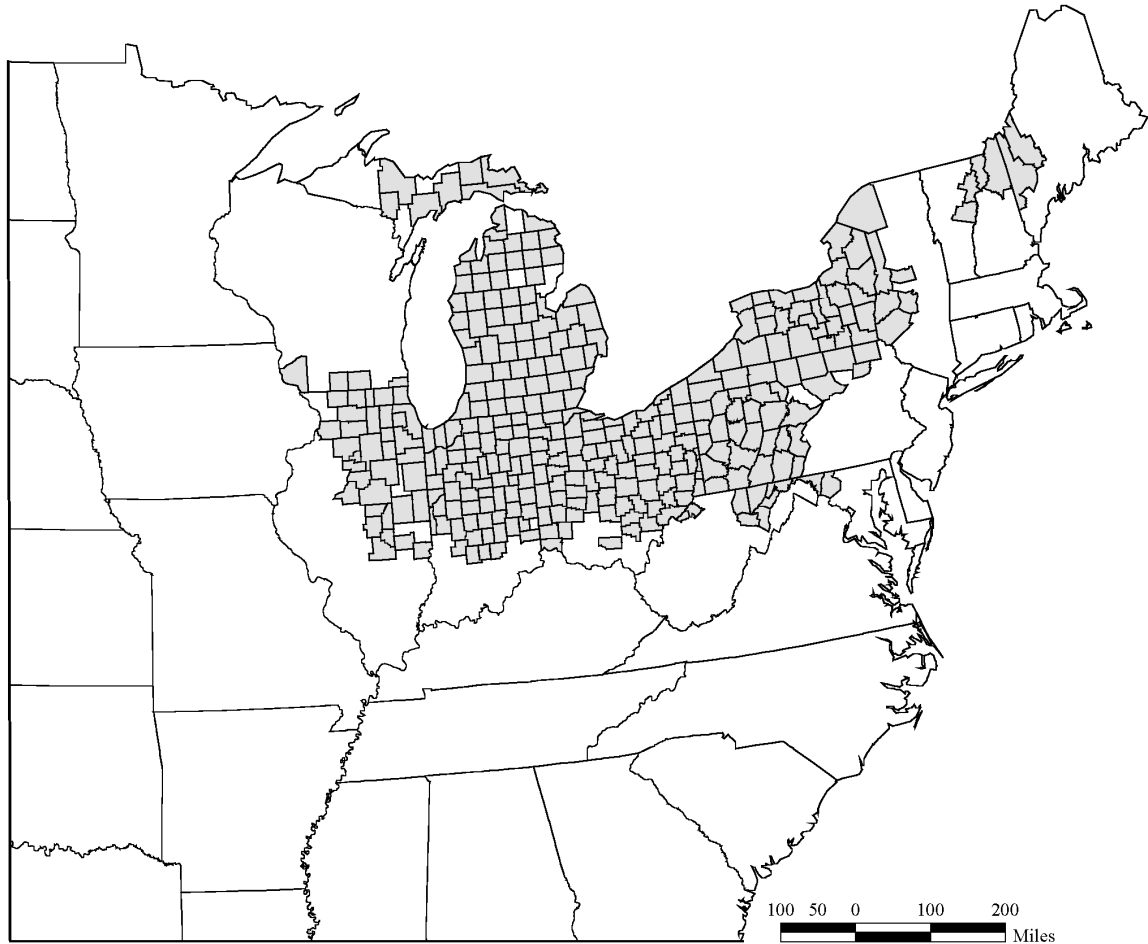
## Common European pine shoot beetle

*Tomicus piniperda* is an introduced insect discovered in a Christmas tree plantation near Cleveland, Ohio, in 1992. The beetle prefers Scotch pine, but feeds on other pines as well. The beetle damages weak and dying trees and feeds in the new growth (shoots) of

healthy trees. Thus far, the beetle is a problem mainly to Christmas tree growers. In its native Europe and Siberia, the beetle causes serious damage to trees in burned sites and areas experiencing severe drought.

State and Federal quarantines have been imposed to reduce the movement of this beetle, which was found in six States during 2002. .

## Eastern Counties Where The Common European Pine Shoot Beetle Was Reported, 2002



## Insect Conditions Highlights

### Spruce beetle

*Dendroctonus rufipennis* is a native insect that occurs across North America from Maine to Alaska and south in the Rocky Mountains to Arizona. Spruce beetle is the most significant mortality agent of mature spruce. Populations also build up in windthrown trees. Besides killing merchantable trees, infestations affect habitat quality for wildlife and fish, reduce scenic quality, and increase fire hazard.

Spruce beetle activity decreased in Alaska to normal, endemic population levels. Outbreaks continue in a few forests in Arizona, Colorado, Montana, Utah, and Wyoming. Throughout much of the West, weather conditions in 2002 were conducive to increases in spruce beetle. Mild winters and warm dry summers have created a situation that has allowed the various populations to significantly increase.

### Spruce Beetle Active and Newly Infested Areas in Alaska, 2002



## Disease Conditions Highlights

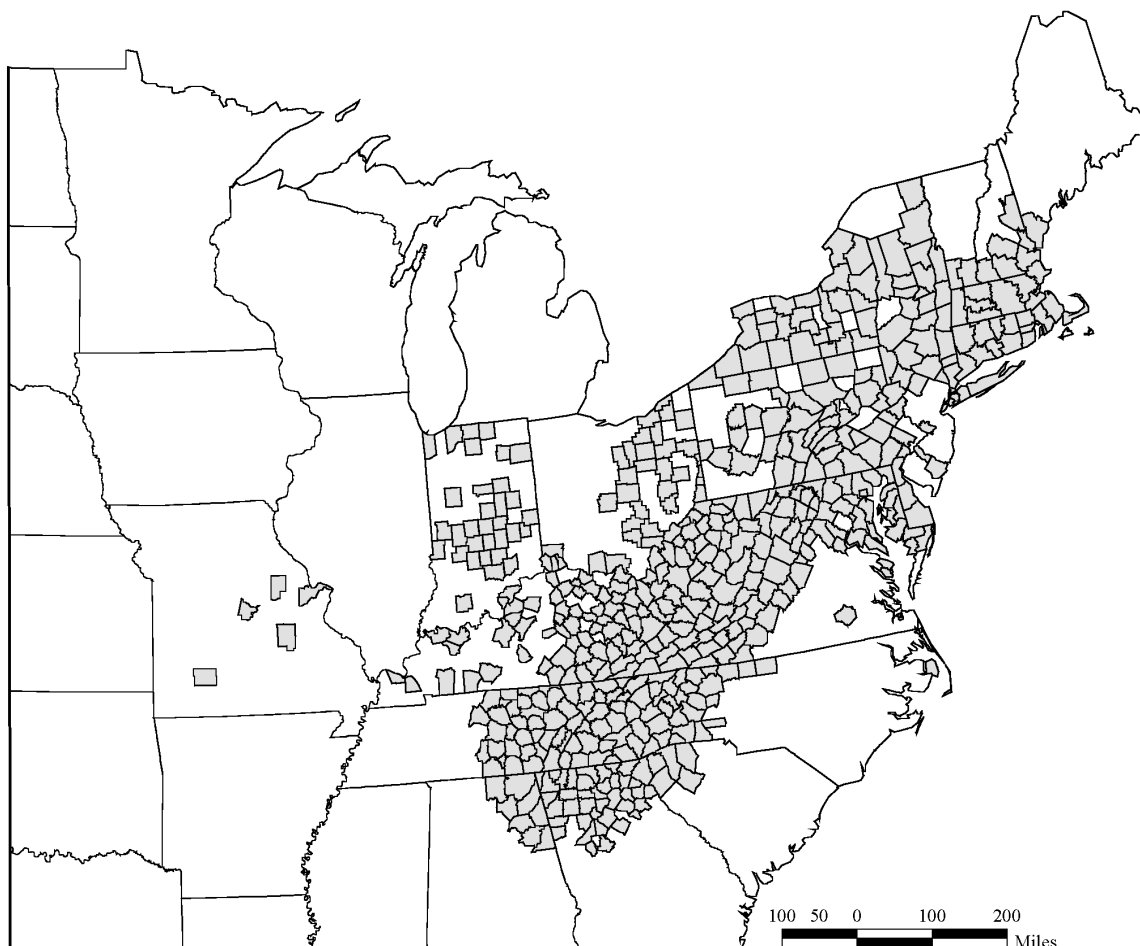
### Dogwood anthracnose

*Discula destructiva*, the fungus that causes dogwood anthracnose, is of unknown origin. First discovered in the Pacific Northwest in 1976, the disease is confirmed in Idaho, Oregon, and Washington. Although the Pacific dogwood is more susceptible to the fungus than the eastern dogwood, drier summers in the West reduce the number of infection cycles. Significant mortality has occurred, but the problem is not as severe as it is in the East.

In the East, the fungus was first found in southeastern New York in 1978. By 1994, this disease was found in 22 States from Maine to Georgia and west to Indiana and Missouri. The range of dogwood extends from southern Maine to Florida and west to Michigan and eastern Texas.

Dogwood anthracnose continues to intensify at the disease front within the infested counties in the South, although in areas long infested, mortality has declined with the decrease in susceptible host. In the Northeast, diseased dogwoods have been found in every county in Maryland, West Virginia, and Delaware. New infestations have been reported in Michigan.

### Eastern Counties Where Dogwood Anthracnose Was Reported, 2002



## Beech bark disease

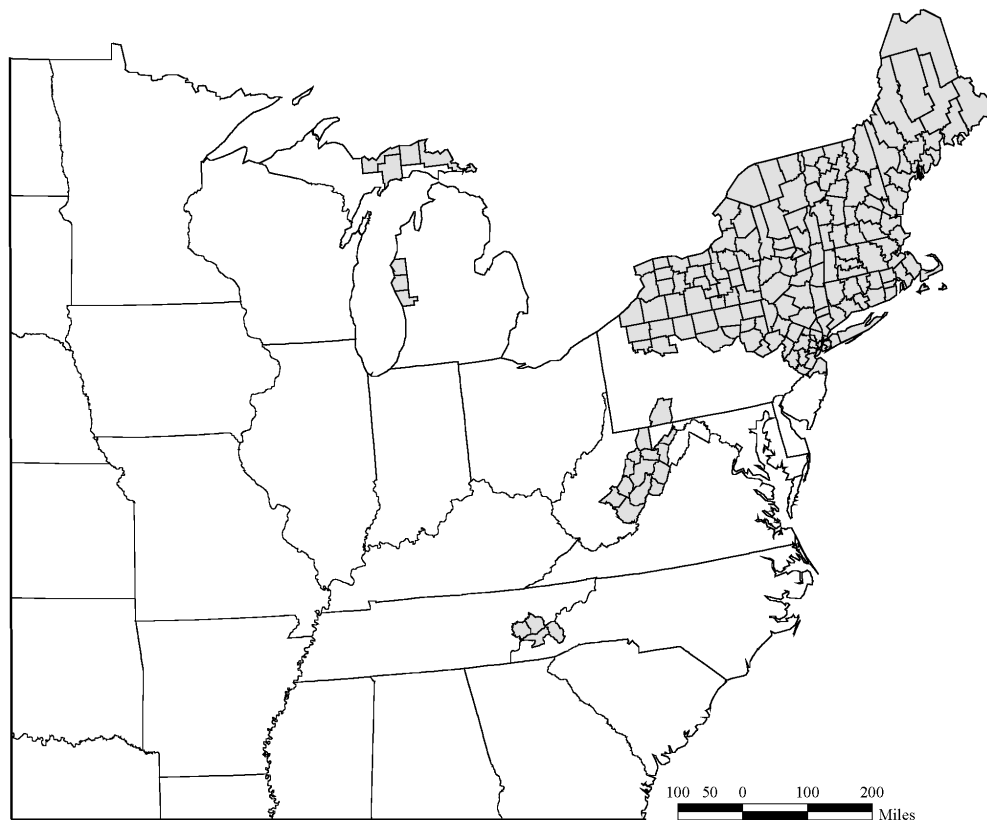
Beech bark disease is caused by the interaction of the beech scale, *Cryptococcus fagisuga* and one or more fungi in the genus *Nectria*. The scale insect creates wounds in the tree that are colonized by fungi such as *Nectria coccinea* var. *faginata*. The scale, and probably the fungus, was accidentally brought to Nova Scotia, Canada, in about 1890. Native fungi, *Nectria galligena* and *Nectria ochroleuca*, can also invade wounds caused by the scale, inciting the disease. By 1932, the disease was killing trees in Maine. It continued to advance south and west into northeastern Pennsylvania.

In 1981, a large area of infested American beech was found in West Virginia, well ahead of the advancing front of the disease. In 2002, the killing front encompassed 1.2 million acres in portions of 12 counties of West Virginia. In 1994, the disease was found affecting approximately 100 acres in three

counties on the North Carolina-Tennessee border (within the Great Smoky Mountains National Park). This infestation was about 300 miles southwest of its previously known distribution. In 2002, mortality continued to intensify, and was spreading downslope toward the Cherokee National Forest. In 2000, the scale was found in Michigan, more than 200 miles from its nearest previously known location in northeastern Ohio. Both *Nectria galligena* and *Nectria coccinea* var. *faginata* have been found in Michigan, causing disease and killing an estimated 7.5 million beech trees. Although the scale has been present in Ohio for some time, the disease, which requires both the scale and the presence of the canker-causing *Nectria* fungi, has not yet been identified in Ohio.

Tree mortality continues within affected areas, and at a greater rate than predicted. The range of American beech extends from Maine to northwest Florida, and west to eastern parts of Wisconsin and Texas.

## Eastern Counties Where Beech Bark Disease Was Reported, 2002





## Butternut canker

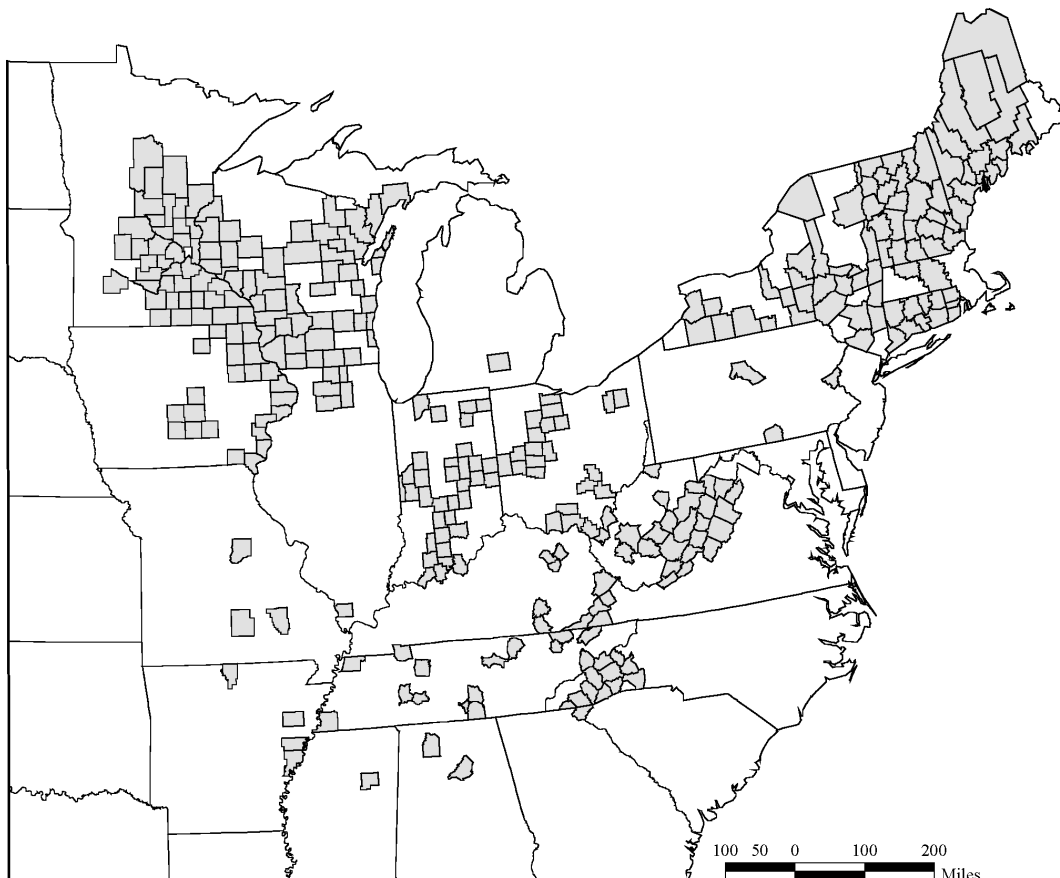
Butternut canker is caused by the fungal pathogen *Sirococcus clavigignenti-juglandacearum*. The origin of the pathogen is unknown, but because of its severe impact on butternut, it is likely that it was introduced into North America. Symptoms of the disease were recognized and reported in 1967 in Wisconsin, but the causal fungus was not identified until the late 1970s. The native range of butternut extends from Maine to Georgia and west to Minnesota and Arkansas. Butternut is usually found scattered in a variety of cover types, and is not abundant in any part of its range.

The disease is found throughout the range of butternut, and is a serious threat to the survival of the species. The pathogen kills large trees, saplings, and

regeneration, causing multiple cankers under the bark that merge and girdle the tree. It is estimated that 77 percent of the butternut trees in North Carolina and Virginia have been killed and in the northeastern area most of the monitored trees are infected. Trees that appear to exhibit resistance to the disease have been found in most States where the trees grow. Many of these trees are being propagated for host resistance studies.

Several States have implemented harvesting guidelines or moratoriums in an attempt to preserve genetic variability in the species and to ensure that potentially resistant trees are not removed. There are no viable control measures for this disease.

### Eastern Counties Where Butternut Canker Was Reported, 2002



## Sudden oak death

Sudden oak death is a recently recognized disease that is killing oaks and at least 20 other plant species. First reported in 1995, the disease has been confirmed in 12 coastal counties north and south of San Francisco, and 1 county in southwestern Oregon. The pathogen responsible for the disease, a fungus-like organism called *Phytophthora ramorum*, is also found in the European Union, where it is causing a recently identified disease on rhododendron and viburnum nursery stock.

On oaks, *P. ramorum* is a bark pathogen. It causes necrotic, often girdling cankers that can lead to mortality on tanoak, coast live oak, California black oak, and Shreve oak. The pathogen also causes leaf spots and/or twig dieback on California bay laurel, rhododendron, big leaf maple, coast redwood, Douglas fir, Pacific madrone, huckleberry, California buckeye, manzanita, toyon, California honeysuckle and California coffeeberry. Under moist conditions, the pathogen sporulates profusely on tanoak, bay, rhododendron, and other species so these “foliar” hosts serve as important reservoirs of inoculum.

The disease is widespread in coastal California and is found commonly in two forest types: in the understory of coast redwood (*Sequoia sempervirens*)

forests on tanoak and in coastal evergreen forests on oaks, madrone (*Arbutus menziesii*), California bay laurel, and other species. In California, sudden oak death has been confirmed in scattered locations along the Pacific coast in Monterey County north into Humboldt County. All confirmations are within 50 miles of the Pacific Coast. Marin and Santa Cruz Counties are heavily infested and dead and dying trees are common in the wildland/urban interface in backyards, parks, and open space greenbelts. Special aerial and ground surveys conducted by the USDA Forest Service and Oregon Department of Forestry in July 2001 detected the pathogen on approximately 40 acres in coastal southern Oregon, just north of the California border. A cooperative program involving State and Federal agencies, as well as private landowners, was undertaken to rapidly eradicate *Phytophthora ramorum* from the known infested sites in Oregon. The surrounding area was intensively monitored in 2002. A few small infection foci were identified and eradicated within the quarantine zone. No infections were observed outside the quarantined area in Oregon. Since sudden oak death is still a rather new forest disease, there remains much to learn about its host preferences and distribution.

More information on this disease may be found at [www.na.fs.fed.us/SOD](http://www.na.fs.fed.us/SOD) or [www.suddenoakdeath.org](http://www.suddenoakdeath.org).

## Counties Where Sudden Oak Death Was Reported, 2002



Table of Known Hosts of *Phytophthora ramorum* in the United States, 2002

Common name	Scientific name
big leaf maple	<i>Acer macrophyllum</i>
California bay laurel	<i>Umbellularia californica</i>
California black oak	<i>Quercus kelloggii</i>
California buckeye	<i>Aeculus californica</i>
California coffeeberry	<i>Rhamnus californica</i>
California hazelnut	<i>Corylus cornuta, var. californica</i>
California honeysuckle	<i>Lonicera hispidula</i>
canyon live oak	<i>Quercus chrysolepis</i>
casacara	<i>Rhamnus purshiana</i>
coast live oak	<i>Quercus agrifolia</i>
coast redwood	<i>Sequoia sempervirens</i>
Douglas-fir	<i>Pseudotsuga menziesii</i>
huckleberry	<i>Vaccinium ovatum</i>
Japanese pieris	<i>Pieris japonica</i>
madrone	<i>Arbutus menzeisii</i>
manzanita	<i>Arctostaphylos manzanita</i>
poison oak	<i>Toxicodendron diversilobum</i>
rhododendron	<i>Rhododendron spp.</i>
salmon berry	<i>Rhus spectabilis</i>
Shreve oak	<i>Quercus parvula, var. shrevei</i>
tanoak	<i>Lithocarpus densiflorus</i>
toyon	<i>Heteromeles arbutifolia</i>
Victorian box	<i>Pittosporum undulatum</i>
western starflower	<i>Trientalis latifolia</i>

The pathogen has also been recovered from arrow wood (*Viburnum*) in Germany and the Netherlands.

Disease Conditions Highlights

**Fusiform rust**

*Cronartium quercuum f. sp. fusiforme*, a native fungus, continues to be the most damaging disease agent of loblolly and slash pines in the South. The disease disfigures and kills trees up to pole size and results in much stem breakage. The disease is damaging in both plantations and natural stands.

An estimated 13.9 million acres of pines are affected. Acres are classified as affected if more than 10 percent of the trees have potentially lethal cankers. Georgia has the greatest amount of the disease, with 4.6 million acres (49 percent) of the host type affected. Genetic selection of resistant planting stock is leading to significant improvement in field survival and stand quality.

Acres (in thousands) Affected by Fusiform Rust, 2002\*

State (survey year)	National Forest System	Other Federal	State and Private	Total
Alabama (90)	7.1	0.0	1,704.2	1,711.3
Arkansas (95)	4.9	0.0	280.5	285.4
Florida (95)	35.3	6.8	1,426.3	1,468.4
Georgia (89)	38.0	102.8	4,452.9	4,593.7
Louisiana (91)	85.0	18.4	1,554.9	1,658.3
Mississippi (94)	118.0	60.0	1,043.0	1,221.0
North Carolina (90)	4.9	7.8	956.2	968.9
Oklahoma (93)	0.0	0.0	33.9	33.9
South Carolina (95)	46.0	59.0	1,332.2	1,437.2
Texas (92)	21.8	0.0	397.3	419.1
Virginia (92)	0.0	0.0	59.3	59.3
<b>Total</b>	<b>361.0</b>	<b>254.8</b>	<b>13,240.7</b>	<b>13,856.5</b>

\* Acres with greater than 10 percent infection.

## Dwarf mistletoes

*Arceuthobium* spp. are parasitic plants that infect the aerial portions of host trees. They affect most conifer species in the West and spruces in the Northeast, causing branch distortions, reduced stem growth, and decreased longevity. Infection by these native plants is generally considered to be the most widespread and economically damaging tree disease in the West. Dwarf mistletoe infection does appear to benefit some wildlife species.

Commercial trees most affected include Douglas-fir, lodgepole pine, true fir, western hemlock, western larch, and ponderosa pine. Dwarf mistletoes are usually host-specific and have patchy distributions within stands and across larger landscapes. Over 28 million acres of western forests have some level of infection. Losses are estimated at around 164 million cubic feet of wood annually.

Dwarf mistletoes are amenable to cultural treatments, although infected areas are often more difficult to manage than uninfected areas. The overall incidence and severity of this disease are thought to have increased over the past century due to fire suppression.

### Acres (in thousands) in the West Affected by Dwarf Mistletoes, 2002

State (survey year)	National Forest System	Other Federal	State and Private	Total
Alaska*	3,060.0	0.0	340.0	3,400.0
Arizona (85-89)	1,040.0	674.0	25.0	1,739.0
California (80-90)	2,283.0	69.0	1,911.0	4,263.0
Colorado (96)	638.0			638.0
Idaho - North (70-80)**	478.0	10.0	244.0	732.0
Idaho - South (94)**	2,600.0			2,600.0
Montana (70-80)	1,694.0	123.0	600.0	2,417.0
New Mexico (97)	1,140.0	348.0	581.0	2,069.0
Nevada (94)	49.0			49.0
Oregon (67)	1,137.0	43.0	2,760.0	3,940.0
Utah (94)	410.0			410.0
Washington (97)	2,703.3	505.0	2,470.0	5,678.3
Wyoming (97)	560.1			560.1
<b>Total</b>	<b>17,792.4</b>	<b>1,772.0</b>	<b>8,931.0</b>	<b>28,495.4</b>

\* Commercial acreage only in Alaska.

\*\* Idaho-North is in Region 1, and Idaho-South is in Region 4.



## **Part 2: Conditions by Damage Agent by Region**

## **Insects: Native**

### **Aspen leaf blotch miner, *Phyllocnistis populiella***

Region 10: Alaska

Host(s): Aspen, balsam poplar, black cottonwood, birch, alder

Populations of the aspen leaf blotch miner increased explosively from 2,300 acres of activity in 2001, to 300,000 acres in 2002. The vast majority of this activity, 271,000 acres, is located between the Yukon and Porcupine Rivers in northeastern Alaska. More than two-thirds of this activity occurred within the Yukon Flats National Wildlife Refuge. The remaining one-third affects stands located on native corporation lands. Another 20,000 acres of moderate to severe activity was mapped near Delta Junction, approximately 80 air miles southeast of Fairbanks, and occurs primarily on State and private lands.

### **Bagworm moth, *Thyridopteryx ephemeraeformis***

Region 9/Northeastern Area: West Virginia

Host(s): Black locust, boxelder, miscellaneous conifers

In West Virginia, light populations were reported on boxelder, black locust, and miscellaneous conifers statewide. This pest, which may cause significant damage to the Christmas tree and wreath industries, was not very abundant throughout Maine in 2002. Control projects were not necessary on most Christmas tree farms and uncultivated balsam used in the wreath industry appeared to have received very little damage as a result of larval activities of this insect. There was no indication the status of this pest will increase in 2003. Damage in Vermont was light statewide.

### **Baldcypress leaf roller, *Archips goyerana***

Region 8: Louisiana

Host(s): Baldcypress

In 2002, 153,000 acres of mixed baldcypress stands in southern and southeastern Louisiana were defoliated by the baldcypress leaf roller. Approximately 56,000 acres were severely (greater than 50 percent) defoliated. The primary impact of this defoliation is loss of radial growth, although dieback and scattered mortality occurred in some areas in Assumption, St. James, and St. Martin Parishes. Permanently flooded areas are most severely impacted.



**Balsam shoot boring sawfly,**  
*Pleroneura brunneicornis*

Region 9/Northeastern Area: Maine, Vermont

Host(s): Balsam fir, Fraser fir

No survey was conducted on this insect in Maine in 2002, but reports of damage in Christmas tree plantations were few. Damage in native stands was spotty and generally light. Occasional light damage occurred on Christmas trees in northern Vermont.

**Balsam twig aphid,**  
*Pleroneura brunneicornis*

Region 9/Northeastern Area: Maine, New York, Vermont

Host(s): Balsam fir

In Maine, population levels of this insect were down with trace to light damage being reported in forest stands. Damage was not expected to significantly impact wreath brush harvest. Balsam twig aphid caused some minor damage to balsam fir foliage in central New York. Occasional damage on Christmas trees was reported in northern Vermont.

**Birch leaf roller,**  
*Epinotia solandriana*

Region 10: Alaska

Host(s): Paper birch, willow, alder, aspen, black cottonwood

The most common leaf roller on birch, *Epinotia solandriana*, is a recurrent problem in south-central and interior Alaska. The year 2002 marked the first year since the late 1970s that this insect has been observed in more than endemic conditions. Birch leaf roller activity was identified on 53,000 acres in 2002. Within the Wood River-Tikchik Lakes State Park, 31,000 acres of severe birch defoliation was mapped. Nearly 100 percent of the birch were 90-100 percent defoliated. A further 15,000 acres were identified as occurring on native corporation and State lands 40 miles northwest of Anchorage in the Mt. Susitna area. Historically, these Alaskan outbreaks persist for several years before succumbing to parasites, predators, disease, or adverse weather. Severe and repeated defoliation by this leaf roller is required to kill birch. Generally, defoliation results in minor growth loss or occasional branch dieback.

**Black turpentine beetle,**  
*Dendroctonus terebrans*

Region 8: Regionwide

Host(s): Loblolly pine, longleaf pine, slash pine, shortleaf pine

Because of the drought, there was a high incidence of black turpentine beetle (BTB) activity in 2002, especially in parts of the extreme Southeast. Tennessee reported high populations in both western and eastern areas, especially in the southern portion of the Appalachian Mountains. BTB activity increased slightly in Mississippi, while in Texas activity remained low.

Insects: Native

**Buck moth,**  
*Hemileuca maia*

Region 8: Louisiana

Host(s): Live oak, other hardwoods

Buck moth defoliation of live oak has been a problem in New Orleans for several years. The moth continues to be locally abundant in the city and of particular concern in the Federal Historic Districts. The insect population was found to be decreasing in 2002; pheromone trapping recovered only 0.9 moths per trap in 2002 as compared to 1.3 in 2001.

**California budworm,**  
*Choristoneura carnana californica*

Region 5: California

Host(s): Douglas-fir

Defoliation was not readily apparent in an area of previously chronic presence on the east side of Trinity Lake.

**California flatheaded borer,**  
*Melanophla californica*

Region 5: California

Host(s): Jeffrey pine, ponderosa pine

The California flatheaded borer was part of the complex of drought, bark beetles, root disease, and dwarf mistletoe responsible for widespread pine mortality in southern California.

**Cedar bark beetles,**  
*Phloeosinus spp.*

Region 5: California

Host(s): Incense-cedar

Cedar bark beetles caused branch dieback and mortality of small cedars on portions of the Eagle Lake Ranger District, Lassen National Forest.

**Common oak moth,**  
*Phoberia atomaris*

Region 9/Northeastern Area: Ohio

Host(s): White oak

In Ross County, Ohio, about 8,600 acres of white oaks were severely defoliated in June.

**Douglas-fir beetle,**  
*Dendroctonus pseudotsugae*

Region 1: Idaho, Montana

Host(s): Douglas-fir

Douglas-fir beetle (DFB) populations continued a gradual decline in northern Idaho and parts of northwestern Montana, although populations are still high in many areas and are increasing somewhat in southwestern Montana. Beetle populations are still high on forests that had significant acreages affected by fire in 2000. Fire-affected Douglas-fir stands on the Bitterroot and Helena National Forests were heavily infested, where ground surveys in 2002 showed higher numbers of new attacks than in 2001. In other areas, beetle populations remained high because environmental conditions were so favorable. Despite more moisture in some parts of the region, much of Montana entered a fifth consecutive year of near-drought conditions. Throughout the region, more than 200,500 acres were infested by Douglas-fir beetle in 2001. Those figures were reduced by more than half in 2002—to just under 97,000 acres. In western Montana, the infested area has declined to just over 60,200 acres; while the area affected by DFB in northern Idaho has declined to approximately 36,500 acres. The Idaho Panhandle National Forests still had many acres containing beetle-killed trees, but few areas were found with current activity. Similar conditions were found on the Clearwater and Nez Perce National Forests. Although the Bitterroot National Forest had some of the more active beetle populations in the region the infested area still declined to about 12,000 acres, although a large portion of the forest, that lies within a wilderness area, was not flown in 2002. The Kootenai, Lolo, Flathead, and Helena National Forests in Montana also had many beetle-infested areas; but the more northerly forests had fewer active outbreaks. Many areas in northern Idaho and western Montana forested by mature Douglas-fir stands still harbored some level of DFB-caused mortality. Regionwide, more than 520,000 beetle-killed Douglas-fir have been recorded within the past 2 years.

Region 2: Colorado, Wyoming

Host(s): Douglas-fir

DFB activity was low along the Front Range of Colorado and in the previous outbreak of the 1996 Buffalo Creek wildfire area. Forest health workers anticipate increases of Douglas-fir beetle activity in 2003 in many areas of the Arapaho-Roosevelt, Pike-San Isabel, San Juan, and White River National Forests from the 2002 wildfires that burned in Douglas-fir forest type.

Significant Douglas-fir mortality is occurring throughout river corridors on the Shoshone National Forest. Significant mortality is occurring throughout the North and South Forks of the Shoshone River. Impacts are being felt as trees die in campgrounds, around summer cabins and resorts, and other scenic corridors. There is also a growing concern over fire hazard with the accumulation of dead trees in these areas. DFB is also on the increase on the southern end of the Shoshone National Forest near Dubois.

The western and eastern fronts of the Bighorn Mountains are experiencing outbreaks of DFB. On the western side populations have increased in both Shell and Tensleep Canyons.

Insects: Native

Region 3: Arizona, New Mexico

Host(s): Douglas-fir

DFB mortality in the Southwest decreased from 3,125 acres in 2001 to 2,500 acres in 2002. In Arizona, DFB mortality was recorded on the Apache-Sitgreaves (575 acres), Coconino (915 acres), Kaibab (565 acres), and Tonto (25 acres) National Forests; Fort Apache (10 acres) and San Carlos (35 acres) Indian Reservations; and on State land (5 acres). In New Mexico, DFB-caused tree mortality was detected on the Carson (90 acres), Gila (40 acres), Lincoln (10 acres), and Santa Fe (175 acres) National Forests and Santa Clara Pueblo (10 acres) and Taos Pueblo (45 acres) tribal lands.

Region 4: Idaho, Utah, Wyoming

Host(s): Douglas-fir

According to aerial survey data, DFB-caused tree mortality remained static across the region. The acres for 2002 are underestimated because Idaho and Utah were only partially surveyed due to the extreme fire season. Approximately 29,700 acres were affected: 18,800 in southern Idaho; 5,700 in Utah; and, 5,200 in western Wyoming. The largest concentrations of mortality were located on the Targhee National Forest in southern Idaho (9,800 acres) and the Bridger-Teton National Forest in Wyoming (3,690 acres). Nearly all national forests, however, had some level of beetle-caused mortality due to continued drought conditions.

Region 6: Oregon, Washington

Host(s): Douglas-fir

DFB activity was detected on slightly fewer acres regionwide, but at nearly half the intensity compared with 2001 levels. Activity was reported on 142,035 acres with an average of 1.49 trees per acre in 2002 compared with 147,123 acres with an average of 2.73 trees per acre in 2001. In Oregon, mapped acres nearly doubled from 26,970 acres in 2001 to 50,693 acres in 2002, however intensities were nearly the same as last year at an estimated 1.28 trees per acre. Significance decreases occurred on all ownerships except private lands in Washington and Oregon, which had significant increases in reported mortality. Those areas with greater than 10,000 acres include the Wallowa-Whitman (29,419), Wenatchee (12,643), and Colville (23,204 National Forests, the Yakama Indian Reservation (10,581), and the Glenwood reporting area (10,903). Areas with the most significant increases from 2001 levels include Federal and private lands within the Umatilla and Wallowa-Whitman reporting areas and private lands within the Glenwood reporting area. Predisposing tree stresses caused by repeated years of defoliation by western spruce budworm, Douglas-fir tussock moth, overstocking, and drought conditions may result in relatively high levels of DFB activity in the next few years.

## **Douglas-fir engraver beetle, *Scolytus unispinosus***

Region 5: California

Host(s): Douglas-fir

A rare outbreak of this engraver occurred in the Concow area of Butte County; both top-kill and tree mortality were observed, mostly in widely dispersed, pole-size trees. Branch dieback and top kill were observed in the Moonlight Valley and Hamilton Mountain areas of the Eagle Lake Ranger District, Lassen National Forest.

## **Douglas-fir tussock moth,** *Orgyia pseudotsugata*

Region 1: Idaho, Montana

Host(s): Douglas-fir, true firs

In northern Idaho about 5,400 acres were defoliated on the Palouse Ranger District of the Clearwater National Forest and adjacent State, private, and reservation lands. This is down from about 142,000 acres defoliated in northern Idaho in 2001. In the spring of 2002, the Idaho Department of Lands conducted an aerial spray project in which 30,107 acres on private, State, and Coeur d'Alene tribal lands were treated with Dimilin. Defoliation did not occur in the sprayed areas. Egg mass surveys indicate populations are declining rapidly. No defoliation is expected in 2003. In Montana, 52 acres of Douglas fir tussock moth (DFTM) defoliation was reported on the Flathead Indian Reservation.

Region 4: Idaho, Nevada

Host(s): Douglas-fir, true firs

Total acreage defoliated by DFTM in 2002 decreased. Acreage affected was over 2,100 compared to approximately 3,900 acres in 2001. In Idaho, tussock moth defoliation was found on over 1,300 acres of Bureau of Land Management and private lands. The outbreak in the Owyhee Mountains of southwestern Idaho appears to be over. In northeastern Nevada, over 800 acres were defoliated on most districts of the Humboldt-Toiyabe National Forest.

Region 5: California

Host(s): White fir

The number of moths trapped in the 2002 cooperative Douglas-fir tussock moth pheromone detection survey decreased for most plots compared to 2001. Data were collected for 168 plots in 2002; 162 plots (96 percent) had an average of less than 25 males per trap and the remaining 6 plots (4 percent) averaged more than 25 moths per trap. Plots that averaged more than 25 moths per trap were located on the following ranger districts: Placerville (Eldorado National Forest), Bass Lake (Sierra National Forest), and Nevada City (Tahoe National Forest). One plot in Yosemite National Park averaged more than 25 moths per trap. Significant activity by DFTM is not anticipated within the plot system area during 2003.

Region 6: Oregon, Washington

Host(s): Douglas-fir, true firs

The DFTM outbreak, which began in 1999, continued into 2002. During the 2002 aerial detection survey, approximately 16,650 acres of defoliation were mapped, compared to 52,841 acres in 2001, and 219,774 acres in 2000. Most (98 percent) of the 16,650 acres of defoliation in 2002 occurred on the Umatilla and Wallowa-Whitman reporting areas. Mapped intensities varied from 12,329 acres in the light category to 4,211 acres in moderate and only 115 acres in the heavy category. The 290-acre outbreak detected on Tekoa Mountain in northeast Washington in 2001 subsided with only 47 acres of defoliation visible to aerial surveyors in 2002.

Monitoring was continued in 2002 on the areas of the Wallowa-Whitman and Umatilla National Forests that were treated with TM BioControl-1 in 2000. Defoliation, top-kill, and mortality were nearly absent. All tree mortality was caused by a combination of defoliation by DFTM and fir engravers.

Monitoring on the Okanogan National Forest continued in 2002 on the evaluation plots that were established prior to treatment with TM-BioControl-1 in 2001. One year after treatment sampling of larval

Insects: Native

populations on treated and untreated plots suggests that the DFTM population crashed in 2002 due to natural causes. Defoliation, top-kill, and tree mortality were nearly absent in 2002.

The Douglas-fir Tussock Moth Early Warning System confirms that populations continued to decline in 2002. Trap catches dropped to endemic levels in most areas. Average number of moths trapped for the region decreased from approximately 6 moths per trap to 1 moth per trap. The highest trap catches occurred in south-central Oregon around the Fremont National Forest; however, these also represented a decline from an average of 14 moths per trap in 2001 to 6 moths per trap in 2002.

## **Eastern tent caterpillar, *Malacosoma americanum***

Region 9/Northeastern Area: Illinois, Maine, Maryland, Massachusetts, New Jersey, New York, Ohio, Vermont, West Virginia

Host(s): Black cherry, crabapple

In Maryland, eastern tent caterpillar caused localized defoliation statewide. In New Jersey, the insect caused extensive defoliation of wild cherry trees in Atlantic, Bergen, Burlington, Camden, Gloucester, Mercer, Monmouth, and Ocean Counties. In Ohio, cherry trees were much less affected in 2002 than in 2001. Only in Athens and Hocking Counties was defoliation noticeable. Light to moderate defoliation was observed over most of West Virginia. Nucleopolyhedrosis virus was reported primarily in the eastern panhandle counties. The southern third of Illinois sustained complete defoliation in April and May.

Defoliation was more noticeable in Maine in 2002 than it has been for several years, but numbers of adults appeared to drop. There was minimal damage in Massachusetts. High eastern tent caterpillar populations were very noticeable in southeastern New York, with some patchy, moderate defoliation observed. In Vermont, there was scattered light damage across the State.

## **Fall cankerworm, *Alsophila pometaria***

Region 9/Northeastern Area: Maine, Maryland, Massachusetts, West Virginia

Host(s): Maples, oaks, other hardwoods

In Maryland, over 1,300 acres were defoliated by the fall cankerworm in Prince Georges, Washington, Montgomery, Frederick, Carroll, and Howard Counties. In West Virginia, light populations existed in Preston County and heavy populations were found in Monongalia County. Larvae were found during surveys in Hardy, Grant, Mineral, and Hampshire Counties, but defoliation appeared minimal in these counties because of prior defoliation by gypsy moth.

Populations in northern Maine remained low in 2002, however, both larval and moth activity seemed to be increasing in oak stands in Lincoln County where defoliation has been heavy in past seasons. In some of these stands, oak leaf-tier/skeletonizer populations also seemed to increase in 2002. This complex plus gypsy moth has caused some branch and tree mortality in past outbreaks. In Massachusetts, 5,261 acres of defoliation was detected by aerial survey in Essex, Plymouth, and Norfolk Counties.

**Fall webworm,**  
*Hyphantria cunea*

Region 5: California

Host(s): Pacific madrone, Oregon ash

Defoliation of madrones in the Klamath River and Trinity River drainages by fall webworm was much lower than in recent years. However, dieback and mortality of madrones is becoming very evident in northwestern California from a combination of canker disease, drought, and defoliation by insects and leaf spot infections.

Region 9/Northeastern Area: Maine, Maryland, Massachusetts, New Hampshire, Pennsylvania, Rhode Island, Vermont, West Virginia

Host(s): Apple, ash, beech, birch, black cherry, cherry, elm, maple, other hardwoods

Fall webworm caterpillars continued to be less numerous than in previous years throughout the States of Maryland, Pennsylvania, and West Virginia. Only spotty and light populations were reported.

In Maine, populations dropped noticeably in 2002 and remained spotty. Although the species was again noticeable across much of southern and central Maine, damage did appear to be much lighter and infested pockets seemed to be more scattered. The highest activity was reported to be in Cumberland and York Counties. There was minimal damage in Massachusetts in 2002. Insect populations were very low throughout New Hampshire. Populations in Rhode Island declined in 2002 following a heavy infestation in 2001. Moderate defoliation occurred statewide. There was scattered light defoliation across Vermont.

**Fir engraver beetle,**  
*Scolytus ventralis*  
*Dryocoetes confusus*

Region 1: Idaho, Montana

Host(s): Grand fir

Fir engraver-caused mortality in grand fir stands increased significantly in northern Idaho and western Montana in 2002. The increased mortality may be related to the on-going droughty conditions found in much of the region. Total infested area exceeded 118,900 acres—up from slightly less than 15,000 acres in 2001. On those infested acres, more than 145,400 trees were killed in 2001 (recorded as faders in 2002). Most of the current mortality occurred in north Idaho, on lands of all ownerships, but concentrated in areas on and adjacent to the Clearwater, Nez Perce, and Idaho Panhandle National Forests. Lands on the Coeur d'Alene Indian Reservation were also severely impacted. In western Montana, most grand fir stands, or stands with a significant grand fir component, showed high amounts of beetle-caused mortality. Especially noticeable were stands on and adjacent to the Flathead National Forest. Moisture deficits continued throughout the region in 2002 and the winter of 2002-2003. Fir engraver populations will likely remain high until moisture conditions return to normal. Northern Idaho also has a high amount of root disease in many grand fir stands that increases susceptibility to fir engraver attack.

Region 3: Arizona, New Mexico

Host(s): White fir, subalpine fir

Tree mortality in the region increased considerably in 2002 to 13,725 vs. 7,385 acres in 2001. In Arizona, fir mortality was recorded on the Apache-Sitgreaves (3,420 acres), Coconino (4,560 acres), Coronado

Insects: Native

(585), Kaibab (80 acres), and Tonto (85 acres) National Forests; Grand Canyon National Park (5 acres); and Fort Apache (185 acres) and San Carlos (5 acres) Indian Reservations. In New Mexico, fir mortality was reported on the Carson (455 acres), Cibola (970 acres), Gila (410 acres), Lincoln (350 acres), and Santa Fe (1,655 acres) National Forests; Jicarilla Apache (160 acres), Mescalero Apache (20 acres), and Santa Clara Pueblo (320 acres) tribal lands; and on State and private lands (460 acres).

Region 4: California, Idaho, Nevada, Utah

Host(s): Grand fir, red fir, subalpine fir, white fir

Fir engraver beetle-caused tree mortality increased in California, Idaho, and Utah due to continued droughty conditions. Aerial surveys recorded approximately 14,600 trees on nearly 5,200 acres affected in 2002. This is an increase from only 7,300 trees on over 2,350 acres in 2001. Affected acreage for 2002 is underestimated since Idaho and Utah were only partially surveyed due to the extreme fire season. Fir mortality decreased in Nevada from nearly 16,400 trees killed over 4,800 acres in 2001 to 7,200 trees killed on over 2,600 acres in 2002. Areas most affected by this insect include the Ely Ranger District on the Humboldt-Toiyabe National Forest in Nevada (4,900 trees on 1,860 acres), the Payette National Forest in southwestern Idaho (2,300 trees on 1,240 acres), and the Manti LaSal National Forest in Utah (3,150 trees on 1,000 acres). Significant tree mortality caused by this insect was also observed on private land, 1,800 trees on 935 acres in southern Idaho and 1,600 trees on 450 acres in Utah.

Region 5: California

Host(s): White fir, red fir

White fir mortality and top-kill were common in the drought-stressed mixed conifer forests of the San Bernardino Mountains and the Peninsular Ranges of southern California. Although less common than in southern California, white fir mortality above 2001 rates was found from northeastern California forests to the southern tip of the Sierra Nevada Mountain Range.

Region 6: Oregon, Washington

Host(s): True firs

Fir engraver activity increased from 20,291 acres (1.75 trees per acre) mapped in 2001 to 161,229 acres (0.91 trees per acre) in 2002. Increases occurred across all ownerships throughout the region. Once again, the majority (56 percent) of mapped mortality occurred on USDA Forest Service lands. Approximately 12 percent of the mapped acres were on tribal lands and 24 percent were on private lands within the region. Most heavily affected areas include the Wallowa-Whitman (28,590 acres at 0.77 trees per acre), Umatilla (26,227 acres at 0.78 trees per acre), Wenatchee (19,175 acres at 0.73 trees per acre), and Colville (12,684 acres at 1.12 trees per acre) National Forests. Additionally, 16,403 acres (0.76 trees per acre) were mapped on the Yakama Indian Reservation (a four-fold increase from 2001). On private lands, highest levels of mortality were recorded on lands within the Umatilla, Wallowa-Whitman, Colville, Glenwood, and northeastern Washington reporting areas.

## **Flatheaded fir borer, *Melanophila drummondi***

Region 5: California

Host(s): Douglas-fir, western hemlock

Two years of drought contributed to an expansion of borer activity in some areas of northwestern California.



## **Forest tent caterpillar, *Malacosoma disstria***

Region 1: North Dakota

Host(s): Basswood, aspen, hardwoods

Forest tent caterpillar (FTC) defoliation in small pockets of basswood, aspen, and other hardwoods in eastern North Dakota has decreased over the last 2 years. However, defoliation of mostly aspen in the Turtle Mountains of north-central North Dakota increased from 3,045 acres in 2001 to 4,345 acres in 2002.

Region 8: Louisiana, North Carolina, South Carolina, Texas

Host(s): Tupelo gum, upland hardwoods

Defoliation of tupelo gum occurred on 153,000 acres of forested wetlands (baldecypress/water tupelo forest type) in Ascension, Livingston, St. James, and St. John Parishes in southeastern Louisiana. This defoliation was severe (50 percent) on 32,000 acres. This represents a slight increase in total defoliated acres from 2001, but the most severely defoliated acres remained nearly the same.

In Texas, an unusual outbreak covered about 125,000 acres in the lower Trinity, Neches, and Sabine River bottoms in April of 2002. Hosts were primarily sweetgum and oaks.

The South Carolina Forestry Commission reported FTC defoliation of about 30,000 acres in the Santee, Pee Dee, and Wacamaw River basins. Pure stands of gum suffered the worst defoliation, with up to 100 percent of foliage lost. Other bottomland hardwood species were also affected with some showing 50 percent or more of leaves eaten by the caterpillars.

North Carolina again noted that 50,000 acres were defoliated in the Roanoke River basin. However, because of early season defoliation, the trees were able to re-leaf, and little mortality was recorded.

Region 9/Northeastern Area: Illinois, Maine, Michigan, Minnesota, New Hampshire, New York, Ohio, Vermont, Wisconsin

Host(s): Aspen, basswood, pin oak, white oak, sweetgum, other hardwoods

In Ohio, individual trees and those in scattered pockets were defoliated in Jackson and Athens Counties. In West Virginia, moderate to heavy isolated populations of FTC was reported on 400 acres in Braxton County.

This was the fourth straight year of the current outbreak in the Lake States. Populations are expected to collapse in the coming year. Over 10 million acres total were defoliated in 2002, down from 15.5 million acres in 2001. About 2,000 acres of oak wood bottoms in southeastern Illinois were defoliated in 2002. High levels of virus activity were observed in larvae indicating a likely populations collapse in 2003.

No defoliation was reported in Maine in 2002, although larvae did appear to be more common. In New Hampshire, there was no defoliation reported and no moths caught in pheromone traps. This insect defoliated only about 180 acres of mixed hardwoods in Onondaga County in New York. There was a statewide increase in larvae and the number of moths in Vermont, with light defoliation occurring in Addison County.

Insects: Native

**Fruittree leaf roller,**  
*Archips argyrospilus*

Region 5: California

Host(s): California black oak

An outbreak in the San Bernardino Mountains of southern California ran through its fourth year; California black oaks on an estimated 25,000 to 30,000 acres of were affected. Damage and egg masses were observed in the Castaic Mountains for the first time.

**Giant bark aphids,**  
*Longistigma caryae*

Region 8: Louisiana, Texas

Host(s): Oaks

The outbreak of giant bark aphids that began in late 2001 across most of eastern Texas continued in 2002. Populations also increased to noticeable levels in western and central Louisiana. Infestations were particularly severe in Rapides Parish, with individual trees having large numbers of aphids. The presence of aphids appeared to peak from late January through early February. This aphid is known to occur in the eastern half of the United States and it is the largest aphid in North America. The aphids are primarily feeding on oak trees and seem to favor water and live oaks.

**Grasshoppers,**  
**Various species**

Region 8: Oklahoma

Host(s): Oaks, other hardwoods

Large areas of post oak-blackjack oak forest were completely defoliated in central Oklahoma in 2002. Damage was most noticeable in late summer/early fall. An estimated 15,000 acres was affected.

**Hemlock looper (fall flying),**  
*Lambdina fiscellaria*

Region 9/Northeastern Area: Maine, Massachusetts, New Hampshire, New York, Vermont

Host(s): Eastern hemlock, balsam fir, white spruce

The recent hemlock looper outbreak in Maine collapsed in 2002 and less than a thousand acres of moderate to severe defoliation were mapped during the aerial survey. This short lived outbreak was sparked by heavy moth activity in the fall of 2000 and peaked with nearly 27,000 acres of heavy to severe and 150,000 acres of light to moderate defoliation in 2001. Resurgence of the hemlock looper was unexpected because of the short interval between the 2000 increase and the collapse of the last outbreak in 1993. Small pockets of light defoliation were observed during ground surveys in Berkshire County in western Massachusetts. In New Hampshire, there was no defoliation and no moths caught in pheromone traps. A number of moths were caught in traps set for spruce budworm in New York, but no significant defoliation of hemlock was found. Populations remained low in Vermont.

**Jack pine budworm,**  
*Choristoneura pinus*

Region 9/Northeastern Area: Michigan

Host(s): Jack pine

In Michigan, about 40,000 acres were defoliated in 2002, down significantly from 118,000 acres in 2001.

**Jeffrey pine beetle,**  
*Dendroctonus jeffreyi*

Region 4: California, Nevada

Host(s): Jeffrey pine

Jeffrey pine beetle activity increased on the Humboldt-Toiyabe National Forest and within the Lake Tahoe Basin Management Area with 1,700 trees killed on 800 acres in 2002 compared to the 50 trees on 30 acres reported in 2001.

Region 5: California

Host(s): Jeffrey pine

Jeffrey pine beetle activity and related mortality was near that of 2001 in northeastern California, generally low in the southern Sierra Nevada Mountains, and abundant in the San Bernardino Mountains in southern California.

**Jeffrey pine needleminer,**  
*Coleotechnites spp., near milleri*

Region 5: California

Host(s): Lodgepole pine

High populations of this needleminer were observed from areas of the San Bernardino Mountains that have been infested in the past, particularly along Highway 18 in the vicinity of Snow Valley and on the south side of Big Bear Lake.

**Jumping oak gall wasp,**  
*Neuroterus saltatorius*

Region 9/Northeastern Area: Missouri, New York

Host(s): Bur oak, white oak

This insect caused some mild damage to ornamental white oaks in Broome County, New York. This may represent the first report of jumping oak gall wasp in the State.

From 1998-2000, high levels of this insect were reported throughout eastern Missouri on white oaks. The numbers of trees effected declined sharply in 2001 and were at nondetectable levels in 2002.

Insects: Native

**Juniper budworm,**  
*Cudonigera houstonana*

Region 8: Texas

Host(s): Ashe juniper

An unusual outbreak of juniper budworm defoliated Ashe juniper trees in central Texas in April 2002. Parts of Travis, Hays, Comal, and Blanco Counties were affected. Actual damage to the trees was relatively minor.

**Lace bugs,**  
*Corythucha spp.*

Region 9/Northeastern Area: Pennsylvania, West Virginia

Host(s): Black cherry, sycamore, oaks

Black cherry trees in Monongalia, Marion, and Harrison Counties, West Virginia, and Greene and Washington Counties, Pennsylvania, exhibited obvious discoloration in late July. Statewide in West Virginia, lace bugs also caused obvious discoloration during July on sycamore and oak trees.

**Large aspen tortrix,**  
*Choristoneura conflictana*

Region 9/Northeastern Area: Maine, New Hampshire, Vermont

Host(s): Bigtooth aspen, aspen

No defoliation was reported in Maine in 2002. In New Hampshire, there was no noticeable defoliation in 2002. Moderate defoliation occurred in Vermont, in Windham and Windsor Counties, with light damage in the eastern part of the State.

**Leaf beetle,**  
*Chrysomela spp.*

Region 5: California

Host(s): Willow

Moderate to heavy defoliation of willows was reported in riparian areas south of the Tioga Pass Entrance Station of Yosemite National Park.

**Locust leaf miner,**  
*Odontota dorsalis*

Region 8: Georgia, Kentucky, North Carolina, South Carolina, Tennessee, and Virginia

Host(s): Black locust

The locust leaf miner has been especially active this summer, with damage becoming evident earlier than usual. Discoloration is most obvious in the Appalachians, with the Blue Ridge Parkway being especially hard hit. This has prompted many public inquiries to the Park Service, USDA Forest Service, and State forestry agencies. The Tennessee Division of Forestry reported a high incidence of locust leaf miner damage in middle and eastern Tennessee. While damage is normally of little consequence except for its aesthetic effect, very heavy infestations during drought periods can contribute to reduction in tree vigor.

Region 9/Northeastern Area: Maine, Maryland, Massachusetts, New Hampshire, New Jersey, Pennsylvania, Vermont, West Virginia

Host(s): Black locust

Locust leaf miner caused less defoliation of black locust throughout the State of Maryland than last year. In New Jersey, the locust leaf miner was visible creating damage along major highways in Middlesex, Monmouth, and Mercer Counties. There were approximately 200 acres in Schuylkill County, Pennsylvania, defoliated this year. In West Virginia, moderate to heavy defoliation occurred again in most eastern and northern panhandle counties.

Populations and resultant defoliation by this species remained extreme throughout the range of the host in Maine. Mortality of black locust on stressed sites seemed to be increasing with no letup in sight. In Massachusetts, there was documentation of a total of 415 acres of small pockets of defoliation. Most of the damage was observed along interstate highways. Defoliation was moderate in the central part of New Hampshire, a decrease in severity from 2001. In Vermont, the damage was the heaviest seen in recent years, with widely scattered heavy defoliation.

**Lodgepole pine needleminer,**  
*Coleotechnites milleri*

Region 5: California

Host(s): Lodgepole pine

Populations of lodgepole needleminer started to increase in several areas of Yosemite National Park in 1993-1994; this expansion continued in 2002. Anticipated widespread population decrease caused by weather and increased parasitism in 2001 did not materialize. Population increases were seen at 22 of 28 monitoring plots. Four plots that had decreasing densities were so severely defoliated that larval populations were limited by available host foliage. Aerial survey found approximately 51,700 acres of defoliation. Increased population densities will likely result in severe defoliation over an area from Tenaya Lake to nearly Tuolumne Meadows with moderate to high mortality of host trees expected.

Insects: Native

**Maple leafcutter,**  
*Paraclemensia acerifoliella*

Region 9/Northeastern Area: Maine, Massachusetts, New Hampshire, Vermont

Host(s): Sugar maple

In Maine, populations of the maple leafcutter remain low and spotty. In Massachusetts, there was minimal damage observed in Franklin County. In New Hampshire, approximately 42 acres of moderate defoliation occurred in Grafton County. This was slightly less than in 2001. Moderate damage occurred in Washington County, Vermont, with light damage in the rest of the State.

**Maple trumpet skeletonizer,**  
*Epinotia aceriella*

Region 9/Northeastern Area: Vermont

Host(s): Sugar maple

There was scattered very light defoliation reported in Vermont.

**Mountain pine beetle,**  
*Dendroctonus ponderosae*

Region 1: Idaho, Montana

Host(s): Lodgepole pine, ponderosa pine, other pines

Mountain pine beetle-infested areas increased significantly once again in 2002. It remains the most frequently encountered and damaging bark beetle in the region. Populations continued to expand in lodgepole pine stands on the Nez Perce and St. Joe National Forests in Idaho and the Lolo, Flathead, and Beaverhead-Deerlodge National Forests in western Montana. Hundreds of thousands of acres of lodgepole pine are becoming increasingly susceptible, and weather conditions are proving to be more and more conducive to beetle survival. Both phenomena have enabled beetle populations to increase remarkably in the last few years. While mountain pine beetle (MPB) populations affecting other host species are significant in some areas, notably whitebark pine stands in northern Idaho and ponderosa pine stands in eastern Montana, more than 95 percent of the MPB-infested areas are in aging lodgepole pine stands. In total, for all affected hosts, infested area increased from slightly more than 149,000 acres in 2000, to over 236,580 acres, regionwide in 2001. That more than doubled to just over 517,600 acres in 2002. Nearly 3 million host trees were killed in 2001—recorded as faded trees in 2002. The most expansive outbreak in the region exists on the Nez Perce National Forest in north-central Idaho, where more than 181,500 acres were infested. Next most seriously affected stands were on the Lolo National Forest, in western Montana, where almost 113,000 acres were infested to some extent—up from less than 70,000 acres in 2001. There, infestations in lodgepole pine stands are slightly more intense, with an average of more than 13 trees per acre being killed. Both outbreaks appeared to be still increasing. Significant outbreaks continued on the Idaho Panhandle National Forest, in both lodgepole and whitebark pine stands, and in predominantly lodgepole pine stands on the Flathead and Clearwater National Forests and Flathead Indian Reservation. In most areas ground surveyed, populations were still active in lodgepole, ponderosa, and whitebark pine stands—especially on the Lolo and Flathead National Forests in Montana and parts of the Idaho Panhandle and Nez Perce National Forests in northern Idaho. Beetle-caused mortality in ponderosa pine stands, regionwide, is not extreme. It is, however, increasing in some areas on the Bitterroot, Lolo, and Lewis and Clark National Forests and Flathead, Rocky Boys, Fort Belknap, and Crow Indian Reservations in Montana.

## Region 2: Colorado, South Dakota, Wyoming

Host(s): Ponderosa pine, lodgepole pine, limber pine, whitebark pine, pinyon pine

Populations of this beetle have nearly doubled in size each year in Colorado since the mid 1990s. Listed below are the counties in Colorado with current outbreak problems of MPB:

- Grand County has the largest amount of lodgepole pines dying due to mountain pine beetle. The areas around Lake Granby continue to have increased tree mortality. Other sites in Grand County are diminishing in population due to depletion of the host material for this insect.
- Chaffee and Saguach Counties contains the second largest area of mountain pine beetle activity in Colorado, most notably between Salida and Granite along the eastern foothills of the Saguatch Range. This area of the Upper Arkansas Valley has ongoing damage primarily in ponderosa pines, causing concern on private lands from Nathrop and Poncha Springs to Cochetopa Hills near the Continental Divide. In some cases, ponderosa pine firewood brought into towns appears to be a source of re-infestations in ornamental pinyon pines.
- Vail Valley and Eagle River Valley in Eagle County continue to experience heavy losses from MPB in lodgepole pine.
- Jackson County has a large outbreak of beetle activity near Rand and along the eastern slope of the Park Range mountains.
- Larimer County has a hotspot of increasing MPB activity from Rustic to Pingree Park in limber and lodgepole pines.

MPB has caused extensive ponderosa pine mortality throughout the Black Hills in South Dakota and Wyoming over the last 3 years. Aerial surveys have detected a large and expanding MPB infestation in the Beaver Park area of the northern Black Hills. Aerial surveys indicated that approximately 350,000 ponderosa pines on over 10,000 acres have recently died due to this insect's activity. Ground surveys found 37 trees per acre killed. Continued studies of these outbreaks areas indicate that beetle populations are still increasing and will cause dramatic levels of future tree mortality.

As available host trees are killed in the Beaver Park area, the large beetle populations expand to surrounding forest sites. The majority of the infestations are confined to national forest land, however, more private and State lands are now becoming infested. The Sturgis watershed area is hard hit by this beetle epidemic, and logging is in progress to reduce the forest susceptibility to attack and remove infested trees. Thinning is also planned to increase tree vigor and health. These practices will also reduce the fire hazard further preserving water quality.

In 2002, mountain pine beetle has affected approximately 15,000 acres of private forest land in addition to forest land within the Black Hills National Forest. Private lands adjacent to the national forest are beginning to suffer considerable mortality and forest landowners are thinning their lands to reduce susceptible host material.

This beetle is also causing considerable damage in ponderosa pine in the lower foothills of the Bighorn Mountains from Johnson County north into Sheridan County on State, private, and Federal lands. With populations in this area of the Bighorns increasing, tree mortality caused by this beetle will be more visible in 2003.

Small pockets of dead lodgepole and ponderosa pines, killed by MPB, were common in the Laramie, Sierra Madre, and Snowy Mountain Ranges of south-central and southeastern Wyoming. Many of these pockets contained over 150 dead trees.

## Region 3: Arizona, New Mexico

Host(s): Ponderosa pine

MPB-caused ponderosa pine mortality increased from 2,270 acres in 2001 to 3,960 in 2002. In Arizona, MPB-caused mortality occurred on the Coconino (130 acres) and Kiabab (5 acres) National Forests, and 60 acres on Grand Canyon National Park. In New Mexico, trees killed by MPB were detected on the Carson

Insects: Native

(3,265 acres) and Santa Fe (230 acres) National Forests and Jicarilla Apache (5 acres), Picuris Pueblo (25 acres), Santa Clara Pueblo (30 acres), and Taos Pueblo (210 acres) tribal lands.

Region 4: California, Colorado, Idaho, Nevada, Utah, Wyoming

Host(s): Limber pine, lodgepole pine, Jeffrey pine, ponderosa pine, western white pine, whitebark pine

MPB-caused tree mortality increased regionwide from 180,800 trees on approximately 97,000 acres in 2001 to 1,217,200 trees on approximately 127,400 acres in 2002. The acres for 2002 are underestimated because Idaho and Utah were only partially surveyed due to the extreme fire season. The largest outbreak in the region, which began in 1998, killed approximately 1,037,600 lodgepole pine trees on approximately 69,650 acres on the Sawtooth National Recreation Area and Salmon-Challis National Forests in central Idaho. The other large outbreak was on the Bridger-Teton National Forest in Wyoming. In 2001, approximately 3,700 whitebark and limber pine trees were killed on 1,030 acres. That number increased dramatically to approximately 14,100 whitebark and limber pine trees killed on 6,465 acres in 2002.

Region 5: California

Host(s): Limber pine, lodgepole pine, ponderosa pine, sugar pine, western white pine, whitebark pine

MPB activity was elevated this year as dry conditions persisted throughout northern California. Most mortality was found in lodgepole pine although in areas where ponderosa pine and lodgepole grow together, ponderosas were attacked and killed as well. Mortality associated with MPB remained generally low throughout most of the southern Sierra Nevada Range. However, scattered pockets of mortality were found in the Lake Tahoe Basin and near Truckee, California. The MPB was less abundant than western pine beetle in southern California. Nevertheless, MPB killed numerous large ponderosa and sugar pines in the San Bernardino and San Jacinto Mountains.

Region 6: Oregon, Washington

Host(s): : Jeffrey pine, lodgepole pine, ponderosa pine, sugar pine, western white pine, whitebark pine

Combined activity in all host types increased 168 percent from 2001 levels. In 2001, 211,129 acres with an average of 5.68 trees per acre were reported compared with 354,541 acres affected with an average of 5.32 trees per acre in 2002. Significant increases across all ownerships were reported in all host types with the exception of a decrease in reported mortality in western white pine.

Acres affected in the whitebark pine type increased significantly from 18,891 acres (3.07 trees per acre) in 2001 to 32,881 acres in 2002 (3.40 trees per acre). A little more than half the affected acres were mapped in wilderness areas of Washington, primarily within the Pasayten (12,930 acres) and Alpine Lakes (2,690 acres) Wilderness Areas. An additional 10,500 acres were mapped on nondesignated national forest lands in Oregon and Washington. Ascertaining exact cause of damage is difficult from an aerial platform; however, many acres of mapped damage within the Okanogan, Wenatchee, and Wallowa-Whitman reporting areas were also mapped as infected with white pine blister rust.

Significant increases of acres mapped in the ponderosa type occurred on all ownerships. In 2001, 36,341 acres (1.34 trees per acre) were mapped, compared with 103,958 acres (1.47 trees per acre) in 2002. Most significant increases were reported on the Okanogan, Deschutes, Ochoco, Yakama, and Malheur reporting areas, accounting for more than 61 percent of the mapped damage regionwide.

Activity in sugar pine increased for the third straight year from 1,714 acres in 2001 to 1,988 acres in 2002, but at a slightly lower reported intensity (0.14 trees per acre, compared with 0.18 trees per acre in 2001). The majority of reported mortality occurred on USDA Forest Service and Bureau of Land Management lands within the Rogue River and Siskiyou reporting areas. Additionally, over 400 acres of white pine blister rust were mapped within these same reporting areas.



Activity in western white pine decreased from 16,362 acres (1.23 trees per acre) in 2001 to 4,087 acres (0.54 trees per acre) in 2002. Decreases occurred across all ownerships except for slight increases on State of Washington lands and within the Eagle Cap Wilderness Area. Aerial detection of western white pine mortality is difficult because it is often found as a minor component in mixed conifer stands and has a color signature very similar to that of Douglas-fir.

Tree mortality in lodgepole pine increased across all ownerships except for slight decreases on State of Washington lands and on State of Oregon lands. Total reported affected acres increased for the fifth straight year from 137,516 acres in 2001 to 208,948 acres in 2002. The vast majority of mortality (98 percent) was reported on Federal and tribal lands. Approximately 38 percent of the acres affected were reported on the Okanogan National Forest with mortality intensities averaging 10.8 trees per acre. On the Warm Springs Indian Reservation, mortality intensities nearly tripled from 3.9 trees per acre in 2001 to 11.5 trees per acre in 2002 on 19,800 acres. Other heavily infested areas included the Deschutes (35,000 acres), Fremont (32,100 acres), Mt. Hood (11,500 acres), and Wenatchee (11,800) National Forests. Approximately 20 percent of the recorded affected acres were mapped within national parks and wilderness areas.

Dense stand conditions continue to predispose areas to MPB infestations.

## **Nantucket pine tip moth,** *Rhyacionia frustrana*

Region 8: Regionwide

Host(s): Loblolly pine, shortleaf pine

Tip moth problems were noted in South Carolina, especially in old-field plantations. One 8-year-old 400-acre plantation displayed nearly 100 percent infestation. Plantations in the North Carolina Coastal Plain and eastern Piedmont experienced moderate, routine infestations.

In northeast Tennessee, the number of tip moth generations extended to four for the second consecutive year due to the hot dry August and September and a mild, rainy fall. Infestations also increased in middle and eastern Tennessee with up to 60 percent of 1-3 year-old shortleaf and loblolly seedlings damaged. Western Tennessee populations remained steady relative to 2001. Mississippi experienced tip moth damage on some large tracts (more than 450 acres) in Lafayette County. Infestation levels in Texas decreased in 2002.

## **Oak leaftier,** *Croesia semipurpurana*

Region 9/Northeastern Area: Maine, Vermont, West Virginia

Host(s): Black oak, northern red oak, scarlet oak

In West Virginia, surveys for oak leaftier eggs were again conducted in Barbour, Pendleton, Pocahontas, Randolph, and Tucker Counties in late winter, but no eggs were observed and follow-up summer larval surveys reported very light populations only in Randolph, Tucker, and Pocahontas Counties.

Defoliation levels have remained low, spotty, and static in Maine since 1998. Populations, however, seemed to increase slightly in 2002. Light damage was observed in Chittenden County, Vermont.

Insects: Native

**Orange-striped oakworm,**  
*Anisota senatoria*

Region 9/Northeastern Area: Connecticut, Maryland, New Jersey, New York, Pennsylvania, Rhode Island, West Virginia

Host(s): Black oak, red oak

Localized infestations were reported in Carroll and Howard Counties in Maryland. In New Jersey, the orange-striped oakworm defoliation was concentrated on 375 acres in Burlington County, but several thousand acres of defoliation was also scattered across several counties. This late season defoliator caused only light defoliation in Cumberland County, Pennsylvania, this year. In West Virginia, orange-striped oakworm was reported as moderate to heavy infestations in scattered, isolated locations.

In Connecticut, defoliation detected by aerial survey occurred on 1,597 acres in Windham County. Oaks on Long Island in New York were moderately to severely defoliated late in the season by orange-striped oakworm. It was the second or third consecutive year of such defoliation in some areas, such as Otis Pike Preserve in Suffolk County. In Rhode Island, 4,000 acres of trees were defoliated in the central and eastern part of the State. Populations showed signs of collapse in Kent County but strengthened in Newport County.

**Oystershell scale,**  
*Lepidosaphes ulmi*

Region 9/Northeastern Area: Maine, Vermont

Host(s): Beech

Observations on American beech in Maine in 2002 did not reveal any extensive new populations of oystershell scale. Beech continued to decline from numerous other agents. Only light damage occurred in Vermont.

**Pandora moth,**  
*Malacosoma constrictum*

Region 5: California

Host(s): Blue oak

An incipient pandora moth outbreak was detected in June on the Mammoth and Mono Lake Districts, Inyo National Forest. Light to moderate defoliation in the upper half of the crowns of Jeffrey and lodgepole pines was observed on about 5,200 acres. Pandora moth outbreaks usually last for 3 or 4 generations and increased defoliation is expected over the next 4 to 6 years.

**Peach bark beetle,**  
*Phloeotribus liminaris*

Region 9/Northeastern Area: New York

Host(s): Black cherry

The population of this insect remained high but scattered across the southern tier of New York in 2002. Availability of cherry slash seems to be a driving force behind the population's dynamics and distribution.

**Periodical cicada,**  
*Magicicada septendecim*

Region 9/Northeastern Area: Ohio, West Virginia

Host(s): Hardwoods

In Ohio, three species of periodical cicadas appeared in portions of Ashtabula, Trumbull, Columbiana, and Mahoning Counties, as well as the northern half of Jefferson County in the spring of 2002. There was also flagging on all hardwoods over 64,600 acres in Brooke and Hancock Counties, West Virginia.

**Phantom hemlock looper,**  
*Nepytia phantasmaria*

Region 6: Oregon, Washington

Host(s): Douglas-fir, western hemlock

Approximately 5,700 acres of defoliation were mapped in 2002, compared with 2,320 acres in 2001. All of the defoliation occurred on the Mt. Baker-Snoqualmie reporting area between Spada Lake and Lake Roesiger in Snohomish County.

**Pine colaspis beetle,**  
*Colaspis pini*

Region 8: Regionwide

Host(s): Southern pines

As in 2001, this beetle caused localized defoliation to pine plantations in central Louisiana, particularly in eastern Rapides Parish. Sporadic infestations were reported from other areas of central and western Louisiana and eastern Texas. No significant damage occurred, but defoliation is unsightly, causing landowner concerns.

Insects: Native

## **Pine engraver beetles, *Ips* spp.**

Region 1: Idaho, Montana

Host(s): Ponderosa pine, lodgepole pine, other pines

Although still at relatively low levels considering the abnormally dry conditions, pine engraver beetle activity increased somewhat in 2002. Most beetle-caused mortality was recorded in ponderosa and lodgepole pine stands in northern Idaho, and ponderosa pine stands in eastern Montana. Total mortality in 2002 is estimated to have increased from about 200 acres in 2001 to approximately 1,700 acres in 2002. While recorded mortality increased in 2002, the increase may have been higher because of a continuation of unusually warm and dry weather for the past few years in most reporting areas. Beetle-killed trees may increase due to environmental conditions and the number of fire-affected ponderosa pine stands in western Montana. The Clearwater National Forest, in northern Idaho, recorded the most engraver beetle-affected acres in Idaho, while ponderosa pine stands on the Northern Cheyenne Indian Reservation were the most severely impacted in Montana. Few other reporting areas recorded significant outbreaks.

Region 2: Colorado, Nebraska, South Dakota, Wyoming

Host(s): Ponderosa pine, pinyon pine

In Colorado, greater than normal incidence of *Ips* beetles in lodgepole has been reported from a number of locations near Fraser, Monarch Pass, and Boulder County.

Major pinyon mortality is occurring in the southwest corner of the State around Mancos in Montezuma County. Usually the primary organism in these trees is pinyon ips (*Ips confusus*). In some trees, signs of blackstain root disease are found, but this situation appears to be mostly drought and *Ips*. Pinyon mortality in the southwestern part of the State now extends from Pagosa Springs to Four Corners area and north to Norwood. Nearly 1 million trees are fading so that roughly 50 percent of the pinyon forest is red due to beetle. No doubt much of the green material is also infested and not yet discolored. Other major areas of pinyon ips mortality occur in the southern Front Range and extend from Pueblo south to Trinidad. "Interior" hotspots of pinyon ips mortality continue in the San Luis Valley near Crestone, and on the east flanks of the Uncompahgre Plateau south of Montrose. Current mortality totals at least 5,000 trees.

*Ips* caused tree mortality continues to skyrocket, in combination with dwarf mistletoe infection and drought. It is very difficult to discern faders that result from such complexes from that of mountain pine beetle and other *Dendroctonus* bark beetles. In particular, this increased *Ips*-dwarf mistletoe-drought mortality greatly complicates aerial surveys. Such "complex-caused" mortality is particularly evident in southern and southwestern Colorado.

Pine engraver beetle populations built up in storm damage and fire areas and increased exponentially around the Black Hills the last 3 years. Many of the areas getting hit hardest by *Ips* in the Black Hills are in the wildland-urban interface. Aerial survey numbers from 2002 indicate that over 1,400 acres were affected and more than 40,000 trees were killed by this beetle.

In 2002, the pine engraver beetle affected approximately 25,000 acres of private forest and urban lands. The population has been increasing in recent years due to the increase in suitable hosts; trees that have been injured or killed by fire and severe snow and hail storms.

Region 3: Arizona, New Mexico

Host(s): Ponderosa pine, piñon pine

Ponderosa pine mortality caused by *Ips* beetles increased over six-fold from 83,960 acres in 2001 to 522,040 in 2002. In Arizona, ponderosa pine and piñon pine trees are severely drought stressed. Mortality due to *Ips* beetles in ponderosa pine was reported on the Apache-Sitgreaves (110,050 acres), Coconino (60,295 acres), Coronado (2,805 acres), Kaibab (6,010 acres), Prescott (35,955 acres), and Tonto (66,585

acres) National Forests; Saguaro (490 acres) and Walnut Canyon (1,385 acres) National Monuments; Bureau of Land Management lands (990 acres); Fort Apache (61,340 acres), Hualapai (195 acres), Navajo (6,545 acres), and San Carlos (111,220 acres) Indian Reservations; and State and private lands (9,755 acres). Piñon ips-caused tree mortality was recorded on the Apache-Sitgreaves (170 acres), Coconino (33,970 acres), Coronado (280 acres), Kaibab (1,270 acres), and Prescott (40 acres) National Forests; Fort Apache (1,695 acres), Hualapai (785 acres), Navajo (17,700 acres), and San Carlos (4,195 acres) Indian Reservations; and State and private lands (1,335 acres). In New Mexico, ips caused ponderosa pine mortality was detected on the Cibola (1,210 acres), Gila (325 acres), Lincoln (1,545 acres), and Santa Fe (825 acres) National Forests; Jicarilla Apache (75 acres) and Mescalero Apache (20 acres) tribal lands; and State and private lands (4,795 acres). Piñon ips beetle-caused tree mortality also occurred on the Carson (16,240 acres), Cibola (4,670 acres), Gila (1,440 acres), Lincoln (860 acres), and Santa Fe (5,425 acres) National Forests; Bandelier National Monument (2,405 acres); Cochiti Pueblo (15,705 acres), Jemez Pueblo (45 acres), and Santo Domingo Pueblo (2,735 acres) tribal lands; and State and private lands (21,185 acres).

#### Region 4: California, Idaho, Nevada, Utah

Host(s): Lodgepole pine, ponderosa pine, pinyon pine

Mortality due to pine engraver beetle remained low throughout the region. However, beetles did kill scattered groups of ponderosa pine in 2002, mostly on the Boise National Forest in southwestern Idaho. Additional ponderosa pine mortality was detected from ground observations in the late fall. This additional mortality was the result of adult beetles that emerged from infested slash in late August and early September, then infested standing green trees during “feeding” attacks.

Tree mortality in the pinyon pine forests of Region 4 caused by pinyon ips beetle increased dramatically. In 2001, approximately 3,900 trees were killed over 2,300 acres. In 2002, approximately 409,200 trees were killed over 70,500 acres. Historically, pinyon/juniper forests have not been aerially surveyed. However, the dramatic increase in pinyon mortality in 2001 and 2002 resulted in requests by affected national forests to document this widespread mortality. Most of the mortality caused by the pinyon ips is the result of an extended drought within the affected areas. The acres for 2002 are underestimated because the pinyon pine forest type was only partially surveyed.

#### Region 5: California

Host(s): Coulter pine, knobcone pine, lodgepole pine, pinyon pine, ponderosa pine

Mortality from pine engravers declined sharply from that of recent years in all areas of northeastern California with the exception of one area on the Modoc National Forest. *Ips pini* was also responsible for some mortality and top-kill of residual Jeffrey pines in thinned areas of the Mammoth and Mono Lakes Districts, Inyo National Forest, and was associated with Jeffrey pine mortality on the west shore of Lake Tahoe.

Mortality of singleleaf pinyon associated with *Ips confusus* continued moderate to high in areas on the east side of the Sierra Nevada in Mono and Inyo Counties. *Ips confusus* populations were high in singleleaf pinyon stands in the eastern portions of the San Bernardino Mountains in southern California.

*Ips paraconfusus* was found in dying pines in the San Bernardino Mountains, the Peninsular Ranges, and in plantations in the San Gabriel Mounts and the mountains north Castaic Lake, southern California. Along with other bark beetles, it was also associated with ponderosa pine mortality in underburned areas of the Mi-wok District, Stanislaus National Forest.

Insects: Native

Region 6: Oregon, Washington

Host(s): Ponderosa pine

Pine engraver activity increased over 2001 levels from 1,725 acres mapped to over 9,500 acres in 2002. The majority of the mortality (73 percent) was mapped on the Rogue River (3,552 acres), Yakama (1,827 acres), and Glenwood (1,605 acres) reporting areas. Fifty-three percent of the affected acres mapped were on private lands of which two-thirds were in Oregon and the remaining in Washington.

Region 8: Regionwide

Host(s): Loblolly pine, shortleaf pine, slash pine

All three common species of pine engraver beetles (*Ips* spp.) were very active in dry areas of the South. While normally acting as secondary pests attacking weakened trees, these insects are capable of reaching more aggressive primary pest status when large areas of hosts are stressed (as by the recent drought). South Carolina reported a large number of mixed southern pine beetle-*Ips* spots in the Coastal Plain. South Carolina also reported a high incidence of pine engraver beetles in unthinned plantations in the Sand Hills region.

Florida recorded scattered *Ips*-caused mortality in pines stressed by a variety of factors. Especially noteworthy was damage along power line rights-of-way where fusiform rust-infected slash pines had been removed. A very slight increase in engraver beetle activity was reported in Mississippi, while activity in Arkansas and Texas was widespread but low. *Ips* damage increased in southeastern Oklahoma. Most reports were of single or scattered tree mortality, but one landowner reported infestations up to 40 acres in size.

## **Pine needle sheathminer, *Zelleria haimbachi***

Region 5: California

Host(s): Ponderosa pine

Since 1997 sheathminer activity on ponderosa pine had increased east of Ponderosa, Siskiyou County. A spring survey found no insects. Pesticide treatments in 2000 and 2001 likely contributed to the population collapse.

## **Pine reproduction weevil, *Cylindrocopturus eatoni***

Region 5: California

Host(s): Ponderosa pine

The pine reproduction weevil did substantial damage in the 30-acre Torch Fire plantation, Lassen National Forest, and in a plantation on private land near Montgomery Creek, Shasta County.

**Pine sawflies,**  
*Neodiprion* spp.  
*Diprion* spp.

Region 5: California

Host(s): Ponderosa pine

Hundreds of acres of planted ponderosa pine were defoliated near the Military Pass Road on the Shasta-Trinity National Forest.

Region 8: Arkansas, Florida, Louisiana, Mississippi, North Carolina, Tennessee, Texas, Virginia

Host(s): Southern pines

In Tennessee, the loblolly pine sawfly (*Diprion taedae linearis*) defoliated over 50 percent of loblolly pines in northern and middle Tennessee. Some trees incurred repeated defoliation. Loblolly pine sawfly activity in southern Arkansas was low, and reported damage was very light. Defoliation declined to very low background levels in Louisiana, with only widely scattered occurrences reported.

Virginia reported scattered sawfly larval defoliation of loblolly pine in the Coastal Plain and nearly total defoliation of white pine stands in the central Appalachian Mountains by the introduced pine sawfly, *Diprion similis*. Kentucky pheromone trapping surveys also recorded a high incidence of this species in the southeastern section of the State. Further evaluations are pending. The introduced pine sawfly was locally severe in middle Tennessee.

In Florida, several hundred acres (including one infestation of about 470 acres less than 5 years old) were defoliated by the redheaded pine sawfly (*Neodiprion lecontei*) in the Okeechobee District in the summer and fall of 2002. Minor, isolated infestations also occurred in Polk and Orange Counties. Redheaded pine sawfly was also active in middle and eastern Tennessee.

**Pinyon needle scale,**  
*Matsucoccus acalyptus*

Region 5: California

Host(s): Singleleaf pinyon pine

The 2001 outbreak in the Cuddy and Lockwood Valleys of Kern and Ventura Counties continued. An estimated 2,500 acres of singleleaf pinyon were affected.

**Ponderosa needleminer,**  
*Coleotechnites ponderosae*

Region 6: Oregon

Host(s): Ponderosa pine

Reported needleminer damage declined for the fourth straight year following the 1998 outbreak of over 24,000 acres. In 2001, about 500 acres were mapped as compared to 15 acres in 2002. The 15-acre polygon was mapped on private lands in northeastern Washington.

Insects: Native

**Ponderosa pine resin midge,**  
*Cecidomyia piniinopis*

Region 5: California

Host(s): Ponderosa pine

Reports of damage to shoots were limited to a plantation north of Covington Mill, Trinity County, and a plantation north of Lassen Volcanic National Park on the Lassen National Forest.

**Red oak borer,**  
*Enaphalodes rufulus*

Region 8: Arkansas, Georgia, South Carolina

Host(s): Northern red oak, black oak

Red oak borer attacks continued at extremely high levels in 2002 in north-central Arkansas in association with oak decline initiated by recent severe drought. Populations are at unprecedented levels. Damage contributed to drought-related mortality in red oaks, and degrade in lumber from attacked trees sharply reduced product values. Mortality, especially in red oaks, is high, and there is serious concern about the impact on oak forests statewide. Red oak borer adults emerged in 2001 and, with a 2-year life cycle, will infest trees until re-emerging in 2003. Drought stress abated in Arkansas in 2002, but the borer and oak decline activity continued. Red oak borer populations are noticeable in the Ozark Plateau region of northeast Oklahoma, as well and mortality is common, particularly in red oak species. Attacks were also noted to be at high levels in bottomland oaks in green tree reservoirs in Arkansas, where extended flooding causes stress.

In central Louisiana, red oak borer activity was noted in conjunction with oak decline in bottomland hardwoods. In North Carolina, red oak borer activity was accelerated by drought conditions. The North Carolina Division of Forest Resources reported increased numbers of inquiries from landowners and shade tree owners, especially in the Piedmont.

**Red turpentine beetle,**  
*Dendroctonus valens*

Region 2: Colorado, South Dakota

Host(s): Ponderosa pine

Populations of red turpentine beetle have increased dramatically due to large fires. Many of the heavily fire-scorched trees were infested in 2002, particularly in the Black Forest in central Colorado and Black Hills of South Dakota. At this time, there has been little movement from fire-scorched trees out into green trees.

Region 5: California

Host(s): Jeffrey pine, ponderosa pine, singleleaf pinyon pine, sugar pine

The red turpentine beetle was associated with fire-injured trees throughout northeastern California, often in association with other bark beetles. Activity by the beetle was light to moderate on pines injured by wildfire and prescribed burns in the southern half of the Sierra Nevada Mountains. The beetle was abundant in southern California because of the severe drought stress present throughout the region.



**Reproduction weevils,**  
*Hylobius pales*  
*Pachylobius picivorus*

Region 8: Regionwide

Host(s): Southern pines

Sporadic damage was reported in Mississippi in 2002. In the Carolinas, damage generally remained light to moderate throughout, with only limited and scattered heavy infestations. Weevil activity remained low in Texas during 2002.

**Roundheaded pine beetle,**  
*Dendroctonus adjunctus*

Region 3: Arizona, New Mexico

Host(s): Ponderosa pine

Roundheaded pine beetle-caused tree mortality in the region increased more than three-fold from 3,670 acres in 2001 to 11,120 acres in 2002. In Arizona, roundheaded pine beetle mortality was recorded on 7,450 acres of the Coronado National Forest. In New Mexico, mortality was detected on the Lincoln (3,195 acres) National Forest and Mescalero Apache tribal lands (475 acres).

**Scarlet oak sawfly,**  
*Caliroa quercuscoccineae*

Region 9/Northeastern Area: West Virginia

Host(s): Black oak, pin oak, red oak

In West Virginia, scarlet oak sawfly surveys were conducted in Kanawha, Putnam, Mason, Wayne, Cabell, Upshur, and Lewis Counties periodically throughout the season in 2002, with little or no insect activity reported for the second straight year.

**Southern pine beetle,**  
*Dendroctonus frontalis*

Region 8: Regionwide

Host(s): Loblolly pine, shortleaf pine, slash pine, longleaf pine, Virginia pine, eastern white pine

Southern pine beetle (SPB) population remained very high in 2002, but the activity shifted south and west. South Carolina set new all time highs for numbers of SPB infestations and activity was also intense in north Georgia and portions of Mississippi. The high levels of beetle activity in Kentucky, Tennessee, and Florida subsided.

South Carolina reported 25 outbreak counties primarily in the central to western section of the State. In 2002, there were over \$250 million lost to SPB infestations, surpassing the previous high of \$107 million lost in 1995. In Spartanburg County, the beetles killed as much timber as is usually harvested in 3 years.

## Insects: Native

North Carolina reported a doubling of the number of counties reporting SPB activity in 2002 versus 2001 (62 versus 31) and an increase in the number of outbreak counties from 22 to 27. Overall, the number of SPB infestations in North Carolina increased 4 percent over 2001, from 3,871 to 4,533.

In Georgia, SPB continued as the top forest pest in the State with 9,708 spots reported; 44 counties were classified in outbreak status. Especially noteworthy was the wildland/urban interface, which saw a great deal of SPB activity in and around Georgia's rapidly expanding cities and towns. Very poor wood and fiber markets hampered salvage efforts.

SPB populations expanded rapidly on the Homochitto and Bienville National Forests in Mississippi. Many large infestations occurred. However, on State and private lands only limited activity (100 spots) was reported.

Virginia saw SPB activity in 17 counties, 3 of which were classified as epidemic. Tennessee reported 58 counties with SPB activity, over 77 percent of which were epidemic. However, as the summer passed, activity decreased significantly.

Kentucky saw a dramatic drop in SPB activity from 2001 levels, in large part due to host depletion in the eastern part of the State. Only 18 areas of minor activity remain in south-central Kentucky.

Florida received a welcome respite from the intense SPB losses of 2000 and 2001. By the end of 2002, there were 77.5 percent fewer infestations than in 2001 (a total of 650 spots in contrast to 2,892 in 2001).

Alabama remained a hot spot for beetle activity in 2002, the State's fourth straight year for epidemic populations, although activity is decreasing. Statewide, 5,053 spots were detected, with 39 counties considered epidemic. This is a further reduction from the record-setting year 2000 when 26,407 spots were reported.

In western Gulf States, beetle populations remained low. No spots were detected in Arkansas, Louisiana, Oklahoma, or Texas.

## Region 9/Northeastern Area: Delaware, Maryland, New Jersey, Ohio, West Virginia

Host(s): Austrian pine, loblolly pine, Scotch pine, Virginia pine

No significant, active SPB hot spots were detected over the entire southern part of Delaware. SPB populations continued to remain light in southern Maryland and no significant damage was reported. In New Jersey, the infestation was first detected in 2001 in Cumberland County with heaviest infestations in Cape May County. In 2002, it had spread and was reported in Atlantic, Passaic, and Warren Counties where damage was mapped by aerial survey. The State reported a total of 23,400 acres of loblolly, pitch and Virginia pines have been killed. In Ohio, SPB infestations were scattered, with only three spots detected in 2002. In 12 southern and eastern West Virginia counties, SPB has killed approximately 265 Virginia pine trees. Lindgren funnel traps baited with frontalinal and turpentine lures were placed in Jackson, Lincoln, and Wayne Counties. Trapping results indicated that the SPB populations were declining.

## **Spruce beetle, *Dendroctonus rufipennis***

Region 1: Idaho, Montana

Host(s): Englemann spruce

Spruce beetle-killed trees remained lightly scattered in 2002; and virtually at endemic conditions throughout the region, with the exception of a significant outbreak in the southeastern portion of Yellowstone National Park, where more than 6000 acres were infested. Although extensive, most of those infested areas averaged less than a tree per acre killed. A few areas affected by fire in 2000—notably

stands on the Beaverhead National Forest and Flathead National Forest—had higher than normal spruce beetle activity. Fewer than 500 acres were affected, regionwide, outside Yellowstone National Park. Most mortality attributed to spruce beetle in Montana was observed on the Beaverhead, Deerlodge, and Flathead National Forests. Very little spruce beetle activity was recorded in northern Idaho—approximately 70 acres on the Clearwater National Forest and 50 on the Kaniksu National Forest. Including the outbreak in Yellowstone National Park, about 4,000 trees were killed regionwide.

#### Region 2: Colorado, Wyoming

Host(s): Engelmann spruce

In 2002, tree mortality from spruce beetle increased significantly. Large numbers of spruce were killed in Routt County as the spruce beetle outbreak continues to expand in the area of the Routt Divide blowdown. Particularly impacted are the various drainages of the Elk River north of Steamboat Springs in Routt and Jackson Counties.

Nearby in the Flat Tops of Rio Blanco, Garfield, and Moffat Counties, numbers of spruce beetle-killed trees are increasing. Aerial survey estimates of recently killed spruce are about 3,500 trees. Aerial surveys also detected dying spruce in the Eagle's Nest Wilderness Area, on the Uncompahgre Plateau, and in the southern San Juan Mountains. The mortality in Conejos County, Colorado, on the Rio Grande National Forest declined somewhat in 2002.

In the Bighorn Mountains, Shell Reservoir and Ten Sleep Canyon areas are experiencing epidemic levels of spruce beetle. Following small blowdown events in 1997-1999, spruce beetle populations are increasing in the Sierra Madre and Snowy Mountain Ranges of the Medicine Bow National Forest. Several large spruce beetle infestations were detected along stream bottoms in the Sierra Madre mountain range.

Large pockets of spruce tree mortality caused by this beetle were observed in the Absaroka Mountain Wilderness Area in western Wyoming. These infestations started in the wilderness areas and now have moved out to impact large areas of State, Bureau of Land Management, and other national forest lands. Spruce beetle populations increased in the Wind River Range, partly in conjunction with fires that occurred in the area over the past few years.

#### Region 3: Arizona, New Mexico

Host(s): Spruce

Spruce beetle-caused tree mortality increased more than six fold from 6,215 acres in 2001 to 40,760 in 2002. In Arizona, spruce beetle mortality occurred on the Apache-Sitgreaves (15,680 acres) and Coronado (1,235 acres) National Forests; Fort Apache (15,585 acres) and Navajo (2,655 acres) Indian Reservations; and private lands (200 acres). In New Mexico, spruce beetle related tree mortality occurred on the Carson (1,675 acres), Cibola (155 acres), Gila (15 acres), Lincoln (610 acres), and Santa Fe (2,440 acres) National Forests; the Valles Caldera National Preserve (20 acres); and Taos Pueblo tribal lands (490 acres).

#### Region 4: Idaho, Utah, Wyoming

Host(s): Spruce

Spruce beetle-caused tree mortality decreased in 2002. Spruce beetle killed 135,350 trees on nearly 29,000 acres in 2002 compared to 336,750 trees on over 76,100 acres in 2001. Southern Utah continues to have the largest infestations with 134,400 trees killed on nearly 28,600 acres. The Manti LaSal National Forest has the largest portion with nearly 77,000 trees killed. The Fishlake National Forest with 19,850 trees killed is the only forest within the region where spruce mortality is increasing. The acres for 2002 are underestimated because Idaho and Utah were only partially surveyed due to the extreme fire season.

Insects: Native

Region 6: Oregon, Washington

Host(s): Engelmann spruce

All reported mortality in Oregon and Washington in 2002 was in Engelmann spruce. Reported acres affected increased for the fourth straight year from approximately 24,900 acres (4.14 trees per acre) in 2001 to over 27,600 acres (11.52 trees per acre) in 2002. The vast majority (76 percent) of mortality occurred on USDA Forest Service lands within the Okanogan reporting area. Over 5,700 acres of the mortality was mapped in the Pasayten Wilderness. Other reporting areas with significant mortality included the Wenatchee National Forest and North Cascades National Park. In other areas, spruce beetle activity was lightly scattered in the host type.

Region 9/Northeastern Area: Maine

Host(s): White spruce, red spruce

The condition of many of Maine's coastal spruce stands continued a gradual decline in 2002. The spruce beetle was the most immediate cause of spruce stand deterioration since the mid-1990s but beetle population levels have gradually declined and losses due to this insect have stabilized. Drought conditions in recent years (1995, 1999, 2001, and 2002) have been a major factor in spruce stand decline and have certainly contributed to the persistence of the beetle outbreak. Other factors contributing to the generally poor spruce condition and persistent low rate of spruce beetle attack were tree over maturity, lack of stand management, and sites with shallow, rocky soils. The current spruce beetle infestation remains confined predominantly to the central Maine coast, especially Penobscot Bay. The area infested by spruce beetle did not increase in 2002 and the intensity of attack in infested stands continued a decline.

Region 10: Alaska

Host(s): Black spruce, Lutz spruce, Sitka spruce, white spruce

Spruce beetle activity declined statewide by 50 percent over 2001 levels to only 52,000 acres, the lowest level in more than 30 years. The activity at Lake Iliamna, primarily on native corporation lands, accounted for one-half of this total. The remaining half of the identified spruce beetle activity was evenly divided between Federal and State lands. Spruce beetle is still active in several other areas, most notably McCarthy, the Kenai Peninsula, and near White Mountain on the Seward Peninsula. Throughout the remainder of the State, with the exception of a few small, active areas, spruce beetle populations have fallen to endemic or near-endemic levels. The outbreak on the Haines State Forest continues to collapse with less than 300 acres mapped in 2002.

## **Spruce budworm, *Choristoneura fumiferana***

Region 9/Northeastern Area: Maine, Michigan, Minnesota, New Hampshire, New York, Vermont, Wisconsin

Host(s): Balsam fir, white spruce, red spruce, black spruce, hemlock

Monitoring of low-level spruce budworm populations continued in Maine in 2002. Monitoring included field observations, a statewide light trap network, and pheromone-bated traps that are highly attractive to budworm moths. Field observations were made in 2002 but no larvae were found and no defoliation was detected. Light traps were operated throughout the budworm flight period at 25 locations statewide. Spruce budworm moth catch in light traps was the lowest on record with only two moths trapped. In 2002, 40 pheromone trap locations were evaluated for spruce budworm moth activity. Moth catch in pheromone-baited traps decreased sharply in 2002. Levels were the lowest since the mid-1990s. No defoliation was detected in New Hampshire and pheromone trap catches were very low, indicating continued low levels in 2003. The pheromone trap moth counts in the Adirondacks in New York were down by about 30 percent

from 2001. Most populations were low to moderate, and no noticeable defoliation was reported. The number of moths decreased in Vermont from 2000 and 2001 levels. In Minnesota, 80,317 acres were defoliated in three northern counties. This was the 49<sup>th</sup> consecutive year of detectable spruce budworm defoliation in Minnesota. About 500 acres of defoliation were found in the Upper Peninsula of Michigan. In Wisconsin, there was 356 acres of defoliation reported from aerial survey of national forest land.

**Texas leaf-cutting ant,**  
*Atta texana*

Region 8: Louisiana, Texas

Host(s): Southern pines, hardwoods

In 2002, localized defoliation of pine plantations occurred in east Texas and west-central Louisiana on sites with deep sandy soil. Populations of these ants remain fairly static from year to year.

**Variable oak leaf caterpillar,**  
*Lochmaeus manteo*

Region 9/Northeastern Area: Pennsylvania

Host(s): Beech

In Potter County, Pennsylvania, variable oakleaf caterpillars defoliated 180 acres. Host defoliation was mainly in the understory, but the population collapsed in the late larval stage due to an unknown pathogen.

**Walkingstick,**  
*Diaperomera femorata*

Region 9/Northeastern Area: Pennsylvania

Host(s): Oak

An aerial survey detected approximately 400 acres of oak defoliation in Fulton and Bedford Counties, Pennsylvania.

**Western black-headed budworm,**  
*Acleris gloverana*

Region 6: Oregon, Washington

Host(s): Western hemlock, Sitka spruce, white spruce, true firs, Douglas-fir, mountain hemlock

Areas of defoliation totaling 2,390 acres were detected in 2002, the first recorded outbreak since 1992, on Alpine Lakes Wilderness, Wenatchee National Forest, Mt. Baker-Snoqualmie National Forest, and State and private lands within the Wenatchee reporting area.

Insects: Native

Region 10: Alaska

Host(s): Western hemlock, mountain hemlock, Lutz spruce, Sitka spruce, white spruce

Western black-headed budworm activity was down across the State in 2002. In the Wood River-Tikchik State Park area of southwest Alaska, budworm activity declined from 30,000 acres in 2001 to 5,182 acres in 2002. In southeast Alaska, only 350 acres of active defoliation were observed. In Prince William Sound, 3,010 acres of activity were mapped in 2002, down from 21,000 acres in 2001. Budworm populations in Alaska are characteristically cyclic, appearing quickly, affecting extensive areas, then decreasing just as dramatically in a few years.

## **Western false hemlock looper, *Nepytia freemani***

Region 1: Idaho, Montana

Host(s): Douglas-fir

First detected on approximately 600 acres in the Flathead National Forest in 2001, infested area increased to 3,400 in 2002 and covered portions of the Flathead Indian Reservation, Flathead National Forest, Lolo National Forest, and Kootenai National Forest. Defoliation was heavy in 2001 and 2002. Although western false hemlock looper outbreaks are relatively uncommon in Region 1, moderate to heavy defoliation is common. Tree mortality was not reported during any of the past outbreaks and is not anticipated. Defoliation usually subsides in 2 or 3 years.

## **Western hemlock looper, *Lambdina fiscellaria lugubrosa***

Region 1: Idaho, Montana

Host(s): Douglas-fir, western hemlock, Engelmann spruce, subalpine fir

First detected on approximately 300 acres in Montana in 2000, infested area increased to 28,800 acres in 2001 and 53,600 acres in 2002, mostly in Idaho. In 2002 the most heavily impacted areas were the Clearwater and Nez Perce National Forests, Idaho. Defoliation ranged from light to heavy with understory trees most heavily impacted. Historically, hemlock looper outbreaks were reported in the Region 1 from 1937-39 and 1972-73.

Region 6: Oregon, Washington

Host(s): Western hemlock, conifers

Acres defoliated in Washington State more than doubled from 17,352 acres in 2001 to over 35,200 acres in 2002 in the areas of Mt. Baker-Snoqualmie National Forest, North Cascades National Park, and State and private lands in the Mt. Baker-Snoqualmie reporting area.

## Western pine beetle, *Dendroctonus brevicomis*

Region 1: Idaho, Montana

Host(s): Ponderosa pine

Ponderosa pine mortality attributed to western pine beetle recorded in 2002 increased substantially from the level recorded in 2001. In 2002, beetle-caused mortality occurred on about 6,700 acres—up from approximately 2,500 acres in 2001. Most mortality was observed on the Idaho Panhandle National Forest in northern Idaho and a few isolated stands in western Montana. For the most part, throughout the region, western pine beetle-caused mortality was light and quite scattered. There remains the potential for western pine beetle populations to increase in 2003. Large amounts of susceptible ponderosa pines, resulting from fires in 2000 and drier-than-normal conditions, have created conditions conducive to beetle population survival and expansion, especially in western Montana.

Region 3: Arizona, New Mexico

Host(s): Ponderosa pine

Tree mortality attributed to this insect increased to 40,445 acres in 2002 vs. 36,265 acres in 2001. In Arizona, no tree mortality was attributed directly to western pine beetle, however the insect was present in many of the *Ips* infested trees. In New Mexico, significant activity was detected on the Cibola (1,055 acres), Gila (31,515 acres), Lincoln (3,270), and Santa Fe (2,970) National Forests; Valles Caldera National Preserve (25 acres); Jemez Pueblo (770 acres), Mescalero Apache (660 acres), and Santa Clara Pueblo (30 acres) tribal lands; and State and private lands (150 acres). Western Pine Beetle in combination with round-headed pine beetle caused mortality on the Lincoln National Forest (23,635 acres), Mescalero Apache tribal lands (1,675 acres), and State and private lands (1,365 acres).

Region 4: Idaho, Nevada

Host(s): Ponderosa pine

In 2002, approximately 7,700 ponderosa pine trees were killed on over 3,600 acres by the western pine beetle, a significant increase over the 260 trees killed in 2001. Most of the mortality occurred in southern Idaho on the Payette National Forest (4,500 trees), the Boise National Forest (1,000 trees), and on private land (1,100 trees). This increased mortality is directly related to continuing drought conditions.

Region 5: California

Host(s): Coulter pine, ponderosa pine

Ponderosa pine mortality from western pine beetle increased throughout northern California on both public and private lands. Mortality spots on public lands varied from small to large in northwestern California and were primarily scattered individuals and small groups on private lands in Shasta and Tehama Counties. Dead and dying old growth ponderosa pine in northeastern California were usually found among dense stands of small-diameter pine and white fir. Drought stress was found throughout the region.

In the southern Sierra Nevada, western pine beetle activity generally increased in 2002 with much of the activity occurring in scattered and small mortality groups. However, mortality was much higher in southern California, particularly in those areas experiencing the most severe drought conditions. Western pine beetles were the most common mortality agent associated with dead and dying pines, even attacking smaller diameter trees not occupied by *Ips paraconfusus*. In some areas mortality was very high, e.g., mortality of Coulter pines in Lost Valley, San Diego County, exceeded 80 percent.

Insects: Native

Region 6: Oregon, Washington

Host(s): Ponderosa pine

Acres affected by western pine beetle activity increased for the third straight year from 18,602 acres (1.21 trees per acre) in 2001 to 39,000 acres (1.07 trees per acre) in 2002, the highest level in 7 years. Increases were noted in both large and pole-sized pines. Approximately 77 percent of the mapped mortality occurred in Oregon, which accounted for only 11 percent of the regionwide mapped mortality in 2001. Areas most heavily affected were mapped on Bureau of Land Management and private lands within the Rogue River reporting area. This accounted for 54 percent of the mapped acreage regionwide. Other private lands with significant number of acres mapped were within the Glenwood reporting area (2,174 acres). USDA Forest Service lands most heavily affected were on the Ochoco (992 acres) and Rogue River (1,080 acres) National Forests.

## **Western pineshoot borer, *Eucosma sonomana***

Region 5: California

Host(s): Ponderosa pine

The western pineshoot borer continues to damage some plantations of ponderosa pine in Siskiyou, Shasta, and Modoc Counties. Damage (stunted terminals) varies widely across plantations, but exceeds 50 percent in some areas.

## **Western spruce budworm, *Choristoneura occidentalis***

Region 1: Idaho, Montana

Host(s): Douglas-fir, Engelmann spruce, true firs

The majority of defoliation of conifers in Region 1 was caused by the western spruce budworm (WSB). A total of 52,444 acres of defoliation from budworm was detected across the Beaverhead-Deerlodge, Gallatin, and Helena National Forests in Montana during the 2002 aerial survey flight. On the Kaniksu District of the Idaho Panhandle National Forest, 6,904 acres were reported as defoliated by WSB. On the Beaverhead National Forest, 23,500 acres of Douglas-fir was defoliated by WSB. Light to heavy defoliation was recorded near Melrose and also in the Tobacco Root Mountains. On the Deerlodge National Forest 4,441 acres of defoliation were recorded from WSB. Heavy defoliation was recorded in the High Ore drainage near Basin. Defoliation was also recorded both north and south of Helena on 4,567 acres and on 19,934 acres near Elkhorn Ridge on the Gallatin National Forest. Defoliation was also noted on the Lewis and Clark National Forest during ground surveys. There was a significant increase in number of moths caught in pheromone traps at several trapping sites on the Beaverhead National Forest near Wisdom and a slight increase in moths caught at several other trapping sites. Even a slight increase suggests that the populations across Montana are beginning to increase. There was little to no budworm activity between 1992 and 2001. Ground surveys in localized areas on forests east of the divide reported moderate to high levels of defoliation. Some tree mortality resulting from heavy defoliation appears to have occurred in pole and sapling size trees over the last 2 years. If weather conditions remain within the normal range or are warmer and drier during 2003, budworm populations may increase across Montana and perhaps Idaho. Moderate to high populations and associated defoliation on parts of the Helena, Beaverhead-Deerlodge, and Gallatin National Forests may appear. Forests west of the divide and on the Nez Perce and Kaniksu National Forests in Idaho are expected to show scattered defoliation.



## Region 2: Colorado, Wyoming

Host(s): Douglas-fir, Engelmann spruce, true firs

The southern portion of the Uncompahgre Plateau and Sangre de Cristo Mountains has seen significant levels of light defoliation by WSB in Englemann spruce in 2002. There was heavy defoliation in Larimer County near Cherokee Park. Acreages of Douglas-fir with light and moderate defoliation are increasing in the Front Range of El Paso and Douglas Counties.

## Region 3: Arizona, New Mexico

Host(s): True firs, Douglas-fir, spruce

WSB defoliation decreased regionwide from 459,550 acres in 2001 to 210,335 in 2002. In Arizona, western spruce budworm defoliation was recorded on the Grand Canyon National Park (175 acres) and the Navajo Indian Reservation (11,255 acres). In New Mexico, WSB defoliation was detected on the Carson (114,680 acres), Cibola (1,695 acres), Gila (760 acres), Lincoln (130 acres), and Santa Fe (32,075 acres) National Forests; Valles Caldera National Preserve (440 acres); Jicarilla Apache (2,220 acres) and Taos Pueblo (8,265 acres) tribal lands; and on State and private lands (38,640 acres).

## Region 4: Idaho, Utah

Host(s): Douglas-fir, true firs

WSB defoliation is increasing in the region. In 2002, over 22,700 acres were affected, an increase of 8,350 acres over approximately 14,350 acres reported in 2001. Similar to 2001, most of the defoliation for 2002 was concentrated on the Targhee and Boise National Forests in southern Idaho (11,700 and 3,475 acres, respectively). WSB defoliation was also recorded in southern Utah on the Dixie (3,750 acres) and Fishlake National Forests (1,800 acres).

## Region 6: Oregon, Washington

Host(s): Douglas fir, true firs, Engelmann spruce, western larch

Areas of aerially visible defoliation decreased from approximately 272,114 acres in 2001 to 58,463 acres in 2002. Approximately 32,200 acres were reported in the light category, 15,350 in the moderate, and 10,900 acres in the heavy category. Most notable decreases were observed on the Yakama Indian Reservation, which plummeted from 116,242 acres in 2001 to approximately 1,200 acres in 2002. A decrease from 21,217 acres reported in 2001 to less than 2,600 acres in 2002 was reported for the Gifford-Pinchot reporting area. Approximately 89 percent of the defoliation was recorded within the Wenatchee reporting area—32,552 acres in the William O. Douglas wilderness, 3,946 acres in the Norse Peak wilderness, and 13,907 acres on nondesignated Forest Service lands of the Wenatchee National Forest. New areas of defoliation were recorded on the Colville (246 acres) and Malheur (1,896 acres) National Forests.

## **White fir sawfly, *Neodiprion abietis***

## Region 5: California

Host(s): White fir

The outbreaks of 2000 collapsed in 2001 and defoliation was visible only along the Pomeroy Road (Siskiyou County) in the vicinity of Deer Mountain in 2002.

Insects: Native

**White pine weevil,**  
*Pissodes strobi*

Region 9/Northeastern Area: Maine, New Hampshire, New Jersey, Vermont

Host(s): Eastern white pine

This perennial problem continued to limit the growth of white pine, as well as Colorado blue and Norway spruce in Maine. In New Hampshire, white pine weevil is an annual concern and continued to reduce timber quality statewide. The weevil was commonly found statewide in Vermont. This beetle was responsible for damaging about 15 acres of white pine in Burlington County, New Jersey.

**Yellow poplar weevil,**  
*Odontopus calceatus*

Region 8: Tennessee

Host(s): Yellow poplar

Yellow poplar weevil populations were heavier than normal in Tennessee north and west of Knoxville and in the Cumberland Plateau. The late May generation caused widespread leaf browning over 20,000 acres.

**Yellowheaded spruce sawfly,**  
*Pikonema alaskensis*

Region 9/Northeastern Area: Maine

Host(s): Spruce

Although sawfly damage continued to be visible on ornamentals in Maine and roadside plantings, it was light in forest plantations.

**Zimmerman pine tip moth,**  
*Dioryctria ponderosae*  
*D. zimmermani*  
*D. tumicolella*

Region 2: Kansas, Nebraska

Host(s): Austrian pine, Scots pine, ponderosa pine

Populations in northwest Kansas are all but eradicated, however, a new infestation occurred in southeast Kansas. *Dioryctria tumicolella* was the species identified in northwest Kansas. *D. ponderosae* and *D. tumicolella*, in central and western Nebraska, and *D. zimmermani*, in eastern Nebraska, continue to kill branches and entire trees in pine windbreaks, plantations, and landscape plantings.

## **Insects: Nonnative**

### **Alder woolly sawfly, *Eriocampa ovata***

Region 10: Alaska

Host(s): Sitka alder, red alder, thinleaf alder

Heavy defoliation of thin-leaf alder (*Alnus incana*) was observed for the sixth consecutive year in many parts of the Anchorage Bowl; especially in riparian areas. Sitka alder (*A. crispa*) was seldom defoliated. Similar to the birch leaf miner, the alder woolly sawfly appears to be a recent (less than 7 years) introduction into the State. This sawfly is a European species now established throughout the northern United States, Canada, and recently into Alaska. The larvae are covered with a distinctive shiny, woolly secretion. They skeletonize the lower leaves on young alders; the upper crown is usually not fed upon.

### **Ambermarked birch leaf miner, *Profenusa thomsoni***

Region 10: Alaska

Host(s): Birch

More than 25,000 acres of defoliated birch were mapped in the Anchorage Bowl during 2002 aerial surveys. The significant causal agent was identified as the ambermarked birch leaf miner (*Profenusa thomsoni*). It appears that this leaf miner is a recent introduction into the Anchorage Bowl and is rapidly expanding. Up to this year, leaf miner defoliation was only concentrated in the Anchorage Bowl area. The leaf miner has since spread into the Eagle River area and as far south as Bird Ridge, approximately 30 miles south of Anchorage. It was also accidentally introduced into the Fairbanks area. More than 1,000 heavily defoliated birch were observed on Eielson Air Force Base. In the absence of an efficient biological control agent, birch leaf miner populations will continue to spread unchecked throughout many parts of south-central and interior Alaska's birch forests.

### **Ambrosia beetle, *Xyleborus similis* *Xylosandrus mutilatus***

Region 8: Florida, Mississippi, Texas

Host(s): Pines, hardwoods

As part of a southwide survey effort in 2000-2002, a number of native and exotic ambrosia beetles have been trapped. Among these were new records of exotic beetles in Florida and Mississippi (*Xylosandrus mutilatus*) and Texas (*Xyleborus similis*).

Insects: Nonnative

**Asian longhorned beetle,**  
*Anoplophora glabripennis*

Region 9/Northeastern Area: Illinois, New Jersey, New York

Host(s): Ash, birch, black locust, elm, horse chestnut, maple, poplar, willow

This destructive insect was discovered in New York City, in Brooklyn and on Long Island, during the summer of 1996. Since then, other infestations were discovered in Queens, Manhattan, Bayside, and Islip. A Federal quarantine encompasses all known infested areas in New York including all newly discovered infested areas. Many of the trees in these areas appeared to have been infested for several years. Hardwoods, especially maples, are the preferred hosts of this insect.

Although fewer infested trees were found in 2002 than the previous year, the beetle was still one of the most serious threats to forest health facing New York. To date, more than 5,800 infested trees were found in New York, including two trees in world famous Central Park. This year, many potential host trees in New York City and Long Island were injected with a systemic insecticide in an attempt to protect them from attack. In an effort to eradicate the insect, surveys continued around the perimeter of the known infestation to identify and remove newly infested trees. Tree planting continued to provide greenery in neighborhoods as the infested trees were cut down and removed from the site.

Late in 2002, an unexpected infestation of Asian longhorned beetle was discovered in about 100 mixed maple trees that had been planted as part of the landscaping around an office complex in Hudson, New Jersey, directly across the Hudson River from New York City. No beetles were reported in the States of Delaware, Maryland, and Ohio, where awareness projects have focused on education of professional arborists.

Surveys in Chicago, Illinois, continued with only 19 additional suspect trees destroyed in 2002. Hopes are high that the population will be eradicated.

**Balsam woolly adelgid,**  
*Adelges piceae*

Region 1: Idaho

Host(s): Grand fir, subalpine fir

Aerial survey data estimate 85,400 acres infested by the balsam woolly adelgid (BWA) in northern Idaho in 2002. This number is an increase in infested acres of about 30,000 acres from 2000 and 2001 (56,400 acres infested reported in 2000; 51,500 reported in 2001). Actual infested acres were probably higher since some areas may not yet be displaying crown symptoms. Areas with the heaviest infestations occurred on the St. Joe, Clearwater, and Nez Perce National Forests, and adjacent State, private, and Bureau of Land Management land. Subalpine fir of all ages and size classes was killed. Extensive gouting and bole infestations occurred on grand fir, but no grand fir over 5 inches in diameter has been documented as being killed by the adelgid. Regeneration mortality of both subalpine and grand fir is high, resulting in forest type conversions in some areas. Continued surveys to delimit the distribution of BWA and damage assessment surveys are planned in the near future.

Region 6: Oregon, Washington

Host(s): True firs

BWA activity continued to increase in the region. A total of 82,429 acres were affected in 2002, compared to 50,824 acres in 2001, and 6,300 acres in 2000. Total acres affected were 47,191 in Washington and 35,238 in Oregon. Areas with the larger acreages affected were the Umatilla, Wallowa-Whitman, and Wenatchee National Forests. In addition, over 5,000 acres each were mapped for the Ochoco National

Forest and the Olympic National Park. Smaller acreages were on the Gifford Pinchot, Mount Baker-Snoqualmie, and Mount Hood National Forests. Favorable environmental conditions during the winter and spring of 2001 and 2002 supported increased levels of activity. A change in aerial survey signatures may also have increased observer recognition.

Region 8: North Carolina, Tennessee, Virginia

Host(s): Fraser fir

Fraser fir has a very limited range in the southern Appalachian Mountains and appears almost exclusively in pure stands on the highest mountain peaks or in combination with red spruce at somewhat lower elevations. Since the introduction of the BWA, approximately 64,700 acres of Fraser fir have been affected. The insect attacks all age classes, but prefers older trees. The summer 2002 witnessed high populations in all infested areas. However, there is an abundance of uninfested or lightly infested regeneration in most areas. Many observers believe this portends well for the future, but in fact, these trees will almost certainly become heavily infested as they mature.

Region 9/Northeastern Area: Maine, New Hampshire, Vermont, West Virginia

Host(s): Balsam fir

This introduced species continued to kill and deform fir in 26 balsam fir stands at high elevation sites in West Virginia.

BWA feeding continued to increase over eastern and central Maine, deforming and killing fir trees. Over 50 percent of the fir was affected east of Milbridge within 20 miles of coast. Another significant area of damage was in the area of Newport and Bangor in low-lying areas. Damage was patchier inland. It has been noted that drought effects and BWA damage appeared in the same areas. A project to evaluate the survival and reproduction of *Pseudoscymnus tsugae* beetles (a hemlock woolly adelgid predator) in association with BWA was undertaken in 2001. Beetles were shown to survive Maine winters in cages. Beetles were released in mid-coast Maine in 2002 in an effort to begin establishing populations to control both the BWA and the hemlock woolly adelgid should that species become established in Maine. In New Hampshire, there was approximately 2,300 acres of scattered balsam fir mortality mapped in Coos, Grafton, and Sullivan Counties. Moderate infestations were observed in scattered locations in Caledonia, Essex, Rutland, and Windham Counties in Vermont.

## **Birch leaf miner,** ***Fenusa pusilla***

Region 9/Northeastern Area: New Jersey

Host(s): Gray birch

Across New Jersey, the first generation of birch leaf miners was quite heavy on grey birch trees again in 2002.

Insects: Nonnative

## **Common European pine shoot beetle, *Tomicus piniperda***

Region 9/Northeastern Area: Indiana, Illinois, Maine, Maryland, Michigan, New Hampshire, New York, Ohio, Pennsylvania, Vermont, West Virginia, Wisconsin

Host(s): Scotch pine, white pine, pines

In Maryland, pine shoot beetle continued to be present in Allegany, Frederick, Garrett, and Washington Counties. No additional counties had a detectable infestation. In Ohio, pine shoot beetle continued to be present in the 71 quarantined counties. In Pennsylvania, this beetle was found in 30 counties in the west and northern parts of the State. To date, in West Virginia, this beetle has been found only in the four northern panhandle counties of Brooke, Hancock, Marshall, and Ohio and in the two north-central counties of Tyler and Tucker.

The Maine Forest Service and USDA Animal and Plant Health Inspection Service have been conducting annual spring joint trapping surveys to detect the pine shoot beetle in Maine since 1999. Eight beetles have been trapped in funnel traps in Franklin and northern Oxford County since 2000. In 2002, five beetles were trapped in Franklin County. No signs or damage symptoms were seen during scouting surveys of red pine plantations in areas where the beetles were trapped. The State of Maine established a quarantine in 2001 that designates the northern portion of Oxford County north of the Appalachian Trail as the regulated area. Maine is now in the process of revising the quarantine to include all of Franklin County. The Federal review process to include all of Franklin County is also underway. In New Hampshire, 1,700 beetles were caught in pheromone traps in Coos County. No damage to pine trees was detected. This insect was found in three additional New York counties in 2002: Fulton, Herkimer, and Schoharie. Currently, 35 counties are known to be infested and under quarantine. In general, New York has not experienced as high a severity of damage from this insect as has been reported from some other locations. In Vermont, no beetles were caught in Franklin, Lamoille, Chittenden, Grand Isle, Orange, Windham, or Washington Counties. Movement of pine products is regulated by a State quarantine.

## **Elongate hemlock scale, *Fiorinia externa***

Region 9/Northeastern Area: Connecticut, Pennsylvania

Host(s): Eastern hemlock

Connecticut reported elongate scale occurred on hemlock all over the State. Along with drought, it caused additional stress to trees damaged by hemlock woolly adelgid. Approximately 870 acres of eastern hemlock were showing signs of dieback and decline from this exotic pest in Lycoming County, Pennsylvania.

## **Emerald ash borer, *Agrilus planipennis***

Region 9/Northeastern Area: Michigan

Host(s): Ash

A new exotic insect was detected in six southeast Michigan counties—Livingston, Macomb, Monroe, Oakland, Washtenaw, and Wayne—in the summer of 2002. This pest, known as the emerald ash borer, is an invasive species, originally from Asia and previously unknown in North America, that affects ash trees. It has also been detected in Windsor, Ontario, Canada. To date, it has killed or damaged millions of ash trees in these affected areas.

## **Gypsy moth (European),** *Lymantria dispar*

Region 1: Idaho, Montana, North Dakota, Wyoming

Host(s): Hardwoods

Cooperative detection monitoring for the gypsy moth (GM) in Region 1 with USDA Animal and Plant Health Inspection Service and State Departments of Agriculture, Forestry, and Lands continued in 2002. A network of strategically located pheromone-baited traps was placed throughout all States in Region 1. On all Federal lands in Region 1 in 2002, one gypsy moth was caught in a trap in Yellowstone National Park, Wyoming. On State lands in Region 1, no moths were caught in Idaho, Wyoming, Montana, or the Dakotas. The trapping program will continue in Region 1 next year.

Region 2: Colorado, Kansas, Nebraska, South Dakota, Wyoming

Host(s): Hardwoods

Over 1,000 detection traps and 250 delimitation traps were deployed throughout Colorado in 2002. No moths have been found in any of the traps this year. This negative result is of interest in the Arvada, Colorado, area since multiple moths were caught there in 2000 and 2001.

There have been a few moths caught in traps that were placed around the State, but no GM larvae or pupae were found on trees in South Dakota. There has not been any defoliation in the State attributed to this insect.

Region 3: Arizona

Host(s): Hardwoods

A delimiting trapping grid was placed in Payson, Arizona, in 2002 following a multiple catch in 2001. No male GM were trapped in Arizona or New Mexico in 2002.

Region 4: Idaho, Nevada, Utah

Host(s): Hardwoods

The GM was first detected in Utah in 1988. Between 1989 and 1993 almost 72,000-acres of Federal, State, and private lands were treated with *Bacillus thuringiensis* (BT). In 1995, after 2 years of intensive pheromone trapping resulted in no moth captures, the gypsy moth was declared eradicated. In 1997, 46 moths were captured in Salt Lake City and 1 moth on the adjacent Wasatch-Cache National Forest. In 1998 and 1999, the Utah Department of Agriculture, in cooperation with the USDA Forest Service, treated approximately 800 acres with BT each year in Salt Lake County. In 2000, only one moth was captured in a 10-acre mass-trapping grid. None were captured in the 2001 mass trapping grid. In 2002, one male GM was captured in the Utah GM detection program on Hill Air Force Base in northern Utah. A delimitation trapping grid will be installed in 2003.

Region 5: California

Host(s): Hardwoods

Pest Detection of the California Department of Food and Agriculture trapped three male moths in 2002—one in Fresno County and two in Los Angeles County. No properties with egg masses or pupal cases were found in 2002.

Insects: Nonnative

Region 6: Oregon, Washington

Host(s): Oaks, apple, sweetgum, other hardwoods

While no defoliation has been observed in either State, pheromone traps continue to catch moths. These catches represent either new introductions or populations not completely eradicated by previous treatments.

In Washington, one GM eradication project totaling 560 acres was conducted. No gypsy moths were caught in the treatment area in 2002. All gypsy moths caught elsewhere in the State in 2002 were single or double adults in a trap and were identified as the European strain. There are no eradication projects planned for 2003.

In Oregon, no eradication projects were conducted in 2002. However, during the pheromone trapping in 2002 one gypsy moth trap in Fisher, Oregon, caught three males of the European strain. Subsequent ground searching found fresh egg masses on the nearest house. Oregon is planning an eradication project in this area encompassing 706 acres of private and Siuslaw National Forest land.

Region 8: Arkansas, Georgia, North Carolina, Tennessee, Virginia

Host(s): Hardwoods, especially oak species

In 2002, aerial surveys detected 51,845 acres of defoliation by gypsy moth in Virginia—a significant decrease from 2001. Populations were highly variable due in part to a late spring freeze, continued drought, the effects of larval disease, and continued suppression program. Although large-area defoliation was confined to the western mountains, small pockets of defoliation increased in number and extent across the Piedmont and Coastal Plain. Virginia Department of Agriculture and Consumer Services (VDACS) conducted suppression activities on approximately 65,000 acres in 2002.

In 2002, the North Carolina Department of Agriculture and Consumer Services, in cooperation with the USDA Forest Service, carried out an eradication project for GM in western North Carolina. Delimiting trapping grids were placed around four areas that had high moth captures in 2001 in Jackson, Clay, McDowell, and Scotland Counties. A total of 60 moths were detected.

In 2002, Tennessee caught a total of 1,630 moths in 18 counties. This total reflects a decrease in the number of moths caught in comparison to 2001 (6,798 moths). As of September 2002, five areas are infested in the State. Eradication activities were conducted on 7,930 acres in Campbell County. In 2002, moths were caught in Monroe and Wilson Counties. Ground treatments and mass trapping are planned in these counties in 2003. Ground treatments in 2002 in Scott County were successful and no treatments are planned in 2003. Sevier County had zero moths for the first year (one in 2001). Cumberland County had no moth catches for the second year. Follow-up trapping will continue in Monroe and Scott Counties where ground treatments were conducted in 2002.

In 2002, Georgia set approximately 6,000 traps. Three moths were caught in the Atlanta area. No treatments are planned for 2003. Detection trapping in Arkansas revealed no new infestations, only the occasional “hitchhiker” trap catch. No treatments are planned.

The Gypsy Moth Slow the Spread (STS) Project conducted aerial treatments in seven States. In the Southern Region, STS treatments are planned for Virginia and North Carolina. In conjunction with the recent outbreaks in the generally infested areas of Virginia, STS project personnel detected and delineated a record high number of isolated infestations in the STS zone during 2000 and 2001. These infestations were subsequently treated in 2002. More than 90 percent of the treatment acreage was accomplished using mating disruption—a tactic that is specific to the GM.

Despite the fact that spread rates increased during the outbreak years, the rate of spread still averages less than 4 miles per year since 1992, when management was first implemented to reduce spread rates. This is well below the unrestricted rate of 13 miles of spread per year that was documented prior to management.



Region 9/Northeastern Area: Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, West Virginia, Wisconsin

Host(s): Apple, aspen, basswood, black walnut, northern red oak, pin oak, red oak, white oak

There was no defoliation from gypsy moth in Connecticut in 2002. Egg mass surveys at 102 sites yielded very low counts. Defoliation of hardwoods resulting from GM larval feeding was recorded on about 51,500 acres in Maine in 2002. The heaviest damage occurred in the southern part of the State around the Sanford area and east. *Entomophaga maimaiga*, virus and parasites all combined to curtail much of the GM population and kept defoliation damage to much less than the 200,000 acres that were expected. A surprising outbreak in Calais and Bering, Maine, denuded approximately 4,663 acres before *E. maimaiga* decimated the population. Egg mass levels found in the 2002 fall survey were back to endemic levels in most locations but it was expected there will be scattered locations throughout southern Maine where defoliation will occur in 2003. In Maryland, defoliation was reported on 13,739 acres of State and private lands and on about 250 acres of Federal lands in Catoctin Mountain Park, Chesapeake Marshlands National Wildlife Refuge, and Patuxent Research Refuge. In Massachusetts, a population collapse caused by the fungus, *E. maimaiga*, was observed in all areas. There were 4,744 acres of defoliation detected by aerial survey in Barnstable, Plymouth, and Worcester Counties, a decline from the 48,000 acres reported in 2001. Defoliation was expected to be minimal in 2003. In New Hampshire, defoliation occurred on 11,800 acres in Carroll, Hillsborough, Merrimack, and Rockingham Counties. Larvae killed by *Entomophaga* fungus were found throughout the infested area. Many sites had very low or no egg masses present so populations in 2003 were expected to be low. There was about 41,800 acres of defoliation in New Jersey. GM defoliation in New York was markedly down from 2001. About 7,100 acres of defoliation was recorded. As in 2001, most of the defoliation reported was on Long Island. Defoliation occurred in the following New York Counties: Nassau, Orange, Rockland, Suffolk, and Sullivan. Ohio reported 2,531 acres of defoliation. There was 55,427 acres of defoliation across the State of Pennsylvania. There was no noticeable defoliation in Rhode Island. No damage was reported in Vermont and egg mass counts indicated that populations would remain low in 2003. In West Virginia, there was 104,921 acres of defoliation reported on State and private lands and 27,276 in the Monongahela National Forest. In Wisconsin, there was 37,364 acres of defoliation detected by aerial survey.

## **Hemlock woolly adelgid,** *Adelges tsugae*

Region 8: Georgia, North Carolina, South Carolina, Tennessee, Virginia

Host(s): Eastern hemlock, Carolina hemlock

Mortality in the Southeast caused by the hemlock woolly adelgid (HWA) was aggravated by the extended drought that further stresses infested trees. The insect continued to spread south and west, with North Carolina reporting seven new counties infested in 2002. Adelgid infestations have been confirmed in 45 Virginia counties, 24 North Carolina counties, 3 Tennessee counties, and 1 county each in Georgia and South Carolina.

Because of the strong influence of spring northward-migrating songbirds in spreading this insect, the entire ranges of Carolina hemlock (*Tsuga caroliniana*) and Eastern hemlock (*T. canadensis*) are at risk.

Region 9/Northeastern Area: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, West Virginia

Host(s): Eastern hemlock

All three of Delaware's counties have HWA. In Maryland, HWA can be found in 14 counties. In New Jersey, populations were found in every county. Tree mortality was reported in Morris, Passaic, Sussex, and Warren Counties from this insect. In Pennsylvania, HWA continued to be found in 39 counties within the natural range of hemlock. Aerial surveys reported hemlock defoliation on 658 acres in Northampton,

## Insects: Nonnative

Warren, Pike, Monroe, and Schuylkill Counties. In West Virginia, HWA was reported in two new counties (Preston and Fayette) bringing the total to 18 counties where this exotic pest occurs.

This pest continued to occur in all 169 towns in Connecticut. Additional stress on hemlock trees came from the elongate scale and circular scale insects. Drought was also a contributing factor. There were no predator beetles released in Connecticut in 2002. In Maine, the adelgid has been found and eradicated in 120 planted hemlocks since 1999. All infested hemlocks have been linked to tree shipments from infested areas in other States. The trees were treated and removed before the insect spread to native stands. In 2002, HWA was detected in 21 trees on 10 landscape sites in the towns of Lubec, Bar Harbor, Camden, Rockland, Southport, Kittery Point, York, and York Harbor. Treated sites will continue to be monitored for a period of 5 years. HWA was not established in Maine on native hemlocks. In Massachusetts, this pest continued to be of major concern. Infestations were documented in 39 communities (no new counties) that were not previously known to have infestations. Isolated areas of decline and mortality totaling 114 acres were recorded. The State continued to release the predator beetle, *Pseudoscymnus tsugae*. There were eight release sites with a total of 56,633 beetles having been released since 1999. In New Hampshire, only the town of Portsmouth in Rockingham County was infested, however, the entire county was quarantined. In 2002, one additional site was found each in Hillsborough and Merrimack Counties. Eradication attempts seem to have been successful at those sites and these counties are not quarantined. It was believed the new sites were infested by natural spread of the adelgid by birds. This insect pest was found in two new counties in New York in 2002: Delaware and Monroe. The infestation in Monroe County appears to have been brought in on nursery stock. To date only 10 infested trees have been found there. These trees were divided between two sites and were treated with dormant oil and pesticides. In the southeastern part of the State, spread of the insect by wind, wildlife, and humans continued unchecked, particularly along the Hudson River. The mild winter of 2002 was probably helpful to adelgid survival. If the trend continues, Albany, Rensselaer, and Schoharie Counties are all in imminent danger of infestation. There was about 3,000 acres of hemlock defoliation and mortality detected by aerial surveys. In Rhode Island, this pest occurred in all 39 cities and towns. Many landscape trees are treated but forest grown hemlocks continued to decline.

## **Larch casebearer, *Coleophora laricella***

Region 1: Idaho, Montana

Host(s): Western larch

In 2002, there were no areas in western Montana or northern Idaho where visible defoliation caused by larch casebearer was recorded by aerial or ground surveys. The population that caused defoliation from 1997-2001 has declined to very low, undetectable levels. Rates of parasitism were monitored each year of the outbreak, but levels did not seem high enough to totally account for the population decline. Other causes were not determined. Affected areas will be occasionally monitored for a resurgence of populations; but we do not anticipate defoliation in 2003.

Region 6: Oregon, Washington

Host(s): Western larch

After years of negligible occurrence, larch casebearer-caused defoliation of western larch slowly increased to 15,836 acres in 1999. Since then defoliation has declined to approximately 248 acres in 2002; three polygons totaling 241 acres were mapped on the Mt. Hood National Forest and an additional 7 acres were mapped on the Umatilla National Forest.

**Larch sawfly,**  
*Pristiphora erichsonii*

Region 10: Alaska

Host(s): Eastern larch, Siberian larch

The most recent larch sawfly epidemic, which began in 1993 and eventually impacted 450,000 acres of larch throughout interior Alaska, appears to be over. No current larch sawfly activity was observed during 2002 aerial surveys.

**Pear thrips,**  
*Taeniothrips inconsequens*

Region 9/Northeastern Area: New Hampshire, Vermont

Host(s): Red maple, sugar maple

There was no noticeable defoliation in New Hampshire in 2002. In Vermont, over-wintering populations were down 85 percent from 2000 and 2001 levels. Damage was very light and widely scattered.

**Pink hibiscus mealybug,**  
*Maconellicoccus hirsutus*

IITF: Puerto Rico, Virgin Islands, Florida

Host(s): Hibiscus, many other species

The pink hibiscus mealybug (PHM) is a serious pest of over 200 plant species and is known to occur on more than 20 Caribbean Islands. It was detected in Puerto Rico in 1997, but to date no infestations have been identified on the Caribbean National Forest. Frequent monitoring surveys are conducted, assisted by the USDA Forest Service. It appears that parasitoids were introduced simultaneously with the mealybug, reducing the impacts in Puerto Rico. With support from the USDA Forest Service and Animal and Plant Health Inspection Service, the Puerto Rico Department of Agriculture continues to rear and release two species of parasitic wasps to combat the PHM. Surveys indicate population reductions of 85-90 percent have been achieved at the parasitoid release sites.

An infestation was detected in Miramar County, Florida, in June 2002. By mid-July, it had spread to Broward and Miami-Dade Counties and encompassed 22 square miles. The USDA and the Florida Division of Plant Industry initiated weekly releases of parasitoids in the infested areas. Because of the large number of known host species in Florida, extension agents continue to carefully monitor for this pest. Timely biological control should reduce impacts and retard spread.

**Red pine scale,**  
*Matsucoccus resinosae*

Region 9/Northeastern Area: Massachusetts, Rhode Island

Host(s): Red pine

In Massachusetts, there were several new stands with a total of 172 acres of defoliation identified during the annual aerial survey. These stands were in the same area of Hampden and Hampshire Counties where

Insects: Nonnative

infestations occurred in 2001. Scale occurred statewide in Rhode Island. Salvage harvesting continued but there is concern that mortality in inaccessible areas may contribute to wildland fire fuel buildup.

**Red-haired pine bark beetle,**  
*Hylurgus ligniperda*

Region 9/Northeastern Area: New York

Host(s): Pine

Since the detection of this beetle at a Christmas tree farm Rochester, New York, in 2000, similar infestations have been found elsewhere in Monroe County, as well as in two adjacent counties, Ontario and Wayne. The beetle generally infests stumps of several pine species, but it is feared that it could vector destructive *Leptographium* fungi to living trees. The beetle appeared to be well established and capable of further natural spread in the State.

**Redgum lerp psyllid,**  
*Glycaspis brimblecombei*

Region 5: California

Host(s): *Eucalyptus camaldulensis*, *E. radis*, *E. globulus*, *E. diversicolor*, *E. sideroxylon*

This exotic now occurs in practically all California counties with red gum eucalyptus.

**Satin moth,**  
*Leucoma salicis*

Region 9/Northeastern Area: Maine, New Hampshire

Host(s): Aspen

Defoliation of both quaking and bigtooth aspen by satin moth in Maine was very limited and difficult to distinguish from dieback, which resulted from past feeding damage. The area between Millinocket Lake and Mt. Katahdin in central Penobscot and Piscataquis Counties had sustained heavy damage in recent years, but exhibited little or no feeding activity in 2002. Data from light traps had few moths and suggest the downtrend will continue in 2003. There was heavy defoliation in aspen along highways in New Hampshire.

**Smaller Japanese cedar longhorn beetle,**  
*Callidiellum rufipenne*

Region 9/Northeastern Area: Connecticut

Host(s): Northern white-cedar, juniper

The smaller cedar longhorn beetle, a native to Japan, Korea, Taiwan, and eastern China, was first seen in the United States in Milford, Connecticut, in 1998 in the branch of a live arborvitae, *Thuja occidentalis*. Quarantine remained in effect in several northeastern counties.

**Spruce aphid,**  
*Elatobium abietinum*

Region 3: Arizona

Host(s): Engelmann spruce, blue spruce

In Arizona, spruce aphid was seen during ground surveys but defoliation was not observed during the aerial detection flights. No spruce aphid activity was observed in New Mexico.

Region 5: California

Host(s): Sitka spruce

Infestations of the spruce aphid are a chronic problem on planted Sitka spruce in the Eureka area, Humboldt County. Recent reports have indicated that damaging infestations have expanded into native stands and a survey of Sitka spruce from Ferndale to Stone Lagoon confirmed that many trees, both native and planted, exhibit symptoms of infestation.

Region 10: Alaska

Host(s): Sitka spruce

In southeast Alaska, spruce aphid activity declined from 20,200 acres reported in 2001 to 2,336 in 2002. A period of very cold weather during the first week of April apparently killed many of the overwintering aphids. The majority of the aphid activity identified this year (1,640 acres) occurred on national forest lands. The greatest concentrations of infested acres were on the outer islands near Craig (791 acres) and on the northeast facing shore of Lynn Canal (478 acres).

**Uglynest caterpillar,**  
*Archips cerasivoranus*

Region 10: Alaska

Host(s): Cotoneaster, crabapple, mountain ash

In 2001, Cooperative Extension Service and Alaska Division of Forestry entomologists found the uglynest caterpillar on cotoneaster and mountain ash hedge plantings in west Anchorage, downtown, and in south Anchorage. Moderate to heavy defoliation occurred in the same areas in 2002, significantly expanding along mountain ash row plantings in the downtown area. In 2002, uglynest caterpillar feeding was also observed on apple and crabapple (*Malus* spp.); moderate to severe branch dieback was also noted on mountain ash in the downtown area.

**Unnamed bark beetle,**  
*Hylurgops palliatus*

Region 9/Northeastern Area: Pennsylvania

Host(s): Pine, larch, spruce

This European bark beetle was recovered for the first time in North America in a forest stand of Norway spruce, Scotch pine, and red pine in Erie, Pennsylvania. Prior to 2001, this species has been the third most

#### Insects: Nonnative

frequently intercepted exotic bark beetle at ports in the United States. This species is known to breed in log stumps and basal portions of dead and dying host trees in Europe. The threat that it represents to these conifer hosts in the United States and Canada is uncertain. Surveys in 2002 revealed that this exotic bark beetle is established and present throughout much of Erie County, Pennsylvania. Surveys in western New York, western Pennsylvania, and eastern Ohio in 2003 should determine the extent of its presence in this region.

## Diseases: Native

### **Annosus root disease, *Heterobasidion annosum***

Region 1: Idaho, Montana

Host(s): Douglas-fir, grand fir, ponderosa pine, subalpine fir, western hemlock

Annosus root disease is common in ponderosa pine stands in western Montana. Most damage is concentrated in lower elevations where ponderosa pine is the dominant tree species and past harvesting of large trees has been common. Presence of annosus root disease in ponderosa pine stands greatly decreases the potential for managing ponderosa pine. These sites are usually too dry to effectively grow alternative tree species, so preventing the introduction and subsequent increase of annosus root disease is crucial for managing ponderosa pine. Annosus root disease is widespread at low levels on Douglas-fir and true firs in mixed conifer stands throughout western Montana and northern Idaho. It is frequently found in association with other root diseases, and appears to be involved in a decline of subalpine fir in high elevations.

Region 3: Arizona, New Mexico

Host(s): True firs, ponderosa pine

This root disease fungus is common in the region, functioning as both a pathogen and a saprophyte. It causes scattered mortality in spruce-fir, mixed conifer, and ponderosa pine forests throughout the region. Mortality rates are typically highest in young regeneration.

Region 4: California, Idaho, Nevada, Utah, Wyoming

Host(s): Bitterbrush, chokecherry, Douglas-fir, Jeffrey pine, lodgepole pine, ponderosa pine, spruce, true firs

This disease can be found throughout the region, but mostly as a saprophyte on dead trees, stumps, roots, and cull logs or fallen stems. The fungus occasionally kills young ponderosa pine especially in plantations on droughty soils.

Region 5: California

Host(s): Conifers, some hardwoods

Annosus root disease was identified in ponderosa pine in the Hirz Bay Campground on the Shasta-Trinity National Forest. The pathogen was isolated from samples taken from dead seedlings and saplings in pockets of mortality within areas replanted after the 1992 Cleveland Fire on the Eldorado National Forest.

Region 6: Oregon, Washington

Host(s): True firs, ponderosa pine, western hemlock

Annosus root disease causes losses in many partially cut white and grand fir stands in southern and eastern Oregon and eastern Washington. Damage is often especially severe in subalpine fir and is associated with smaller stumps than other true fir species. Mortality is high where annosus root disease and fir engravers operate as a complex. The Region 6 Current Vegetation Survey requires examination of cut stumps. This has led to increased reporting and awareness of annosus root disease on many national forests. In eastern portions of the region, where many stands were cut 10-20 years ago, trees surrounding cut stumps are

Diseases: Native

dying. Disease severity is expected to increase with time. Annosus root disease was observed with increasing frequency in stands, which are predominantly ponderosa pine on drier sites in eastern Washington and Oregon, and in true fir species in mixed conifer, and true fir stands throughout southwest Oregon.

Reports of the disease in mountain hemlock and Pacific silver fir in high-elevation stands in the Cascade Range are also increasing. Annosus root disease in low-elevation western hemlock stands primarily causes butt rot. Impacts are considered low unless stands are managed at rotations greater than 120 years.

Region 8: Regionwide

Host(s): Southern pines

A South Carolina Forestry Commission survey showed that annosus root disease has been increasing in severity and occurrence for several years. Losses averaged 2 cords per acre. A total of 31 counties had some level of apparent annosus-caused loss. Total acreage affected was 53,850, and direct loss was placed at \$1.94 million.

In Florida, annosus root disease is a serious occasional problem in pine plantations. The disease has necessitated the premature harvesting of several infected plantations, including at least one Conservation Reserve Program (CRP) plantation. The disease is expected to be increasingly problematic as thinnings and other partial harvests are scheduled. In Georgia, annosus root disease remains problematic throughout the State on high hazard sites, especially in older CRP plantations that have been thinned.

One industrial forest landowner in Alabama reported severe losses from annosus root disease in thinned 20- to 30-year-old loblolly pine plantations. A Federal installation in Mississippi also reported some suspected root disease that was causing growth loss and mortality. An evaluation of this area is planned for 2003.

Region 9/Northeastern Area: Rhode Island, Wisconsin

Host(s): Red pine

In Wisconsin, annosus root rot was first reported in 1993 as a cause of mortality in a red pine plantation in Adams County. Since then 10 counties have been found to harbor the disease. A survey conducted found about 3.8 percent of stands in these counties are infected by annosus root rot. There were 12 acres of damage mapped by aerial survey on Narragansett Indian Lands in Washington County, Rhode Island.

## **Anthracnose, *Gnomonia* spp.**

Region 9/Northeastern Area: Massachusetts, New Jersey, New York, Vermont, West Virginia

Host(s): American sycamore, ash, beech, birch, maple, oak, other hardwoods

In Massachusetts, 780 acres of oak species in Worcester County experienced defoliation. Most healthy trees recovered, but unhealthy trees that are showing signs of decline because of drought will probably experience further decline in 2003. In New York, ash anthracnose was observed on green and white ash in Orange County, and sycamore anthracnose was reported from several locations across the State. Neither was observed to cause any severe damage. Heaviest damage in southern Vermont occurred on sycamore trees.

The wet spring weather created an environment for heavy infection of sycamore with anthracnose over most of northern New Jersey; however, the sycamores fully recovered by July with a second set of leaves. In West Virginia, anthracnose disease of hardwoods was widespread throughout the State, causing moderate to heavy damage. Moisture conditions in West Virginia influenced the severity of this disease. Although the spring weather was very moist, the summer was largely hot and dry.



## **Armillaria root disease, *Armillaria* spp.**

Region 1: Idaho, Montana

Host(s): Douglas-fir, other conifers

This pathogen is the most broadly distributed of the root pathogens and the most important disease agent. It usually occurs in conjunction with annosus root disease, laminated root rot, or brown cubical root and butt rot. *Armillaria* can kill conifers of all species when they are young, but only Douglas-fir, subalpine fir, and grand fir remain highly susceptible throughout their lives. Consequently, the damage is much greater in the latter species where severe disease often renders formerly forested sites to long-term shrub fields.

Region 2: Colorado, South Dakota, Wyoming

Host(s): Engelmann spruce, Colorado blue spruce, Douglas-fir, hardwoods, lodgepole pine, ponderosa pine, subalpine fir, white fir

*Armillaria* is the most common root disease in the region. Its impacts continue to be especially evident in the mixed conifer and spruce-fir cover types. *Armillaria* is among the key causal agents contributing to subalpine fir decline, which accounts for the most tree mortality in the Rocky Mountain Region. *Armillaria* incidence in developed recreation sites in Colorado has resulted in heightened awareness among resource managers and numerous tree removal projects. Permanent plots have been established to assess the role of this and other root diseases in the region.

Region 3: Arizona, New Mexico

Host(s): Douglas-fir, ponderosa pine, true firs, spruce, aspen

*Armillaria* is the most common (and the most easily recognized) root disease fungus in the region, functioning as both a pathogen and a saprophyte. It causes scattered mortality in spruce-fir and mixed conifer forests throughout the region. Some ponderosa pine sites, particularly those on pumice-derived soils, sustain significant mortality. Mortality rates are typically highest in young regeneration. Permanent plots have been established to assess the role of this and other root diseases.

Region 4: Idaho, Nevada, Utah, Wyoming

Host(s): Douglas-fir, grand fir, pine, spruce, subalpine fir

Evidence of *Armillaria* root disease can be found throughout the region. It functions primarily as a weak pathogen or saprophyte causing little direct mortality. In southern Utah, it may act as a primary pathogen, killing mature and immature ponderosa pine and mature fir and spruce on cool sites at high elevation.

Region 5: California

Host(s): Conifers, some hardwoods

White mycelial fans characteristic of *A. mellea* were found at the base of recently killed pines planted in 1993 or 1995 within the 1992 Cleveland Fire on the Eldorado National Forest. Live sprouts of California black oak were within 20 feet of the dead trees and probably provided the source of inoculum.

Diseases: Native

Region 6: Oregon, Washington

Host(s): Conifers

The most serious losses from this disease have occurred east of the Cascade Range in mixed conifer stands. Armillaria root disease continues to be the most severe root disease in northeastern Oregon. It is also the most commonly encountered root disease in eastern Washington. Mortality continues in both disturbed and undisturbed stands. True firs and Douglas-fir sustain the most losses. However, in localized areas, ponderosa pine mortality is significant.

Disturbance and conversion to more susceptible hosts have caused this root disease to increase in occurrence and severity over historic conditions. The world's largest known root disease clone has been confirmed on the Malheur National Forest in eastern Oregon and covers about 2,400 acres. This clone and the adjacent associated armillaria root disease complex is being investigated by scientists with the Pacific Northwest Research Station and Oregon State University. A number of other large concentrations of armillaria root disease are known throughout the Blue Mountains.

In mid- to high-elevation stands in the Cascades of southwestern Oregon, armillaria root disease causes mortality of several conifer species. Mortality on lower slopes west of the Cascades and in the Coast Range is usually confined to younger, stressed trees. Assessing species resistance on a site-by-site basis and discriminating for the more resistant species during stand management activities are considered the most effective means of controlling spread and mortality.

**Black stain root disease,**  
***Leptographium wageneri***  
***Ophiostoma wageneri***

Region 3: New Mexico

Host(s): Piñon pine, Douglas-fir

Both *Leptographium wageneri* var. *wageneri*, affecting piñon, and *L. wageneri* var. *pseudotsugae*, affecting Douglas-fir, are rare in the Southwestern Region. The former has only been confirmed in two isolated areas in northern New Mexico, while the latter has been observed on a single site in southern New Mexico.

Region 4: Idaho, Nevada, Utah

Host(s): Pinyon pine

Aerial detection and follow-up ground surveys have discovered about two-dozen root disease centers in pinyon pine stands in Region 4. Perennial infections caused mortality of individual pinyon pine over 50 acres of the Bureau of Land Management Burley District in southern Idaho. In Utah and Nevada, the host is more prevalent. The infected acreage totals 1,150 acres on the Humboldt-Toiyabe National Forest in Nevada and 1,350 acres on the Dixie and Manti-LaSal National Forests in Utah. In many cases the areas with black stain have now been infested with pinyon engraver beetles.

Region 5: California

Host(s): Douglas-fir, Jeffrey pine, pinyon pine, ponderosa pine

Black stain root disease and associated bark beetles continued to kill ponderosa pines on a site south of Viola, Shasta County. Black stain was also identified in two ponderosa mortality areas located during aerial surveys of Crowder Flat, Modoc National Forest. Pockets of infection were also found in 40-year-old, planted Douglas-fir on the Happy Camp District, Klamath National Forest.

Region 6: Oregon, Washington

Host(s): Douglas fir, ponderosa pine

In southwestern Oregon, black stain root disease is the most commonly encountered disease in Douglas-fir plantations. High-risk areas are those where disturbances, such as road building or soil compaction, have occurred or where road maintenance equipment injured roadside Douglas-firs. Infected larger individuals are found scattered in previously entered forest stands.

Black stain root disease continues to be observed on ponderosa pine east of the Cascades; it is widespread on the southeastern portion of the Malheur National Forest. Some smaller localized infestations are known in other portions of the Blue Mountains. Black stain root disease is seen infrequently in eastern Washington. Pacific Northwest Research Station scientists are investigating relationships with natural and prescribed fire, vector insects, and management strategies.

### **Botryosphaeria canker, *Botryosphaeria* spp.**

Region 9/Northeastern Area: Pennsylvania

Host(s): Chestnut oak

Ground surveys found this fungus causing dieback and declines of chestnut oak on 8,000 acres in Carbon, Columbia, Lackawanna, and Luzerne Counties, Pennsylvania.

### **Brown cubical root and butt rot, *Phaeolus schweinitzii***

Region 1: Idaho, Montana

Host(s): Douglas-fir, other conifers

Brown cubical root and butt rot is common on mature Douglas-fir throughout its range. Damage is mainly due to defect and growth loss, rather than mortality, although it is often associated with endemic levels of Douglas-fir bark beetle. It is frequently found in association with other root diseases, especially armillaria, in dead trees.

Region 3: Arizona, New Mexico

Host(s): Douglas-fir, other conifers

This disease is common on old Douglas-fir in many parts of the region. It causes defect and can contribute toward blowdown.

Diseases: Native

**Cercospora blight,**  
*Cercospora sequoiae* var. *juniperi*

Region 2: Nebraska

Host(s): Rocky Mountain juniper, eastern redcedar

This disease continues to severely defoliate and kill junipers and redcedars in windbreaks in central and eastern Nebraska.

**Cytospora canker,**  
*Cytospora abietis*

Region 5: California

Host(s): Red fir, white fir

Cytospora canker is typically found in association with branch infections of true fir dwarf mistletoe (*Arceuthobium abietinum*) in red and white fir. A second year of drought accentuated expression of branch mortality (flagging) on South Fork Mountain and in several wilderness areas in northwestern California. Flagging associated with infections was also seen on Robinson Flat, Tahoe National Forest, and Grizzly Summit, Plumas National Forest.

**Cytospora canker,**  
*Cytospora chrysosperma*

Region 5: California

Host(s): Poplar, willow

*Cytospora chrysosperma* was detected in poplars and willows at lower elevations on the east side of the Sierra Nevada and southern Cascade Mountains. Areas with high mortality were limited to drier locations. Scattered willow dieback could be detected in nearly all stands and in some areas as much as 60 percent of the willow stems were killed. Non-native poplars, especially Lombardy poplars, suffered severe dieback and even mortality. It is not clear whether drought or cytospora infection was the major cause of the observed mortality.

**Diplodia blight of pines,**  
*Sphaeropsis sapinea* (*Diplodia pinea*)

Region 2: Nebraska, South Dakota

Host(s): Ponderosa pine, Austrian pine, Scotch pine

In 2002, trees on about 400 acres of forest land, urban land, and agroforestry land had serious infections of diplodia tip blight. The disease is common throughout South Dakota, particularly on Austrian pine. There has also been an increase in the incidence of the disease in the Black Hills due to spring hail storms. In eastern Nebraska, the disease continues to be a serious problem in pine windbreaks and landscape plantings. In Kansas, the disease was at moderate levels in 2002.

Region 5: California

Host(s): Gray pine, ponderosa pine

Prior to an outbreak that developed in the 1990s, this disease was rarely reported in northern California. Damage from the disease has steadily decreased in recent years. The disease, however, still persists at low levels in some areas, e.g., the upper Sacramento River Canyon. Similarly, widespread foliar and twig dieback of ponderosa pine caused by *S. sapinea* has all but disappeared from the central and southern Sierra Nevada. Long-term effects of the outbreak in the 1990s are unknown and the health of 20 overstory ponderosa pine near Groveland are being followed to document and track the effects of the blight.

### **Douglas-fir needle cast, *Rhabdocline pseudotsugae***

Region 6: Oregon, Washington

Host(s): Douglas-fir

There was above normal occurrence of Douglas-fir needle cast in Douglas-fir in northeast Washington, especially the Republic area.

### **Dwarf mistletoes, *Arceuthobium* spp.**

Region 1: Idaho, Montana

Host(s): Douglas-fir, lodgepole pine, ponderosa pine, limber pine, whitebark pine, western larch

Lodgepole pine dwarf mistletoe occurs on approximately 2 million acres (28 percent) of the lodgepole pine type in Region 1 and causes about 18 million cubic feet of growth reduction annually. Douglas-fir dwarf mistletoe occurs on about 0.6 million acres (13 percent) of Douglas-fir, reducing growth by approximately 13 million cubic feet annually. Western larch dwarf mistletoe occurs on about 0.8 million acres (38 percent) of western larch stands and reduces annual growth by over 15 million cubic feet. Dwarf mistletoes are locally severe within ponderosa pine stands around Coeur d'Alene, Idaho, and along the Spokane River drainage in northern Idaho. Limber pine and whitebark pine are heavily infected in localized areas in Montana, with higher infection levels east of the Continental Divide.

Region 2: Colorado, Wyoming

Host(s): Douglas-fir, limber pine, lodgepole pine, ponderosa pine

Dwarf mistletoes cause the greatest amounts of disease losses in the Rocky Mountain Region. Program emphasis continues for landscape-scale surveys and resulting suppression projects in developed recreation sites and wood fiber production areas. Dwarf mistletoe presence along with expanding mountain pine beetle populations complicates efforts to meet certain resource management goals. In conjunction with mild winter conditions and a period of drought years, these parasitic plants are contributing to mortality in many areas of the Front Range, including the Red Feather Lakes area; Estes Park; much of the higher elevation portions of Boulder, Clear Creek, and Gilpin Counties; the Jarre Canyon area of Douglas County; Park County including South Park; and the foothills west of Colorado Springs in El Paso County. Dwarf mistletoe is also a continuing problem in the Black Forest northeast of Colorado Springs in ponderosa pine.

Diseases: Native

Region 3: Arizona, New Mexico

Host(s): Pines, Douglas-fir, spruce, true firs

Dwarf mistletoes continue to be the most widespread and damaging pathogens in the Southwest. Three species of dwarf mistletoe—those affecting ponderosa pine, piñon pine, and Douglas fir—occur throughout most of the ranges of their hosts, while five other species have more limited distributions. Roughly 2.2 million acres of commercial ponderosa pine forest is infected, resulting in an estimated 25 million cubic foot volume loss annually.

Region 4: Idaho, Nevada, Utah, Wyoming

Host(s): Douglas-fir, pine, true firs, spruce, western larch

These plant parasites remain the most widespread and frequently observed disease within Region 4. Regional incidence by major host species is estimated as follows: lodgepole pine, 50 percent; ponderosa pine, 20 percent; and Douglas-fir, 20 percent. These percentages by host type represent stands having some level of infection.

Region 5: California

Host(s): Douglas-fir, pines, true firs

Areas of heavy dwarf mistletoe infection revealed themselves again this year as drought conditions created severe water stress in infected trees. Heavily infected trees on poorer sites suffered severe branch dieback and, in some cases, died. Some of the more dramatic locations where this occurred were east of Chilcoot and south of Doyle, Plumas National Forest, and Harvey Mountain and northwest of Eagle Lake, Lassen National Forest. Dwarf mistletoes plus drought contributed to the high rates of tree mortality in some parts of southern California.

In an unusual situation, red fir dwarf mistletoe (*Arceuthobium abietinum* f.sp. *magnificae*) was found infecting intermingled Brewer spruce at Eaton Lake in the Russian Wilderness on the Klamath National Forest.

Region 6: Oregon, Washington

Host(s): Conifers

Dwarf mistletoes are present on approximately 9.5 million acres of forested lands in the Pacific Northwest Region. Their status changes little from year to year. However, long-term impacts, including reduced growth, mortality, deformity, and top-kill, are significant, particularly in unmanaged stands. Most conifer species are affected to some degree. Douglas-fir dwarf mistletoe is abundant east of the Cascades and in southwestern Oregon. Western larch dwarf mistletoe causes significant effects in northeastern Oregon and eastern Washington. The intensity of dwarf mistletoes in eastern Oregon and Washington and in southwest Oregon is closely related to fire ecology. Lack of frequent, periodic fire in the last century has allowed infection levels to increase on many sites, especially those where mistletoe was not culturally controlled. New management policies including green tree retention requirements, and restrictions on silvicultural treatment of certain sensitive areas and large diameter trees will reduce sanitation opportunities, and allow mistletoe intensification in the future. New information about wildlife use of dwarf mistletoe is leading to retention of infected trees in some locations.

Region 9/Northeastern Area: Maine, New Hampshire, New York, Vermont

Host(s): Black spruce, red spruce, white spruce

Severe damage as the result of infection by this parasitic plant continued to occur in stands of white spruce in coastal areas of Maine. Evidence of significant mistletoe infestation was noted in 2002 on coastal headlands and islands from Machias in the east to the Boothbay region in the west. Landscape trees succumb each year in the area of coastal residences. Dwarf mistletoe also frequently occurred on black spruce, particularly in inland bogs, and on red spruce in many forest situations. Scattered occurrences continued in New Hampshire, New York, and Vermont.

Region 10: Alaska

Host(s): Western hemlock

Hemlock dwarf mistletoe is an important disease of western hemlock in unmanaged, old-growth stands throughout southeast Alaska as far north as Haines. Hemlock dwarf mistletoe continues to cause growth loss, top-kill, and mortality in old-growth forests; its impact in managed stands depends on the abundance of large infected trees remaining on site after harvesting. The incidence of dwarf mistletoe varies in old-growth hemlock stands in southeast Alaska from stands in which every mature western hemlock tree is severely infected to other stands in which the disease is minimal. The dominant small-scale (canopy gap) disturbance pattern in the old forests of coastal Alaska favors the short-range dispersal mechanism of hemlock dwarf mistletoe and may explain the common occurrence of the disease here. The disease is uncommon on any host above elevations of approximately 1,000 feet. We have found the aggressive heart rot fungus *Phellinus hartigii* associated with large mistletoe brooms on western hemlock.

## **Elytroderma needle blight,** ***Elytroderma deformans***

Region 1: Idaho, Montana

Host(s): Ponderosa pine, lodgepole pine

Elytroderma needle blight has been heavy in several areas of western Montana for a number of years: Jette Lake area north of Polson and the Bitterroot Valley south of Missoula. It is widespread but at generally low levels throughout northern Idaho.

Region 5: California

Host(s): Jeffrey pine, ponderosa pine

Branch mortality on young pines caused by Elytroderma was observed in Lassen Volcanic National Park along Highway 89 near Manzanita Lake, at Eskimo Summit on Highway 44, and at Moon Light Pass, Lassen National Forest. Elytroderma disease continues to be widespread on Jeffrey pines in the vicinity of Laguna Mountain, Descanso Ranger District, Cleveland National Forest.

Diseases: Native

**Fusiform rust,**  
*Cronartium quercuum f. sp. fusiforme*

Region 8: Regionwide

Host(s): Southern pines, especially loblolly and slash pines

Fusiform rust continues to be the most significant disease of loblolly and slash pine in the South, although there were no survey reports generated this summer. Anecdotal reports suggest that the incidence of main stem infection is decreasing, and that the disease is becoming more confined to branches where the impact is minimized. The Resistance Screening Center in Asheville continues to screen seed lots for fusiform rust resistance.

**Hemlock needle cast,**  
*Fabrella tsugae*

Region 9/Northeastern Area: Pennsylvania

Host(s): Eastern hemlock

Ground surveys detected 40 acres of eastern hemlock moderately affected by this fungal pathogen in Sullivan County, Pennsylvania.

**Hypoxyton canker,**  
*Hypoxyton spp.*

Region 8: Regionwide

Host(s): Oaks

The summer of 2002 saw a large number of reports of hypoxyton canker (caused by *Hypoxyton* spp.) on oaks and other species in the South, especially in the Appalachian Mountains. Damage seems most severe on south-facing slopes and on shallow, rocky sites stressed by drought. Hypoxyton canker often proliferates under conditions that stress its hosts. The North Carolina Division of Forest Resources reports not only a much higher incidence of the disease on forest trees, but on shade trees as well.

**Incense-cedar rust,**  
*Gymnosporangium libocedri*

Region 5: California

Host(s): Incense-cedar

Incense cedar rust combined with drought and high stand densities may be the cause of scattered cedar mortality and branch dieback near Portola during the summer. Nearly all cedars in this area were infected and many had fading brooms.



**Laminated root rot,**  
*Phellinus weirii*

Region 1: Idaho, Montana

Host(s): Douglas-fir, grand fir

This disease is most severe on sites that historically may have supported primarily western white pine and western larch. These tree species have been replaced by highly susceptible Douglas-fir, grand fir, and subalpine fir with consequent increases in this pathogen. Like armillaria, and usually in conjunction with armillaria and/or annosus root disease, this pathogen often converts formerly forested sites to long-term shrub fields.

Region 6: Oregon, Washington

Host(s): Conifers

Laminated root rot is the most serious forest tree disease west of the Cascade Mountain crest in Washington and Oregon. Overall, an estimated eight percent of the area with susceptible host species is affected in this portion of the region. Locally, 15 to 20 percent of an area may be affected. East of the Cascade crest, laminated root rot affects mixed conifer stands north of the Crooked River in central and northeastern Oregon, and throughout eastern Washington. Effects of the disease include significant changes in species composition, size, and structure. Regeneration of susceptible species in root disease centers may not grow beyond sapling and pole size. Hardwood trees and shrubs, which are immune to the fungus, often increase their site occupancy.

**Lodgepole pine needle cast,**  
*Lophodermella concolor*

Region 6: Oregon, Washington

Host(s): Lodgepole pine

Appearance of this needle disease on lodgepole pine is sporadic and strongly influenced by weather conditions. Infected trees will shed foliage prematurely, and vigor and growth may be reduced with successive years of infection. Over 78 percent of the trees with heavy discolorations of the lower crowns of lodgepole pine, typical of lodgepole pine needle cast, were detected on the Gifford-Pinchot and Mt. Hood reporting areas, the bulk occurring on Federal lands. Areas mapped as affected by lodgepole pine needle cast in 2002 totaled 7,006 acres, up from the 5,235 acres reported in 2001.

**Madrone canker,**  
*Natrassia mangiferae* and/or *Botryosphaeria dothidea*

Region 5: California

Host(s): Pacific madrone

Madrone mortality and dieback caused by twig and branch cankers continued to increase in 2002. Cankers were present from the north end of the Yolla Bolla Wilderness to the Oregon border. Areas where madrone canker was particularly visible were along the major streams in the region and in the Trinity Alps Wilderness.

Diseases: Native

## **Oak wilt,** *Ceratocystis fagacearum*

Region 2: Nebraska, Kansas

Host(s): Red oak, bur oak

Oak wilt continues to be a problem in forests along the eastern edge of Kansas and Nebraska. Only a few cases of oak wilt were reported in extreme northeast Kansas, occurring in woodlots and in housing developments built in oak stands. This year had light to moderate damage in both States.

Region 8: North Carolina, Tennessee, Texas, Virginia

Host(s): Live oaks, red oaks

Oak wilt continues to be a devastating tree killer in 66 central Texas counties. Urban, suburban, and rural oaks are affected. Live oak is a premier shade tree species in the region and is highly valued for beauty, shade, and wildlife benefits. The Texas Forest Service completed the 15<sup>th</sup> year of cooperative suppression of the disease. Since this project's inception, more than 2.9 million feet (more than 550 miles) of barrier trenches have been installed on more than 2,000 oak wilt infection centers in 34 counties. Oak wilt foresters with the Texas Forest Service conducted aerial surveys for oak wilt infection centers over about 3.1 million acres in central Texas in 2002.

In Tennessee, oak wilt aerial survey flights over Lincoln, Franklin, Moore, and Marion Counties were negative this summer. The North Carolina Division of Forest Resources reported in its 2002 survey 25 oak wilt infection centers in the Appalachian Mountain counties of Buncombe, Haywood and Jackson.

Region 9/Northeastern Area: Illinois, Iowa, Indiana, Minnesota, Michigan, Minnesota, Missouri, West Virginia, Wisconsin

Host(s): Black oak, bur oak, pin oak, red oak, scarlet oak

Aerial surveys in West Virginia for oak wilt disease were conducted in Grant and Hardy Counties where 17 and 3 oak wilt centers were found respectively. Additionally, aerial surveys were conducted over the four historically oak wilt free counties of Brooke, Ohio, Tucker, and Webster, and no oak wilt was detected.

Oak wilt continues to be the single most important disease in the Central States. In the last 2 years, 15 counties in Missouri have been confirmed to have the disease. Barron County in Wisconsin was added to the list of infected counties in 2002.

## **Pine wilt,** *Bursaphelenchus xylophilus*

Region 2: Nebraska, South Dakota

Host(s): Ponderosa pine, Scotch pine, Austrian pine

Heavy mortality linked to this nematode was found frequently throughout Kansas, mostly affecting Scotch pine. Drought exacerbated the problem, and more cases occurred in Austrian pine in southeast Kansas.

Heavy mortality linked to this nematode was found frequently throughout southeastern Nebraska, mostly affecting Scotch pine.

While the nematode has been extracted from ponderosa pines near Fort Meade, South Dakota, the disease pine wilt has appeared only occasionally in Scotch pine and Austrian pine in southern South Dakota. In

2002, however, approximately 10 acres of dead trees in several windbreaks were identified with the disease.

## **Ponderosa pine needle cast, *Lophodermella* spp.**

Region 2: Colorado

Host(s): Ponderosa pine

In 2001 and 2002, ponderosa pines across the San Juan, Grand Mesa, Uncompahgree, and Gunnison National Forests showed foliage discoloration caused by this needle cast fungus. Trees of all sizes were discolored and the needles eventually lost, leading to an appearance of thin crowns. Needle casts seldom cause mortality, but when present for several years in a row, will cause reductions in growth. Although it appears likely that the needlecast plays a major role in the damage, forest health specialists are also analyzing climatic and other data to evaluate the potential role of additional factors.

## **Stem decay, *Basidiomycetes* (many)**

Region 10: Alaska

Host(s): All tree species

In southeast Alaska, approximately one-third of the gross volume of spruce/hemlock forests is defective due to heart and butt rot fungi. These extraordinary effects occur where long-lived tree species predominate as in the old-growth forests. The great longevity of individual trees allows ample time for the slow-growing fungi to cause significant amounts of decay. Wood decay fungi play an important role in the structure and function of southeast Alaskan old-growth forests where fire and other forms of catastrophic disturbance are uncommon. By predisposing large old trees to bole breakage, these fungi serve as important disturbance factors that cause small-scale canopy gaps. A completed study investigated how frequently fungi enter wounds of different sizes and the rate of subsequent decay in these wounded trees. Generally, larger, deeper wounds and larger diameter breaks in tops result in a faster rate of decay. Results indicate that heart rot development is much slower in southeast Alaska than the Pacific Northwest.

Stem decay is the most important cause of volume loss and reduced wood quality in boreal Alaskan hardwood species. Stem decay is considered a limitation on the availability and cost of harvesting timber. In south-central and interior Alaska, incidence of stem decay fungi increases as stands age and is generally high in stands over 100 years old. Stem decay fungi will limit harvest rotation age of forests that are managed for wood production purposes. Studies are currently underway in paper birch forests to identify the most important stem decay fungi and assess the relationships among decay, stand age, presence of decay indicators, and site factors.

Diseases: Native

**Sugar pine needle cast,**  
*Lophodermella arcuata*

Region 5: California

Host(s): Sugar pine, western white pine

High levels of infection occurred on western white pine in the vicinity of South Cow Creek Campsite, Latour State Forest in 2001. Ridges shade the site and conditions favor high humidity. Infected needles began fading in the spring of 2002 and were shed later in the summer. Thin crowns on some trees suggest repeated yearly infections. Sugar pines in the area were not affected.

**Swiss needle cast,**  
*Phaeocryptopus gaumannii*

Region 6: Oregon, Washington

Host(s): Douglas-fir

In spring 2002, approximately 387,000 acres of discolored Douglas-fir along the Oregon coast were mapped by a special aerial survey. Surveys were also conducted during the springs of 1996 through 2001. An overall decrease in affected acreage and intensification of the affected areas has been detected. Estimates of affected acreage for all years, however, are conservative since mapped acres represent only those areas with obvious symptoms; ground surveys indicated that Swiss needle cast was present in all Douglas-fir stands throughout the survey area.

Following 3 years of special surveys for Swiss needle cast, Washington Department of Natural Resources elected not to conduct surveys in 2001 and 2002. Although the timing for Swiss needle cast surveys was not optimum, over 87,300 acres were mapped, which probably represents only some of the most severely affected stands.

**Tomentosus root disease,**  
*Inonotus tomentosus* (Fr.) Teng.

Region 10: Alaska

Host(s): Lutz spruce, Sitka spruce, white spruce

In south-central and interior Alaska, tomentosus root rot causes growth loss and mortality of spruce in all age classes. Root disease fungi are capable of spreading from tree to tree through root contacts. Infected trees are prone to uprooting, bole breakage, and outright mortality due to the extensive decay of root systems and lower tree bole. Volume loss due to root diseases can be substantial, up to 1/3 of the gross volume. In managed stands, root rot fungi are considered long-term site problems because the fungi can remain alive and active in large roots and stumps for decades, impacting the growth and survival of susceptible host species on infected sites. The disease appears to be widespread across the native range of spruce in south-central and interior Alaska, but to date, has not been found in southeast Alaska.

**True fir needle cast,**  
*Lirula abietis-concoloris*

Region 5: California

Host(s): White fir

True fir needle cast persisted on white fir along Highway 38 on the Front Country and Mountaintop Ranger Districts, San Bernardino National Forest.

**True mistletoes,**  
*Phoradendron spp.*

Region 3: Arizona, New Mexico

Host(s): Juniper, various hardwoods

These are common in piñon-juniper woodlands throughout the region and are locally abundant in riparian areas. Heavy infection contributes toward tree mortality, particularly during periods of drought.

Region 5: California

Host(s): Hardwoods, white fir

True mistletoes and drought continue to cause dieback and decline in hardwoods and white fir in developed recreation sites on all national forests in Southern California.

**White pine needle cast,**  
*Lophodermella arcuata*

Region 9/Northeastern Area: New Jersey

Host(s): Eastern white pine

Aerial surveys detected about 50 acres of discolored eastern white pine in Burlington County, New Jersey. Ground checking determined that *Lophodermella arcuata* was the damage-causing agent.

## Diseases: Nonnative

### **Beech bark disease, *Nectria coccinea* var. *faginata***

Region 8: North Carolina, Tennessee, Virginia

Host(s): American beech

Although beech bark disease was not found in any new counties in 2002, the disease continues to intensify within currently affected areas. Tree mortality continues to intensify in Tennessee along the Appalachian Trail and in Blount, Cocke, and Sevier Counties within the Great Smoky Mountains National Park. The disease has intensified at a faster rate than predicted and is spreading down slope toward the Cherokee National Forest.

Region 9/Northeastern Area: Connecticut, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia

Host(s): American beech

Infections from beech bark disease occurred throughout Connecticut. This disease, which was introduced to Maine in the early 1930s, continued to kill or reduce the quality of beech stems statewide. But the disease probably does not threaten to eliminate beech from the Maine forest because some trees are resistant and even susceptible trees sprout profusely from roots when trees are damaged, killed, or harvested. Losses attributable to beech bark disease were extensive but the effects of drought, oystershell scale, late spring frosts, and various hardwood defoliators complicated assessment of the damage. In Massachusetts, beech bark disease continued to be a major decline factor in trees in Berkshire County. A total of 1,593 acres of damage was documented during the annual aerial survey. Drought conditions added stress to trees and increased intensity of the disease. More mortality was noticed in the higher elevations. New Hampshire reported that the disease was widespread throughout the State. Beech bark disease was readily found throughout New York State. It was not found in any new counties in 2002. About 3,800 acres of dieback of American beech was associated with the disease in combination with drought in 2002, particularly along ridge tops and other dry sites. In Rhode Island, mature stands of American beech in Washington and Kent Counties were infected. In Vermont, beech scale and *Nectria* infection were the heaviest recorded in many years. Severity of the disease was increased by drought conditions.

In Lake County, Ohio, the beech scale remains the only part of the complex present. In Pennsylvania, the beech scale can be found across the north-central counties of the State. A survey in 2002 in West Virginia found that beech scale was widespread and established on 2.4 million acres in parts of 12 counties while the killing front was detected over an area encompassing 1.2 million acres in portions of six counties. The survey added five new Ohio counties (Greenbrier, Mineral, Nicholas, Preston, and Webster) in 2002.

Michigan has over 7 million acres of maple-beech-birch type with an estimated 138 million trees in all size classes. Beech bark disease was discovered in Michigan in the spring of 2000. "Killing Front" loss trends from beech bark disease place Michigan's estimated losses during this first phase of the disease at 7.5 million beech trees in the greater than 9-inches-diameter category. This conservatively represents 800 million board feet of saw timber. The disease has not been found outside the core area identified in 2001.

**Dutch elm disease,  
*Ophiostoma (=Ceratocystis) ulmi* and *Ophiostoma novo-ulmi***

Region 1: Idaho, Montana, North Dakota

Host(s): American elm

Dutch elm disease (DED) continues to spread in urban areas in Idaho, North Dakota, and Montana. Montana's highest losses are occurring in the cities of Billings and Great Falls. In North Dakota, heavy losses have occurred in both urban areas and in naturally occurring American elms in riparian zones and wooded draws of western North Dakota. This disease is common in many communities along the Snake River in southern Idaho and is slowly working its way into northern Idaho communities. Larger cities have had good success with aggressive treatment. Smaller communities however, do not have resources available to undertake a successful management program and, as a result, may lose the bulk of their native elms.

Region 2: Colorado, Kansas, Nebraska, South Dakota

Host(s): American elm

DED infection occurred in low numbers in eastern Colorado and continued to be a problem in riparian areas and cities throughout the State. The City of Colorado Springs reported heavier than normal trunk attacks on American elms by smaller European elm bark beetles and 33 trees were confirmed with the disease and removed. This is a little higher than normal for that metro area. Losses also increased at the Air Force Academy near Colorado Springs.

In South Dakota communities, DED has been increasing in incidence in areas with significant American elm populations. Losses in the last 2 years have been three to four times higher than that experienced in previous years, with a total of approximately 100 acres of street and park trees affected across the State. Due to the inability of communities to conduct prompt removals of the infected trees there will be an increase in root-graft infections for 2003.

The disease was at moderate levels in Kansas and Nebraska during 2002.

Region 8: Regionwide

Host(s): American elm

Localized mortality continues to occur at low severity level in urban and wild populations of elm. North Carolina reported a number of scattered incidents of the disease in 2002.

Region 9/Northeastern Area: Area-wide

Host(s): American elm

Again, symptoms of this disease were conspicuous throughout the Mid-Atlantic States. In Wilmington, Delaware, high-value American elms with slight symptoms of the disease were protected with a fungicide.

Symptoms of this disease were conspicuous throughout the region. Many old elms that escaped the initial wave of infection now succumb, at least partially because more aggressive strains of the disease organism have developed.

Diseases: Nonnative

## **European larch canker, *Lachnellula willkommii***

Region 9/Northeastern Area: Maine

Host(s): Larch

European larch canker is a fungal disease, which originated in Europe and was first found on native larch (tamarack) in southeastern Maine in 1981. Information gathered from existing cankers indicates this disease has been present in Maine since at least the 1960s and perhaps much longer. This disease may infect any species of the genus *Larix* or *Pseudolarix*. Since larch canker has the potential for causing serious damage to both native larch stands and reforestation projects utilizing non-native larches in Maine and elsewhere, the disease is under State and Federal quarantine. The trend for this disease was static; no evidence of spread from infested areas to noninfested areas was noted in 2002.

## **Littleleaf disease, *Phytophthora cinnamomi***

Region 8: Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia

Host(s): Loblolly pine, shortleaf pine

Littleleaf disease continues to cause growth loss and mortality across the Piedmont areas of the affected states. Shortleaf pine is highly susceptible while loblolly pine is affected, but at a later age. Many of the stands that were converted from shortleaf to loblolly to reduce the impact of this disease are now reaching the age of susceptibility. Bark beetles often attack these stands once they have been weakened by root infection.

Some moderation of littleleaf symptoms over time has been reported. It is believed that root penetration of soil hardpans and gradual increases in soil porosity due to increasing biological activity on severely eroded sites will gradually reduce the impact of this disease over a period of a century or more.

## **White pine blister rust, *Cronartium ribicola***

Region 1: Idaho, Montana

Host(s): Limber pine, western white pine, whitebark pine

White pine blister rust causes extensive tree mortality throughout the range of western white pine. Mortality of naturally occurring regeneration has virtually eliminated western white pine from many forests. This has resulted in major changes in historical transitions in forest types over broad areas. Efforts to restore white pine are concentrated on planting genetically improved stock. Recent surveys have found some plantations with higher than expected infection levels, but the improved stock consistently outperforms natural regeneration. In addition, pruning lower branches in infected plantations is being conducted on a large scale because it can greatly prolong survival in some areas.

Blister rust also caused extensive mortality in high-elevation five-needle pines. Recent surveys in northern Idaho and western Montana high-elevation forests found infection rates in whitebark pine regeneration of up to 90 percent. There is a growing concern that severe losses of large diameter whitebark pine due to mountain pine beetle coupled with regeneration losses due to blister rust may have significant impacts on water and wildlife in these fragile ecosystems. Region 1 has initiated a major effort to locate phenotypically resistant whitebark pine trees for a breeding program.



## Region 2: Colorado, South Dakota, Wyoming

Host(s): Limber pine, whitebark pine

White pine blister rust occurs at low infection levels in limber pine stands of northern Colorado. Its intensity and spread on the limber pine is closely monitored. Efforts are underway to collect a variety of data on five-needle pines in Colorado, the distribution of *Ribes* plants, the alternate host for blister rust, and to hazard rate limber pine stands for the disease.

This disease caused decline in the few remaining stands of limber pine in the central areas of the Black Hills of South Dakota. Mortality of these trees was not direct, but infected trees are more susceptible to bark beetle attack.

In Wyoming, white pine blister rust ranged from low to severe infection levels in whitebark and limber pine forest types. Some stands had high disease levels with more than 60 percent of the trees infected and dying due to the rust. USDA Forest Service aerial surveys show white pine blister rust, along with other damaging agents such as mountain pine beetle, dwarf mistletoe disease, and needle blights damaged more than 46,000 acres of white pine in northern Wyoming.

White pine blister rust caused marked decline in limber pines in the Laramie, Pole, and Snowy Mountain Ranges in southern Wyoming. Limber pine is a major tree species throughout this area, often growing on harsh sites where no other tree vegetation can grow. Extensive studies and monitoring are ongoing in all of these five-needle pine sites to better understand this disease and its impact in Wyoming.

## Region 3: New Mexico

Host(s): Southwestern white pine

Blister rust occurs throughout most of the range of southwestern white pine in the Sacramento Mountains, adjoining White Mountains, and nearby Capitan Mountains of southern New Mexico. This area includes two districts of the Lincoln National Forest and the Mescalero-Apache Indian Reservation. The disease has been found more recently on Gallinas Peak, Cibola National Forest, more than 50 miles north of the Capitans. Blister rust has still not been detected in northern New Mexico or in Arizona.

## Region 4: California, Idaho, Nevada, Wyoming

Host(s): Limber pine, whitebark pine, bristlecone pine, western white pine, sugar pine

This introduced disease is common throughout its hosts range in southern Idaho and western Wyoming. In 2002, white pine blister rust damage was noted on 1,600 trees over 600 acres on the Salmon-Challis National Forest. It is present in the western portion of Region 4 in California and Nevada near the Lake Tahoe area. Although no infection has been found or reported in Utah, the disease has been identified very close to the Utah border in southern Idaho and to the west in the Jarbidge Mountains of northeastern Nevada. Five-needled pine trees are of low occurrence and frequency in Region 4. Often relegated to high alpine areas, these pines grow slowly but provide important ecosystem functions such as shade and stabilization of snow retention for watershed integrity, recreation, aesthetics, and wildlife habitat and usage.

## Region 5: California

Host(s): Sugar pine, western white pine, whitebark pine

Munzer Meadow and other areas of Breckenridge Mountain (Sequoia National Forest) were examined for blister rust on sugar pine or *Ribes* in 1996 and 2000. Only one instance of rust sporulation on *Ribes* was found in 1996. In May of 2002, these areas were again surveyed and *Cronarium ribicola* was present and fruiting on sugar pine branches at several locations within T28S, R32E, Sec. 19, SW<sup>1</sup>/<sub>4</sub>, SW<sup>1</sup>/<sub>4</sub>. These locations are now the known southern extent of the rust in California.

Diseases: Nonnative

Region 6: Oregon, Washington

Host(s): Western white pine, sugar pine, whitebark pine

*Cronartium ribicola* was introduced to the west coast in 1910. Its impacts include top-kill, branch flagging, and tree mortality. While much of the mortality associated with this disease occurred earlier in the century, its impacts are still great in wild populations of five-needled pines throughout their range. Locally, this disease, in combination with mountain pine beetle, still kills many host trees. Of particular concern are the effects of blister rust in whitebark pine at high elevations in the Cascades and in the Blue and Willowa Mountains, and in sugar pine in southwest Oregon where about 45 percent of stands with host components are affected.

Observers mapped approximately 19,000 acres of symptoms in 2002 compared with 14,800 acres in 2001. With the exception of blister rust in whitebark pine (which grows at higher elevations and in more open conditions), blister rust is very difficult to detect from the air. Approximately 89 percent of the reported acres mapped regionwide fell within the Wenatchee, Okanogan, and Gifford-Pinchot National Forests. In Oregon, the most heavily infested area was on the Willowa-Whitman National Forest, especially within the Eagle Cap Wilderness.

Region 8: North Carolina

Host(s): Eastern white pine

White pine blister rust continues to be a disease of concern for North Carolina landowners. The northwestern mountains are an area of particularly high hazard. The disease can be especially devastating to growers of ornamentals and Christmas trees, many of whom are centered in this area. The North Carolina Division of Forest Resources continues to review seedling applications for white pine seedlings and to screen or examine areas prior to planting. In 2002, 78 applications to permit the planting of over 300,000 white pine seedlings were reviewed. A total of 678-planted acres (and the area surrounding them) was examined to prevent the occurrence of this disease.

Region 9/Northeastern Area: Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, Vermont, West Virginia

Host(s): Eastern white pine

This disease remained common, but static at moderate levels in Mercer, Monroe, Pocahontas, and Summers Counties, West Virginia.

This disease occurred across New England and New York at various levels of infection in white pine stands. It remained static at moderate levels, but was common throughout Maine. The State continued limited control efforts in certain high value pine stands. In 2002, a total of 710 acres of high quality pine timber was scouted for *Ribes* plants in Androscoggin, Oxford, and Cumberland Counties and 2,030 plants were destroyed. White pine blister rust continued to be a problem of trees in the landscape as well, often involving trees which were infected when purchased as nursery stock. There was an increase in damage in Massachusetts in 2002. Most severe damage occurred in white pine regeneration in southern Berkshire and central Worcester Counties.

## **Diseases: Origin Unknown**

### **Butternut canker,** *Sirococcus clavignenti-juglandacearum*

Region 8: Regionwide

Host(s): Butternut

This disease has been in the South for at least 40 years and is believed to have killed three of every four butternuts in North Carolina and Virginia. The fungus kills trees of all ages. Butternut canker is expected to spread and kill most of the resource, including regeneration. The species will be replaced by other species on these sites (e.g., black walnut). Trees exhibiting resistance have been found in Arkansas, North Carolina, Tennessee, Kentucky, and Virginia, but it is too early to predict the benefits of selection and breeding on resistance to the disease.

Region 9/Northeastern Area: Areawide

Host(s): Butternut

Butternut canker was first found in Maine in 1993 when it was located in Kennebec County. Surveys have continued in succeeding years and the canker has now been located in all counties in Maine, except Washington County. Butternut canker was prevalent statewide in New Hampshire. Butternut canker was common in New York wherever butternut is found and it is unusual to see a symptom-free butternut. In Rhode Island, the disease occurred statewide although not confirmed in Bristol County. The disease occurred statewide in Vermont causing dieback and mortality and uninfected trees were rarely observed.

### **Dogwood anthracnose,** *Discula destructiva*

Region 8: Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia

Host(s): Flowering dogwood

The very dry conditions in the eastern part of the region inhibited the spread of dogwood anthracnose during the summer of 2002. Nevertheless, the disease continued to intensify within the generally infested area. North Carolina reported a notable decline in mortality attributable to dogwood anthracnose in mountain counties.

Region 9/Northeastern Area: Areawide

Host(s): Flowering dogwood

This disease has spread throughout the range of flowering dogwood in the Northeastern States. The incidence of dogwood anthracnose continued to be prevalent in all three Delaware counties with dead and dying dogwood trees quite noticeable in many areas of the State. Dogwood anthracnose was found in all counties in Maryland. Diseased and dying trees were found in all counties in West Virginia. In Massachusetts, the disease was observed in all but the island counties of Dukes and Nantucket. Rhode Island reported presence of the disease in all five counties in the State. Vermont reported an increase in dieback and mortality and the elimination of flowering dogwood, which is an endangered species in Vermont, from some sites.

Diseases: Origin unknown

**Phytophthora canker,**  
*Phytophthora nemarosa*

Region 5: California

Host(s): California laurel, coast live oak, tanoak

A previously undescribed *Phytophthora* species is occasionally isolated from lethal cankers on tanoak and coast live oak, and from foliar lesions on tanoak and California laurel in coastal areas similar to where *P. ramorum* is active. Its DNA sequence indicates a close relationship to *P. ilicis* (a foliar pathogen of holly) and *P. psychrophila* (newly described from oak forest soils in Europe). In culture it grows more slowly and with a lower temperature optimum than *P. ramorum*. In a forest setting, it is usually associated with the death of single trees, in contrast to the usual patches of mortality caused by *P. ramorum*.

**Pitch canker,**  
*Fusarium circinatum*

Region 5: California

Host(s): Bishop pine, Douglas-fir, Monterey pine, Monterey pine x knobcone pine

The California Board of Forestry's Coastal Pitch Canker Zone of Infestation remains in effect and the disease is still a management concern within the zone. There have been no reports of significant spread within the Coastal Pitch Canker Zone of Infestation.

Monterey pines at three monitoring plots in Santa Cruz County continued to show little or no new infections of pitch canker. Most surviving trees in the plots previously experienced infections, some quite severe. Since 2000, one tree died and two more appear to be dying. The decline and mortality of these trees appears to be due to damage suffered many years ago, rather than recent or current infections.

Region 8: Regionwide

Host(s): Southern pines

Only scattered trees across the region are infected, but impacts can be locally significant. Pitch canker continues to infect Virginia pine saplings in portions of eastern Tennessee. The year 2002 was a "flare year" for pitch canker in several areas of Florida. Significant damage was reported on State-owned plantations that were formerly industry properties.

**Port-Orford-cedar root disease,**  
*Phytophthora lateralis*

Region 5: California

Host(s): Pacific yew, Port-Orford-cedar

*Phytophthora lateralis* is well established along the Sacramento River from Dunsmuir to the mouth of Shotgun Creek and continues to cause tree mortality in the upper river canyon. Its range is expected to increase down river as far as hosts exist.

## Region 6: Oregon

Host(s): Port-Orford-cedar

Port-Orford-cedar root disease continues to cause mortality of Port-Orford-cedar on sites with conditions favorable for spread and establishment of the causal pathogen. The annual aerial survey reported evidence of the disease on 5,971 acres (1.2 trees per acre) in 2002, down slightly from the 6,300 acres reported in 2001 (0.8 trees per acre). All of the reported mortality occurred within the Rogue River, Siskiyou, and Coos-Douglas reporting areas. Hosts growing in riparian areas, swamps, drainage ditches, and low-lying areas downhill from roads suffer by far the greatest impacts. Trees on about 9 percent of the area within the limited range of Port-Orford-cedar are affected. Management activities such as road gating during the wet season, washing vehicles before they enter uninfested areas, and roadside sanitation treatments help slow the spread of the pathogen. A major cooperative effort between the Forest Service, Bureau of Land Management, and Oregon State University to develop Port-Orford-cedar that is resistant to *P. lateralis* now has results. In fall 2002, the first operational collections of resistant seed from the Dorena containerized seed orchard occurred. Sowing occurred in winter 2002-2003 and seedlings will be available for outplanting in the spring of 2004. Approximately 26,000 resistant seedlings will be planted in 2004, many of them in the 500,000 acre area burned in the 2002 Biscuit fire.

## Sudden oak death, *Phytophthora ramorum*

## Region 5: California

Host(s): California laurel, California black oak, coast live oak, Shreve oak, tanoak

The number of recognized tree and plant hosts susceptible to *Phytophthora ramorum* in the United States is now 24. Coast redwood, Douglas-fir, and canyon live oak are three of the new hosts. The number of counties with known infections pathogen is now 12 in California: Alameda, Contra Costa, Humboldt, Marin, Mendocino, Monterey, Napa, San Mateo, Santa Clara, Santa Cruz, Solano, and Sonoma.

On coast redwood, the pathogen has been recovered from blighted basal sprouts and from needles and twigs. The symptoms are common in infested areas with redwood, but damage is limited to needles and twigs. There is no indication that the pathogen can kill mature redwood.

*Phytophthora ramorum* has been confirmed on a few Douglas-firs in only one area in Sonoma County. The trees are beneath heavily infested laurel trees and damage is limited to a few branches and tops.

The confirmation of *P. ramorum* on the Los Padres National Forest near Big Sur is the first report of Sudden oak death on a national forest. The site is part of a larger infestation that extends 20 miles from the coast up to an elevation of 3,000 feet. This and all other confirmations remain within 50 miles of the Pacific Ocean.

Positive polymerase chain reaction (PCR) laboratory tests indicated that *P. ramorum* was present in maple leaves from the Sierra Nevada foothills near Auburn. However, this report remains unconfirmed because the pathogen has not been successfully isolated from the area by cultural methods. Numerous attempts at isolation from maple and other species have failed.

The leaflet, *Sudden Oak Death Caused by a New Species, Phytophthora ramorum*, is available at <http://www.na.fs.fed.us/SOD>. For specifics on the disease and its occurrence and research updates from the California Oak Mortality Task Force, visit: <http://www.suddenoakdeath.org>.

Diseases: Origin unknown

Region 6: Oregon

Host(s): Tanoak, evergreen huckleberry, Pacific rhododendron

Sudden oak death, caused by *Phytophthora ramorum*, was detected in Curry County Oregon in July 2001 during a special aerial survey. Nine sites, ranging in size from less than 1 acre to approximately 12 acres and totaling 40 acres were confirmed northeast of Brookings, Oregon. The Oregon Department of Agriculture designated a 9-square-mile regulated zone around the confirmed sites. The affected area includes Federal, private industrial, and private nonindustrial forest lands. Tanoak (*Lithocarpus densiflorus*), evergreen huckleberry (*Vaccinium ovatum*), Pacific rhododendron (*Rhododendron macrophyllum*), Oregon myrtle (*Umbellularia californica*), cascara (*Rhamnus purshiana*), salmonberry (*Rubus spectabilis*), and poison oak (*Toxicodendron diversiloba*) are confirmed hosts in Oregon.

In 2002, two aerial surveys were done to detect recent tanoak mortality. The survey in July covered the majority of the tanoak type in Oregon; approximately 1.8 million acres were flown. The survey in October was targeted to high risk tanoak forests close to the coast; 250,000 acres in Oregon were covered. Ground reconnaissance associated with treating sites found in 2001 was also done. All recent tanoak mortality was examined. The presence of *Phytophthora ramorum* was confirmed using both standard isolation techniques and molecular probes. Twelve infested acres inside the regulated area were identified from the 2002 ground and aerial surveys. New finds were closely associated with sites identified in 2001. Sudden oak death was not identified outside of the regulated area established in 2001.

A cooperative program involving State and Federal agencies as well as private landowners is currently underway to eradicate *P. ramorum* from the known sites. Sites are delineated based on canker, tip blight, and leafspot symptoms. Treatment areas include a 50- to 100-foot buffer. All host materials are cut, piled, and burned. Broadcast burns are done when feasible. Extensive post-treatment monitoring is ongoing within the treated areas as well as in forests adjacent to treated sites.

The Oregon Department of Agriculture and the USDA Animal Plant Health Inspection service have established quarantines to protect areas within and outside of Oregon from the artificial spread of *P. ramorum*. Whole plants and some plant parts of the known affected species and associated soil are covered by these regulations.

# Declines and Complexes

## Ash decline

Region 9/Northeastern Area: New Hampshire

Host(s): White ash

In New Hampshire, decline of white ash is scattered throughout the State, possibly due to ash yellows. Ground checks of ash stands in the Finger Lakes region of New York, that were noted as being in “decline” during the aerial survey, did not result in any conclusion as to the primary damage causing agent. No evidence of emerald ash borer infestation was found, nor were most trees showing symptoms of ash yellows or other disease. Poor site conditions and the drought may have played a role. In Rhode Island, white ash decline occurred statewide with unknown cause.

## Aspen decline

Region 5: California

Host(s): Aspen

Aspen stands declining from undetermined causes have been observed in several locations in Mono County in and around the Mono Lake and Mammoth Districts, Inyo National Forest.

## Aspen defoliator complex

**Western Tent Caterpillar,**

***Malacosoma californicum***

**Large Aspen Tortrix,**

***Choristoneura conflictana***

**Black Leaf Spot,**

***Marssonina populi***

**Weather Related Damages**

Region 3: Arizona, New Mexico

Host(s): Aspen

Aspen defoliation, decline, and mortality, caused by one or some times the entire above named complex of insects, diseases, and abiotic factors stayed about the same at 49,720 acres in 2001 and 49,675 in 2002. In Arizona, aspen has been in decline throughout the northern-half of the State, since a frost event occurred in June of 1999 that was followed by several years of drought. Although the acreage did not change this year, the degree of damage did. Many areas experienced large-scale mortality rather than mere defoliation. In Arizona, aspen decline was recorded on the Apache-Sitgreaves (12,145 acres), Coconino (5,220 acres), Coronado (55 acres), Kaibab (6,555 acres), and Tonto (50 acres) National Forests; Grand Canyon National Park (4,220 acres); Fort Apache (3,155 acres) and Navajo (3,225 acres) Indian Reservations; and on State and private lands (395 acres). In New Mexico, defoliation was detected on the Carson (2,645 acres), Cibola (1,045 acres), Gila (625 acres), Lincoln (395 acres), and Santa Fe (3,530 acres) National Forests; Valles Caldera National Preserve (1,575 acres); Mescalero Apache (60 acres) and Santa Clara Pueblo (440 acres) tribal lands; and 4,340 acres of State and private holdings.

Declines and Complexes

## **Bacterial leaf scorch, *Xylella fastidiosa***

Region 9/Northeastern Area: Delaware, Maryland, New Jersey

Host(s): Maple, northern red oak, scarlet oak, pin oak

Bacterial leaf scorch is now known to occur in New Castle County, Delaware. No surveys were conducted in Kent or Sussex Counties, Delaware. In Maryland, ground surveys in 2002 were conducted throughout the State and the disease was found on mostly maples and oaks in all counties except Garrett, St. Mary's, Somerset, and Charles. High-valued, urban trees in Annapolis and Ocean City, Maryland, were found to have this disease in 2001. In New Jersey, surveys conducted in 14 counties found discoloration of oak trees scattered over 200,000 acres.

## **Brown ash decline**

Region 9/Northeastern Area: Maine

Host(s): Black ash (brown ash)

Maine brown ash plots were not measured in 2002 but some plots were visited to check for drought effects. Forest health monitoring staff made observations of crown conditions in several plots in 2002 and found that brown ash condition was stable with no obvious decline due to drought. If ash crowns were affected by low water in 2001 and 2002, crown decline was not apparent during the 2002 field checks. Measurement of a representative sample of brown ash plots is planned for 2003 to check for drought damage.

## **Chaparral decline**

Region 5: California

Host(s): Chaparral

Chaparral dieback remains extensive in the San Bernardino and San Jacinto Mountains in southern California. The condition has been accentuated by the current drought.



**Cytospora canker of true firs,***Cytospora abietis***Dwarf mistletoe,***Arceuthobium* spp.**Sawfly,***Neodiprion* spp.**Fir engraver beetle,***Scolytus ventralis*

Region 6: Oregon, Washington

Host(s): True firs

The various agents of this complex are widely distributed throughout Oregon and Washington wherever true firs occur. Activity levels of each agent typically fluctuate more-or-less independently among locations and over time. *Cytospora abietis* is a weak, canker-inducing fungus that attacks stressed trees. It commonly infects branches bearing dwarf mistletoe infections, causing branch death. Conifer-feeding sawfly larvae feed on old foliage, temporarily weakening trees and slowing their growth. Outbreaks are usually sporadic and subside quickly. Fir engraver beetle activity is strongly associated with tree stress. During 2002, 2,309 acres of this complex were mapped, down from 4,341 acres mapped in 2001. All of the aerially detected damage occurred within the Rogue River and Siskiyou reporting areas with all but 82 acres mapped on Federal lands.

**Elm yellows**

Region 9/Northeastern Area: Maryland, Ohio, Pennsylvania, West Virginia

Host(s): American elm, slippery elm

Elm yellows exists at low levels in Frederick, Washington, and Allegany Counties, Maryland. In Ohio, elm yellows was found in the crowns of scattered elms. In Pennsylvania, the disease continued to be widely distributed and active throughout the Commonwealth. Symptomatic trees were observed in early to mid-June in the Harrisburg area and by early July tree mortality was evident from Dauphin County to Washington County. Although the elm yellows disease outbreak continued in the eastern panhandle of West Virginia, a 2002 survey found no major changes in the range of elm yellows in the same area.

**Larch needle cast,***Meria laricis***Larch needle blight,***Hypodermella laricis*

Region 6: Oregon, Washington

Host(s): Western larch

Larch needle blight and larch needle cast, which are reported as a complex because of their similar signatures as viewed from the air, declined from 5,600 acres reported in 2001 to approximately 260 acres in 2002. Fifteen acres were mapped on the Ochoco National Forest, 133 acres on the Wallowa-Whitman National Forest, 61 acres in the Strawberry Mountain Wilderness of the Malheur National Forest, and 52 acres on private lands within the Wallowa-Whitman reporting area. Concentrations of infections were quite localized and mainly involved dense thickets of seedlings and saplings. These foliage diseases were

## Declines and Complexes

most severe in stands of western larch growing in moist grand fir and moist sub-alpine fir plant associations as well as in riparian areas.

### **Larch stressors**

**Eastern larch beetle,**

*Dendroctonus simplex*

**Larch casebearer,**

*Coleophora laricella*

**Larch sawfly,**

*Pristiphora erichsonii*

**Variable water levels**

Region 9/Northeastern Area: Maine, New Hampshire, Vermont

Host(s): Eastern larch

Approximately 7,550 acres of seriously defoliated, discolored, and dead larch were mapped in Maine in 2002. In addition to this mapped acreage, scattered individual larch and small clusters of stressed or dead trees were seen throughout eastern and northeastern Maine (an area of over 1.4 million acres). Nearly all stands mapped in 2002 contained examples of all the stressors listed but the most common and most visible agent in mapped area was larch sawfly. Most stands that were heavily defoliated by sawfly or that have been stressed by drought and then flood level waters, have become heavily infested with eastern larch beetle. New Hampshire reported 406 acres of larch decline in the northernmost county of Coos. This was less than in 2001. Larch decline in Vermont was worsened by drought and larch casebearer defoliation, along with the eastern larch beetle statewide.

### **Limber pine decline**

Region 1: Montana

Host(s): Limber pine

Limber pine mortality is continuing across scattered locations in central and eastern Montana. In some stands on the Lewis and Clark National Forest, nearly 100 percent mortality has been observed. Data from permanent plots indicate the mortality is strongly associated with severe defoliation from a needle disease caused by *Dothistroma septospora*. Other factors thought to be contributing to this decline are winter damage, drought, and competition-related stress.

### **Oak decline**

Region 8: Regionwide

Host(s): Oaks, other hardwoods

The oak resource in the Southern United States is significant. Approximately two-thirds of the hardwood forest is classified as upland hardwood, where a malady known as “oak decline” is prevalent. Oak decline has been reported in the United States for over 130 years. It is a syndrome that involves the interaction of factors such as climate, site quality, and tree age; drought and insect defoliation escalate the condition. Pests such as armillaria root disease and the two-lined chestnut borer, which are ordinarily nonaggressive pests on vigorous trees, successfully attack trees stressed by oak decline. Decline is characterized by a

gradual but progressive dieback of the crown. Mortality typically results after several years, with mature overstory trees the most heavily affected.

The severe drought of the past 5 years has seriously aggravated the condition in the South, including Florida. In the Appalachians, trees on south-facing slopes and rocky, shallow soils are most affected. The severity of oak decline lessened in the western part of Tennessee in 2002 because of abundant rainfall. However, in middle and eastern Tennessee, the syndrome was static to increasing (up to 5 percent mortality) with west and southwest facing slopes most affected. Hickories as well as oaks (red, black, and white) died.

Drought-initiated oak decline of unprecedented magnitude continued in Arkansas although drought severity abated considerably in 2002. Particularly impacted were the Ozark and Ouachita Mountains; widespread red oak mortality occurred, aggravated by red oak borer activity (see Native Insects, Red oak borer). Mortality levels will have severe impacts on oak ecosystems and have seriously damaged oak sawtimber markets.

Region 9/Northeastern Area: Missouri

Host(s): Red oak

In Missouri, oak decline in the Ozarks is a complex phenomenon involving primarily red oaks of advanced age that are growing on soils that are shallow, rocky, and drought prone. Drought conditions of the past several years have accelerated the decline and led to attacks by secondary fungal agents and wood boring insects. *Armillaria* root rot and hypoxylon canker are commonly associated with decline and mortality, as are the red oak borer, twolined chestnut borer, carpenter worms, and a variety of other borers (*Cerambycidae*, *Buprestidae*, and *Brentidae*). It is estimated that over 100,000 acres of Mark Twain National Forest land has sustained scattered mortality due to oak decline.

## Subalpine fir decline

Region 1: Idaho, Montana

Host(s): Subalpine fir

Subalpine fir mortality remained very high in 2002 with an estimated 264,294 trees killed on about 168,790 regionwide. In 2001, an estimated 216,000 red subalpine fir trees were recorded on 90,700 acres. Much of the mortality occurring on these high-elevation sites results from varying combinations of root diseases, bark beetles, and possibly other factors such as climatic change. The most significant factor, however, is thought to be mortality directly or indirectly caused by western balsam bark beetle (*Dryocoetes confusus*). The pathogenic fungus carried by western balsam bark beetle, *Ophiostoma dryocoetidis*, appears to cause mortality even when trees are only lightly attacked by the beetles. Most of the current tree mortality occurred on the Idaho Panhandle and Nez Perce National Forests in northern Idaho. Other forests with significant subalpine fir mortality include the Clearwater National Forest in Idaho and the Gallatin, Beaverhead, Flathead, and Lewis and Clark National Forests in western Montana.

Region 2: Colorado, Wyoming

Host(s): Subalpine fir

Sub-alpine fir decline was the most widespread damage detected in Colorado. Forest health specialists believe that most of this decline is caused by the western balsam bark beetle, *Dryocoetes confusus*, and *Armillaria* root disease. Since little is known about this decline, it is not possible to determine how much of the damage occurred this past year. Dead sub-alpine fir holds its red needles longer than most other conifer species, and so it is possible that observed mortality may be cumulative from the last 2 to 4 years.

## Declines and Complexes

An outbreak of *Dryocoetes* continues in the northern Bighorns, causing subalpine fir decline for more than 5 years. Much of the outbreak has been associated with blowdown events that occurred in the middle 1990s. This outbreak appears to be subsiding slightly because much of the suitable host material has been destroyed.

Many stands of subalpine fir are declining on private and State lands in central Wyoming, particularly on Casper Mountain in Natrona County. In 2002, most of the mortality of subalpine fir occurred in the North Laramie Range where over 1,600 trees were killed. Large pockets of subalpine fir are declining on Little and Pine Mountains south of Rock Springs and in the Medicine Bow and Sierra Madre Mountains in Wyoming.

Region 4: Idaho, Nevada, Utah, Wyoming

Host(s): Subalpine fir

Decline and die-off of subalpine fir started in the late 1980s in Region 4. Peak mortality periods occurred during the mid-1990s when over a million trees were affected by this complex. Although there are a number of pathogens involved in this complex, the primary insect causing subalpine fir mortality is the western balsam bark beetle, *Dryocoetes confusus*. Drought, heat stress, and winter drying, compounded by overstocked and overmature stand conditions also contribute to subalpine fir mortality. In 2002, the death of approximately 334,300 subalpine fir was recorded. This represents an increase from nearly 254,300 trees recorded in 2001.

## Sugar maple decline

Region 9/Northeastern Area: Pennsylvania

Host(s): Sugar maple

Since the mid-1980s, the health and decline of sugar maple in northern Pennsylvania has been associated with several droughts and several insect defoliations across the unglaciated and glaciated regions of the Allegheny Plateau. Studies across elevation gradients in this region have shown that low soil pH adversely influences tree growth and crown vigor. Insect defoliation and drought are additional stressors on sugar maple trees.

## White pine decline

Region 9/Northeastern Area: Maine, New Hampshire, New York, Vermont

Host(s): Eastern white pine

In Maine, the condition of pines affected by white pine decline stabilized in 2001, and remained stable in 2002. Following the drought of 1995 and up until 2002, white pines with symptoms of this disease declined and died on sites where rooting depth was restricted. Studies of tree crown condition in 2001 and 2002 noted no significant differences in crown transparency between previously symptomatic trees that have survived and previously nonsymptomatic trees. There was also very little additional mortality. Expanded rooting depth studies have supported previous findings that rooting depth was less than 12 inches in all declining stands and deeper than this in all asymptomatic stands. Declining trees were still evident in New Hampshire in areas where previously observed, in some cases in association with the fungus *Caliciopsis pinea*. Decline of mature white pines was evident near roadsides in the Adirondacks in New York and may have been linked to road salt, drought, and possibly other factors. In Albany County, declining health and a possible canker disease of white pine is under investigation and has yet to be linked

conclusively to a specific damage-causing agent. About 10 percent of white pine was affected with caliciopsis canker in Vermont.

## Yellow-cedar decline

Region 10: Alaska

Host(s): Yellow-cedar

Decline and mortality of yellow-cedar persists as one of the most spectacular forest problems in Alaska. Approximately 478,500 acres of yellow-cedar decline have been mapped across an extensive portion of southeast Alaska. Ground surveys show 65 percent of the basal area of yellow-cedar is dead on this acreage. In 2002, areas of particularly active mortality to yellow-cedar were observed on about 3,000 acres scattered around southeast Alaska, with the most numerous areas being in Peril Strait, western Baranof Island, and southwest Chichagof Island. Research suggests that the total acreage of yellow-cedar decline has been increasing very gradually; the slow increase in area (less than 3 feet per year) has been a result of the expansion of existing decline into adjacent stands. Most stands contain snags that died up to 100 years ago, recently killed cedars, dying cedars (with yellow, red, or thinning crowns), healthy cedars, and other tree species. Yellow-cedar snags accumulate on affected sites and forest composition is substantially altered as yellow-cedar die, giving way to other tree species. Regionwide, this excessive mortality of yellow-cedar may lead to diminishing populations (but not extinction) of yellow-cedar, particularly when the poor regeneration of the species is considered. Salvage opportunities for this valuable resource are now being recognized.

All research suggests that contagious organisms are not the primary cause for this extensive mortality. Site factors, probably associated with poorly drained anaerobic soils, appears to be responsible for initiating and continuing cedar decline. Two hypotheses have been proposed to explain the primary cause of death in yellow-cedar decline:

- Toxins are produced by decomposition in the wet, organic soils, or
- Shallow fine roots are damaged from freezing, associated with climatic warming and reduced insulating snowpack in the last century.

## Seed Orchard Insects and Diseases

### **Coneworms,**

*Dioryctria amatella*

*Dioryctria clarioralis*

*Dioryctria disclusa*

*Dioryctria merkeli*

Region 8: Regionwide

Host(s): Southern pines

Damage surveys conducted during a South-wide efficacy test of phosmet and bifenthrin revealed an average 20 percent loss of second-year cones (2002 cone crop) in untreated trees. Damage levels in slash pine orchards were similar to those in loblolly pine seed orchards. This loss does not include first-year flowers and conelets and is, therefore, a low estimate of the total damage caused by coneworms. In eastern Texas, losses in unsprayed orchards remained static in 2002 at about 34 percent. Losses in treated orchards were considerably less.

### **Pine catkin sawfly,**

*Xyela* spp.

Region 8: Louisiana

Host(s): Southern pines

The unusual outbreak of this small, seldom-seen insect that occurred on loblolly pine in central Louisiana in the spring of 2001 declined dramatically in 2002. Infestations of mature larvae were observed at orchards and in private yards under infested trees, but numbers were much smaller than in 2001. The impact on pollination was insignificant.

### **Pine seedworm,**

*Cydia* spp.

Region 8: Regionwide

Host(s): Southern pines

The inventory of longleaf pine in central Louisiana revealed low, but consistent seedworm populations. Estimated loss was 2-3 percent of seed.

**Pitch canker,**  
*Fusarium subglutinans* f. sp. *pini*

Region 8: Regionwide

Hosts: Southern pines

About 10 percent of the pine cones harvested from State seed orchards in east Texas in 2002 were apparently damaged by pitch canker.

**Seed bugs,**  
*Leptoglossus corculus*  
*Tetyra bipustata*

Region 8: Regionwide

Host(s): Southern pines

Both species of seedbug were present in pine seed orchards throughout the South. Samples of conelet ovule damage indicated that seedbugs caused about 20 percent seed loss on loblolly pine at the Stuart Seed Orchard in central Louisiana. Orchards inventoried in central and northern Louisiana indicated very large populations of *T. bipunctata* in September and October; some trees were estimated to have 500 seedbugs per tree.

**Western conifer seed bug,**  
*Leptoglossus occidentalis*  
**Coneworm,**  
*Dioryctria abietivorella*  
**Cone beetle,**  
*Conophthorus ponderosae*

Region 1: Idaho, Montana

Host(s): Douglas-fir, western white pine, other conifers

Cone and seed insects can cause considerable damage to the seeds of western conifers, significantly reducing seed crops. Though insects are found feeding on a variety of tree species in wild stands, they are especially of concern in blister rust-resistant western white pine seed orchards. The insects that cause the most damage in western white pine are western conifer seed bug, *Leptoglossus occidentalis*, cone beetle, *Conophthorus ponderosae*, and coneworm, *Dioryctria abietivorella*. One or more of these insects are often abundant enough in northern Idaho white pine seed orchards to warrant an insecticidal spray treatment to protect cones. Cone beetles killed 40 percent of the western white pine cone crop at Grouse Creek Tree Improvement Area in northern Idaho in 2002. Treatments are planned for 2003 using the behavior chemical 4aa (microencapsulated 4-allylanisol) in cooperation with Forest Insect and Disease Research.

Tree improvement areas in Montana are now nearing cone-producing age. Monitoring will occur as cones are produced.

# Nursery Insects and Diseases

## Abiotic seedling damage

Region 1: Montana

Host(s): Conifers, hardwoods

An unusually severe late frost occurred during the spring of 2002 at a large western Montana nursery, resulting in widespread damage to both hardwood and conifer seedlings. Seedlings had broken bud and young, succulent tissues were extensively damaged. Many seedlings were killed and many more had to be culled.

## Aphids

Region 6: Oregon

Host(s): Port-Orford cedar

Aphids were evident on Port-Orford cedar greenhouse plug stock at the tree improvement center beginning in late July. Seedlings were successfully treated with several applications of Safer soap. Little to no damage was evident at the end of the growing season.

## Black vine root weevil, *Otiorhynchus sulcatus*

Region 6: Oregon

Host(s): Engelmann spruce, western red cedar, aspen, roses, gooseberries, willow, dogwood

Monitoring at the nursery detected adult weevils around containerized western red cedar adjacent to the shadehouse and in one lot of containerized Engelmann spruce. The infested stock and adjacent area were treated twice with Lorsban to prevent the adult weevils from laying eggs. At packing, additional damage was found in the containerized aspen, roses, gooseberries, willow, and dogwood that were grown in the shadehouse. The monitoring program will be expanded to the shadehouse in 2003.

Root weevil populations are normally a huge problem in the western larch containerized seed orchards at the tree improvement center. In 2002, beneficial nematodes were applied to potted stock in several greenhouses in the spring (during the larval stages). The treatment was fairly successful, with losses due to root damage of less than 1 percent in those greenhouses. However, with the mild winter this year, a more intense program of controlling both larvae and adults will be undertaken in the spring of 2003.



## **Cranberry girdler moth, *Chrysoteuchia topiaria***

Region 1: Idaho

Host(s): Douglas-fir, western larch, Engelmann spruce

The cranberry girdler moth occurs occasionally at the USDA Forest Service Nursery in Coeur d'Alene, Idaho. This insect causes damage to bareroot Douglas-fir, western larch, and Engelmann spruce seedlings by feeding on root crown tissues just below the ground level. Most damage occurs on Douglas-fir. Pheromone monitoring traps are used to determine adult populations; based on population monitoring, insecticide applications may be used periodically to limit damage.

Region 6: Oregon

Host(s): Conifers

During the 2002 growing season, trapping of adult moths at the nursery did not yield significant numbers above the threshold. Seedling monitoring did not show significant damage on Douglas-fir or true fir species. No chemical treatments were made for girdler control this season. Damage levels observed during packing for these species were minor.

The monitoring program for cranberry girdler at the tree improvement center is not yet at maximum potential. Cranberry girdler damage in the western white pine and sugar pine rust runs was minimal in 2002. However, damage was evident in whitebark pine plug seedlings grown in a greenhouse close to a grassy area. There was approximately 1-2 percent loss in the crop. Seedlings are not normally grown in this greenhouse and the affected lots were moved to the normal seedling growing area toward the end of the season.

## **Cylindrocarpon root disease, *Cylindrocarpon destructans***

Region 1: Idaho, Montana

Host(s): Western white pine, whitebark pine

*Cylindrocarpon destructans* causes root disease of container-grown five-needle pines (western white pine, whitebark pine) at several container nurseries in Region 1. The pathogen causes low levels of root decay, often without eliciting above-ground disease symptoms on affected seedlings. The disease is best controlled by container sterilization with hot water treatments, seed treatments, and periodic fungicide applications. *Cylindrocarpon destructans* can also cause root disease on other conifer hosts grown in both bare root and container nurseries.

## **Cypress canker, *Seridium* spp.**

Region 6: Oregon

Host(s): Port-Orford-cedar

A few new stem cankers were found on containerized Port-Orford-cedar growing outdoors at the tree improvement center. Healthy stock is being moved indoors to avoid infection. Trials are continuing to evaluate the efficacy of fungicides for treatment.

**Damping-off,**  
***Fusarium* spp.**  
***Pythium* spp.**

Region 1: Idaho, Montana

Host(s): Conifers

Damping-off is common in both bareroot and container nurseries in Region 1. Disease levels vary each year because of seedlot differences and weather conditions during periods of seed germination and seedling establishment. Damage is most often controlled by pre-sowing seed treatments (especially prolonged running water rinses and treatments with aqueous solutions of sodium hypochlorite) and application of post-sowing fungicides when germinants are susceptible and temperature and moisture conditions are conducive.

Region 6: Oregon

Host(s): Conifers

The nursery experienced a very low rate of mortality. Conditions this spring favored the early development of the seedlings. Fumigation, early sowing, deep watering, and delayed fertilization helped to control damping-off.

Region 8: Regionwide

Host(s): Various species

Damping off is the most common disease problem facing southern nurseries. Loss of seedlings to damping-off varies greatly from year to year owing to the interaction of pathogenic fungi and environmental conditions. Seedling losses can be severe when germination is slow due to cold, wet weather. Despite the drought, damping-off continued to be one of the most significant problems of nurseries in the South in 2002.

**Fusarium root disease,**  
***Fusarium* spp.**

Region 1: Idaho, Montana

Host(s): Conifers

*Fusarium*-associated diseases are generally the most important and damaging diseases of conifer seedling production in both bareroot and container nurseries in Region 1. These fungi are capable of causing several different types of diseases throughout the seedling production cycle. The most damaging *Fusarium* species in bareroot nurseries is *F. oxysporum*, while *F. proliferatum* seems to be the most important pathogen in container operations. Other *Fusarium* species are commonly isolated from both diseased and healthy seedlings; some of these are capable of eliciting diseases whereas others are more commonly saprophytes or secondary colonizers of seedling root tissues. *Fusarium* diseases are most commonly controlled by pre-plant soil fumigation in bareroot nurseries and seed, container sterilization, and fungicide treatments in container nurseries.

During 2002, container-grown ponderosa pine were severely damaged by *Fusarium* in a nursery in Montana. Both *F. avenaceum* and *F. sporotrichioides* were the major causes of top blight. Hundreds of seedlings were affected and important economic losses resulted.

Region 6: Oregon

Host(s): Conifers

A few seedlots of 1+0 bareroot Douglas-fir at the nursery showed losses due to *Fusarium* late in the growing season. Damage was estimated at an incidence rate of less than 3 percent. The disease was probably in response to wrenching and high temperatures during the growing season. Cooling by irrigation helped to limit losses. In addition, there were some losses due to *Fusarium* in eastside Douglas-fir, western red cedar, and larch container stock.

## **Gray mold, *Botrytis cinerea***

Region 1: Idaho, Montana

Host(s): Western larch, Engelmann spruce, western red cedar, western white pine

*Botrytis cinerea* is an important disease of container-grown western larch, Engelmann spruce, western red cedar, and western white pine seedlings in container nurseries in Region 1. This disease is best prevented by careful monitoring and sanitation procedures. When the disease is discovered, fungicide applications, alternating several different chemicals, are implemented. *Botrytis* can also cause important damage to cold-stored seedlings after lifting and prior to outplanting. Pathogen development is restricted by storing seedlings at below-freezing temperatures and rapidly thawing them prior to outplanting.

Region 6: Oregon

Host(s): Conifers

*Botrytis* was found contaminating one lot of incense cedar seed at the nursery. In the future incense cedar seed will be surface sterilized with bleach prior to sowing.

## **Larch needlecast, *Meria laricis***

Region 6: Oregon

Host(s): Larch

All western larch containerized stock is now kept under cover in greenhouses at the tree improvement center. In addition, one or two preventive treatments with chlorothalonil and propiconazole were done during the spring. *Meria* infection was still present, but at much lower levels as compared to the prior 10-year period.

**Leaf spots,**  
***Marssonina* spp.**  
***Septoria* spp.**

Region 6: Oregon

Host(s): Aspen

Leaf spots caused some damage to containerized aspen seedlings at the nursery. Aeration, sanitation and if necessary, fungicides, will be used to control these diseases in the future.

**Lygus,**  
***Lygus hesperus***

Region 6: Oregon

Host(s): Conifers

Trapping at the nursery showed high numbers of adult lygus insects, and damage thresholds were reached. Five treatments of Pydrin were made on the 1+0 crop from late June through August. The bug vac was not used this season because of time constraints and manpower availability. Lygus damage at the time of packing was negligible.

**Needle casts,**  
***Lophodermella arcuata***  
***Lophodermium nitens***

Region 6: Oregon

Host(s):

Needle casts were abundant at the tree improvement center in 2002 and required treatment with chlorothalonil to prevent needle spotting and premature needle loss that would interfere with blister rust inoculation trials.

**Phytophthora root rot,**  
***Phytophthora* spp.**

Region 6: Oregon

Host(s): Douglas-fir

Due to the continued lack of a treated water system at the tree improvement center, *Phytophthora* remains a problem in the western white pine and sugar pine rust runs. In 2002, there were minor infections in the 2+0 stock, but no treatment was undertaken. The area is being closely monitored and infection does not seem to be spreading.

**Pythium root disease,**  
***Pythium spp.***

Region 1: Idaho, Montana

Host(s): Conifers

Root diseases caused by *Pythium* spp. are common in poorly-drained portions of bareroot seedling beds.

**Rhizoctonia needle blight,**  
***Rhizoctonia spp.***

Region 8: Regionwide

Host(s): Longleaf pine

Over 30,000 seedlings were lost to *Rhizoctonia* needle blight in 2002 at the Taylor State Nursery in South Carolina.

**Root deterioration**

Region 6: Oregon

Host(s): Sugar pine, western white pine

Deteriorated roots were found in some 2+0 sugar and western white pine seedlings at the nursery during the packing operation. Affected seedlings had few lateral roots, and corky basal swellings on the taproot just below the soil line. Existing lateral roots were often decayed. Affected western white pine seedlings were often stunted, chlorotic, or dead, but sugar pines often had no aboveground symptoms. *Cylindrocarpon destructans* and *C. didymum* have been consistently associated with this damage but more testing will be needed to determine if these fungi are the cause of disease.

**Spider mite,**  
***Oligonychus subnudus***  
***Tetranychus spp.***

Region 5: California

Host(s): Ponderosa pine

Feeding by this mite caused injury to 2-0 ponderosa pine seedlings at the USDA Forest Service Placerville Nursery. The injury caused extensive yellowing of the foliage in 10 nursery beds.

**Tip blight,**  
***Phoma* spp.**

Region 6: Oregon

Host(s): Eastern white pine, western white pine

Eastern white pine seedlings and newly grafted western white pines at the tree improvement center were damaged by tip blight, probably caused by *Phoma eupyrena*. The affected seedlings were treated with chlorothalonil and by removing diseased shoots and fallen needles. They will be treated with chlorothalonil again prior to outplanting.

## **Abiotic Damage**

### **Air pollution**

Region 5: California

Host(s): Jeffrey pine, ponderosa pine

In 1987, the University of California–Davis established a network of 24 ozone-monitoring plots in the Lake Tahoe Basin. Each plot contained 15 Jeffrey pines to be used as bioindicators for ozone injury. USDA Forest Service personnel found and rated 22 of the 24 plots in 1991 and 2002. The percentage of trees showing ozone injury was 27 percent in 1987, 39 percent in 1991, and 24 percent in 2002. This does not reflect the severity of the ozone injury to individual trees but it does suggest the amount of injury may have peaked. In the 15 years since these plots were installed, 92 (28 percent) of the original 330 trees have died.

Region 8: Tennessee

Host(s): All species

Ozone damage was light to moderate in the Cumberland Plateau region of Tennessee in 2002.

### **Agricultural nitrogen emissions/pitch canker**

Region 8: Florida, Georgia, North Carolina, South Carolina

Host(s): Loblolly pine, slash pine

An increasingly important problem involves point source air pollution emitted from poultry houses and hog farms. Apparently, high concentrations of airborne nitrogen unintentionally fertilize pines, thereby increasing the susceptibility of these trees to infection by pitch canker disease. A cooperative evaluation-monitoring project is currently being conducted to determine whether a causal relationship exists between agricultural nitrogen emissions and pitch canker, and whether management recommendations are needed regarding the relative proximity of animal husbandry operations and pine plantations.

### **Animal damage**

Region 2: Colorado

Host(s): All species

Related to the drought and the reduced amount of food present in the forest, Colorado seemed to experience more animal damages to trees than normal, particularly porcupine feeding on ponderosa pine phloem in the Black Forest area. Fox squirrel damages to cottonwoods and other deciduous trees in the riparian forests and tree browsing by deer were more apparent. Black bears were frequently reported in foothills residential backyards feeding on tree fruits and other nontraditional food sources due to reduced natural foods in the mountains. Excessive elk feeding on aspen bark was noted in Larimer County.

Abiotic Damage

## **Bear Damage**

Region 6: Washington

Host(s): Douglas-fir, western hemlock

Acres with trees killed by bear as interpreted by aerial observers increased from 68,937 acres in 2001 to over 145,000 acres in 2002. The vast majority of recorded damage was mapped in western Oregon and western Washington. The aerial survey only detects trees that have been recently killed by bear feeding. A ground survey on Quinault lands found that at least 3.5 times as many Douglas-fir trees are damaged as killed.

## **Beaver damage**

Region 8: South Carolina, Tennessee

Host(s): Hardwoods

The South Carolina Forestry Commission reports significant beaver damage to forest trees throughout much of the State. Forty-five counties reported at least some losses. Most damage was to hardwoods, and the Commission estimates 4,475 acres are affected, representing 80,550 cords valued at nearly \$1.5 million. Nevertheless, the mortality due to beaver activity was less than half of 2001 levels, apparently due to the drought and a lack of water for the animals to impound.

Tennessee noted that beaver dams resulted in flooding of 20 acres of hardwoods in the northwestern part of the State.

## **Chemical damage**

Region 2: Colorado, Kansas, Nebraska

Host(s): All tree species

Ice and dust-control materials utilizing magnesium chloride are being increasingly applied in the mountain road systems in Colorado, with corresponding increases in tree damage throughout the State. The Air Force Academy near Colorado Springs reports having 150 trees damaged or killed by these salts on their land. Serious problems were reported from other areas including Aspen and the Black Forest.

Herbicide damage to windbreaks and other tree plantings continued to be a serious problem in Kansas and Nebraska. Pesticide drift from crop weed control programs caused noticeable damage in parts of Kansas.

## **Drought effects**

Region 2: Colorado, South Dakota, Wyoming

Host(s): All tree species

Drought was major concern in 2002 and will continue to be a problem in 2003. Currently, Colorado reservoirs are only 40 percent of normal levels. Plantings in urban areas of Colorado blue spruce, lindens, and maples seemed to be very susceptible to drought. Forest health specialists report seeing a "halo" effect caused by drought in aspen stands surrounded by meadows, where the trees on the edge of the aspen clone show the moisture stress first.



Colorado blue spruce, cottonwood, green ash, and ponderosa pine were all affected by drought in 2002. There are approximately 200,000 acres of windbreaks in South Dakota that were affected by the drought during 2002. While some of the western portions of the State began experiencing drought in 2001, this condition became almost statewide by 2002. In addition to agro forestry plantings, urban forests were also impacted by the drought conditions. The increased environmental stress has resulted in an increase in successful colonization by borers such as ash bark beetles (*Hylesinus spp*), cottonwood borer (*Plectrodera scalator*), and Zimmerman pine moth (*Dioryctria spp.*).

### Region 3: Arizona, New Mexico

Host(s): Ponderosa pine, piñon pine, various hardwood species

Discoloration of foliage attributed to drought occurred on about 26,685 acres in 2002. In Arizona, this occurred on the Apache-Sitgreaves (1,940 acres), Coconino (1,655 acres), Coronado (6,540 acres), Kaibab (4,130 acres), Prescott (3,010 acres), and Tonto (260 acres) National Forests; Grand Canyon National Park (305 acres) and Saguaro National Monument (3,695 acres); Bureau of Land Management land (10 acres); Navajo Tribal Lands (4,110 acres); and on State and private land (1,030 acres). No drought damage was recorded in New Mexico in 2002.

### Region 5: California

Host(s): California black oak

In parts of southern California, precipitation in 2002 was unprecedentedly low and high rates of tree mortality reflected the resulting stress and bark beetle susceptibility. In northern California, black oaks in southern Lassen County headed into dormancy in late August, although the area involved was not as extensive as last year.

### Region 8: Regionwide

Host(s): All species

Drought conditions over much of the South abated considerably in 2002. Relief began in the form of rainfall from tropical storms in Texas, Louisiana, Arkansas, and Florida early in the summer, and by fall significant rains had eased the drought throughout the region. In many areas, however, the relief arrived too late to influence the growing season. Oklahoma forests continued to suffer, particularly in the northwestern part of the State. Windbreaks, riparian woodlands, and urban trees were most impacted. In Tennessee, Fraser fir Christmas trees were withheld from marketing in 2002 due to extensive shoot damage caused by the drought.

Georgia suffered continued drought-caused tree losses. Impacts in nurseries were again severe, with heavy loss of containerized seedlings recorded. Drought stress exacerbated the effects of the ongoing southern pine beetle outbreak in Georgia and the Carolinas.

### Region 9/Northeastern Area: Delaware, Maine, Massachusetts, Missouri, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia

Host(s): Various species

In Delaware, an extended drought took its toll on many forest trees, particularly white oak trees throughout the areas of the State that were significantly affected by the combined stresses of the 1994 ice storm, 1995 severe drought, and repeated gypsy moth defoliation in 1995-1996. Many of these trees were showing signs of severe decline. In New Jersey, the combination of drought and 2 consecutive years of gypsy moth defoliation have resulted in extensive oak losses in parts of western Bergen and eastern Passaic Counties. Oak mortality in some unsprayed areas in New Jersey defoliated by gypsy moth were estimated to be about

## Abiotic Damage

40 percent, representing the largest area of oak loss since 1972. In Ohio, excessive rainfall in April and May was followed by four hot, dry summer months, resulting in trees showing significant drought stress in the fall. In Pennsylvania, drought continued to be the dominant stressor throughout many areas of the Commonwealth. In West Virginia, the summer of 2002 was largely dry.

The declining health of Maine's coastal spruce stands intensified in 2002 due to another extremely dry season following record drought conditions in 2001. Maine experienced drought conditions during 4 of the last 7 years. About 9,300 acres of damage from drought was detected by aerial survey. In Massachusetts, effects were noticeable statewide. Beech, birch, and older trees that were subjected to other stress factors were showing signs of decline and mortality. The presence of increased woodborer activity was noted in the stands that were most severely impacted by drought. The aerial survey identified 1,506 acres of drought-related decline. New Hampshire reported drought conditions to be prevalent throughout the State for the second consecutive year with 5,747 acres of trees that were stressed or killed. In New York, precipitation deficits during the spring and summer ranged from 2-6 inches across most of the State, although parts of the west had a surplus during the early spring. The Catskills region seemed to have borne the worst of it. Drought stress was very evident at many locations and probably was a contributing factor to many of the forest health problems observed in 2002. Rhode Island experienced drought conditions during the growing season. July and August were very dry with extended heat waves. Leaf drop was reported on ash, butternut, and maple mostly in landscape settings. In Vermont, which has experienced 3 to 4 years of low precipitation, widespread foliage browning occurred, especially on ledge sites, along with mortality of previously stressed trees.

The lingering effects of long-term droughts in Missouri continued with increased attacks from wood-boring insects resulting in widespread decline of oaks throughout the southern part of the State. Above normal precipitation during the first half of the year did little to ameliorate the situation because precipitation returned to below normal levels the second half of the year.

## Fire

Region 8: Regionwide

Host(s): All species

Fire incidence and resulting tree mortality was reduced significantly in Florida, due in large measure to the return of rainfall to normal levels. Although the Appalachian Mountains experienced some significant spring fires, by fall the wildfire danger had declined to low levels throughout the region.

Region 9/Northeastern Area: New Jersey

Host(s): Pitch pine

In New Jersey, a major wildfire occurred on June 2, involving 1,300 acres in Ocean and Burlington Counties. Mortality was concentrated on 591 acres in the burned area.

## Flooding

Region 9/Northeastern Area: Massachusetts

Host(s): Various hardwoods and softwoods

In 2002, 119 acres of flooding and high water were recorded in Massachusetts. There has been an increase in small stream flooding caused by an increasing population of beaver.

## Frost

Region 8: North Carolina, Tennessee

Host(s): Various species

Five consecutive days of frost in North Carolina in May severely damaged Fraser fir seedlings. Additional damage occurred to out-planted Christmas trees. In total, an estimated \$30 million in losses were recorded.

A late May frost in Tennessee moderately affected hardwoods on the southern Cumberland Plateau. A frost in Carter and Unicoi Counties in northeast Tennessee damaged Fraser fir Christmas trees to the extent they could not be sold.

Region 9/Northeastern Area: Maryland, New Jersey, Ohio, Pennsylvania, West Virginia, New Hampshire, New York, Vermont

Host(s): Hardwoods, softwoods

In Maryland, frost damage was reported on 3,667 acres in Allegany County. New Jersey reported a small area of about 150 acres of frost damage in Burlington County. Ohio trees in Fayette, Highland, Pike, and Ross Counties experienced late May freeze/frost damage, especially black locust, black walnut, redbud, sycamore, sassafras, tulip tree, and Norway spruce. Symptoms vary from scorched leaf margins, leaf browning, and/or leaf wilting. In Pennsylvania, over 35,000 acres were defoliated due to extensive frost/freezing in Bedford, Union, Somerset, Snyder, Mifflin, Centre, and Clinton Counties. Most of West Virginia experienced an unusually late period of frost/freezing temperatures on May 19-22, 2002. Damage to trees ranged from simple leaf burn to total leaf drop. Trees hardest hit included yellow poplar, redbud, sycamore, walnut, and oak. The total area defoliated by frost in West Virginia was about 14,000 acres. Christmas tree growers reported severe damage to their fir and spruce trees as a result of the spring freeze.

Frost in May affected many oaks in central New Hampshire. In New York, about 1,550 acres in Delaware and Schoharie Counties were damaged by an early April ice storm. Damage was light to severe and patchy in nature. About 250 acres of frost damage was detected by aerial survey on Fire Island National Seashore in Suffolk County. Damage was scattered in southern Vermont, with heavy damage to Christmas trees.

## Hail

Region 9/Northeastern Area: Pennsylvania, Missouri

Host(s): Hardwoods

Aerial surveys detected approximately 2,700 acres of oak and hickory defoliation by a hailstorm in Fulton and Franklin Counties, Pennsylvania.

About 67,000 acres were damaged in Iron, Madison, and Bollinger Counties, Missouri, by a severe hailstorm that spanned an area 41 miles long by 3 miles wide. Hail up to 1 inch in diameter was reported.

## Ice/snow damage

Region 8: North Carolina, Oklahoma, Tennessee

Host(s): All species

A large area of northwestern Oklahoma was impacted by a severe ice storm in late January 2002. An estimated 400,000 acres of forest and woodlands suffered branch and main stem breakage.

## Abiotic Damage

A very damaging ice storm struck North Carolina December 4-5, cutting power to 1.7 million residents. Governor Easley subsequently declared 33 counties a disaster area. The North Carolina Division of Forest Resources is carrying out damage impact surveys. Preliminary data show the damage to be across both sides of I-85, with most damage occurring on forest edges and in recently thinned stands.

Northern and middle Tennessee incurred ice damage to sawtimber sized white pine as well as to loblolly pine, eastern red cedar, and magnolia.

Region 9/Northeastern Area: Pennsylvania

Host(s): Hardwoods

A mid-November ice storm caused extensive damage to over 108,000 acres of hardwoods still in full leaf in Centre, Huntingdon, and Perry Counties, Pennsylvania. Major damage also occurred in Somerset County, around Mt. Davis, the highest point, at 3,213 feet, in Pennsylvania,. One-half to 1 inch of ice accumulated on branches and leaves, breaking tops, especially on oaks.

## Squirrel damage

Region 5: California

Host(s): Lodgepole pine

Pole-size and larger lodgepole pines near Chester were stripped of bark throughout their upper boles by Douglas squirrels. Patches removed varied in size and about 40 percent of the trees in a 100-acre area were affected.

## Wind

Region 8: Tennessee

Host(s): Southern pines, hardwoods

Several tornadoes struck Tennessee in 2002, with the eastern part of the State most heavily affected. Over 300 acres in Morgan County and 200 acres in Anderson County were severely damaged. Straight-line wind damage also occurred in the Cumberland Plateau where 5 acres were affected.

Region 9/Northeastern Area: Missouri, Pennsylvania

Host(s): Hardwoods, softwoods

Aerial surveys detected approximately 184 acres of oak/hickory trees damaged by high winds in Schuylkill, Dauphin, and Lebanon Counties, Pennsylvania. Two separate tornados damaged nearly 21,000 acres in Madison, Carter, and Butler Counties, Missouri, on April 24, 2002.

# Appendix



## Appendix A

### Forested Areas\*

About one-third of the Nation's land area, 736.7 million acres, is forested – 380.3 million acres (52 percent) in the East, 227.3 million acres (31 percent) in the continental West, and 129.1 million acres (17 percent) in Alaska. By ownership nationwide, 42 percent of the acreage is in public ownership and 58 percent is in private ownership. Of the public ownership, 20 percent is in the East, 48 percent in the continental West, and 32 percent in Alaska. In contrast, 75 percent of the private ownership is in the East, 18 percent in the continental West, and 7 percent in Alaska.

**Eastern hardwood forests** make up 74 percent of all the forested acreage in the East. The largest component of the eastern hardwood forest type is oak-hickory, which occupies 130 million acres, or 34 percent, of the eastern forested acreage and is found in the South and the southern half of the North.

The beech-birch-maple forests occur on 51 million acres, or 13 percent, of the eastern forests and are located in the North.

The oak-pine forests occupy 32 million acres, or 8 percent, of the eastern forested acreage and are located in the South, as are the oak-gum-cypress forests, which occur on 29 million acres, or 8 percent, of the eastern forested acreage.

The aspen-birch forests occupy 17 million acres, or 4 percent, of the eastern forested acreage and are located in the North. The elm-ash-cottonwood forests on 15 million acres, or 4 percent, of the forested acreage are bottom land forests in both the North and South. Other forest types occupy 13 million acres, or 3 percent, of the forested acreage in the East.

**Eastern softwood forests** make up the remaining 26 percent of the eastern forested acreage. The loblolly-shortleaf pine forests occupy 50 million acres, or 13 percent, of the eastern forested acreage and occur in the South. Also in the South are the longleaf-slash pine forests, which cover 14 million acres, or 4 percent, of the forested lands.

The spruce-fir forests are on 20 million acres, or 5 percent, of the forested lands and the white-red-jack pine forest on 15 million acres, or 4 percent, of the forest lands; both are in the North.

**Western hardwood forests** occupy 49 million acres, or 14 percent, of the western forested acreage, including that in Alaska. The primary species are oaks in California, aspen in the Intermountain Region, and red alder in the Pacific Northwest.

**Western softwood forests** make up 86 percent of all the western forests. Douglas-fir forests occupy 43 million acres, or 12 percent, of the western forest lands. Douglas-fir is found throughout much of the West, except Alaska.

Ponderosa pine forests occupy 31 million acres, or 9 percent, of the forested acreage; the species is present through much of the West. Lodgepole pine is also found throughout much of the West. It is most abundant in the Intermountain Region, occupying 18 million acres, or 5 percent, of the forested acreage.

Hemlock-Sitka spruce forests are found on the Pacific Slope in Oregon and Washington and along coastal Alaska. These forests occupy 16 million acres, or 5 percent, of the forested lands. The fir-spruce forests occupy 60 million acres, or 17 percent, of the acreage and are mid-to-high elevation forests throughout the West.

The other softwoods group is made up primarily of black spruce stands in interior Alaska and occupies 70 million acres, or 20 percent, of the forested land in the West.

The pinyon juniper type occupies 48 million acres, or 14 percent, of the forested acreage.

Other western types (western white pine, larch, redwood, chaparral, and nonstocked areas) occupy 17 million acres, or 5 percent, of the western forested acreage.

\* Data may not add to totals because of rounding

From: Powell, Douglas S.; Faulkner, Joanne L.; Darr, David R.; Zhu, Zhiliang; MacCleery, Douglas W. 1993. Forest resources of the United States, 1992. General Technical Report RM-234. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 132p.+map. [Revised, June 1994]

## Appendix B

### Reporting Area Definition

Reporting area is defined as an area of land designated by the name of the Federal or tribal land (in most cases) included in the area, but also contains intermingled and adjacent lands of all ownerships. Reporting areas border on each other to include all lands. The name of the reporting area defines its location; for example, the Mount Hood reporting area includes the Mount Hood National Forest and vicinity.