United States
Department of
Agriculture

Forest Service

**Forest
Health
Protection**

December 1998

Forest Insect and Disease Conditions in the United States 1997

Healthy Forests Make
a World of Difference

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PREFACE

This is the 47th annual report prepared by the U.S. Department of Agriculture, 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 1997. 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.

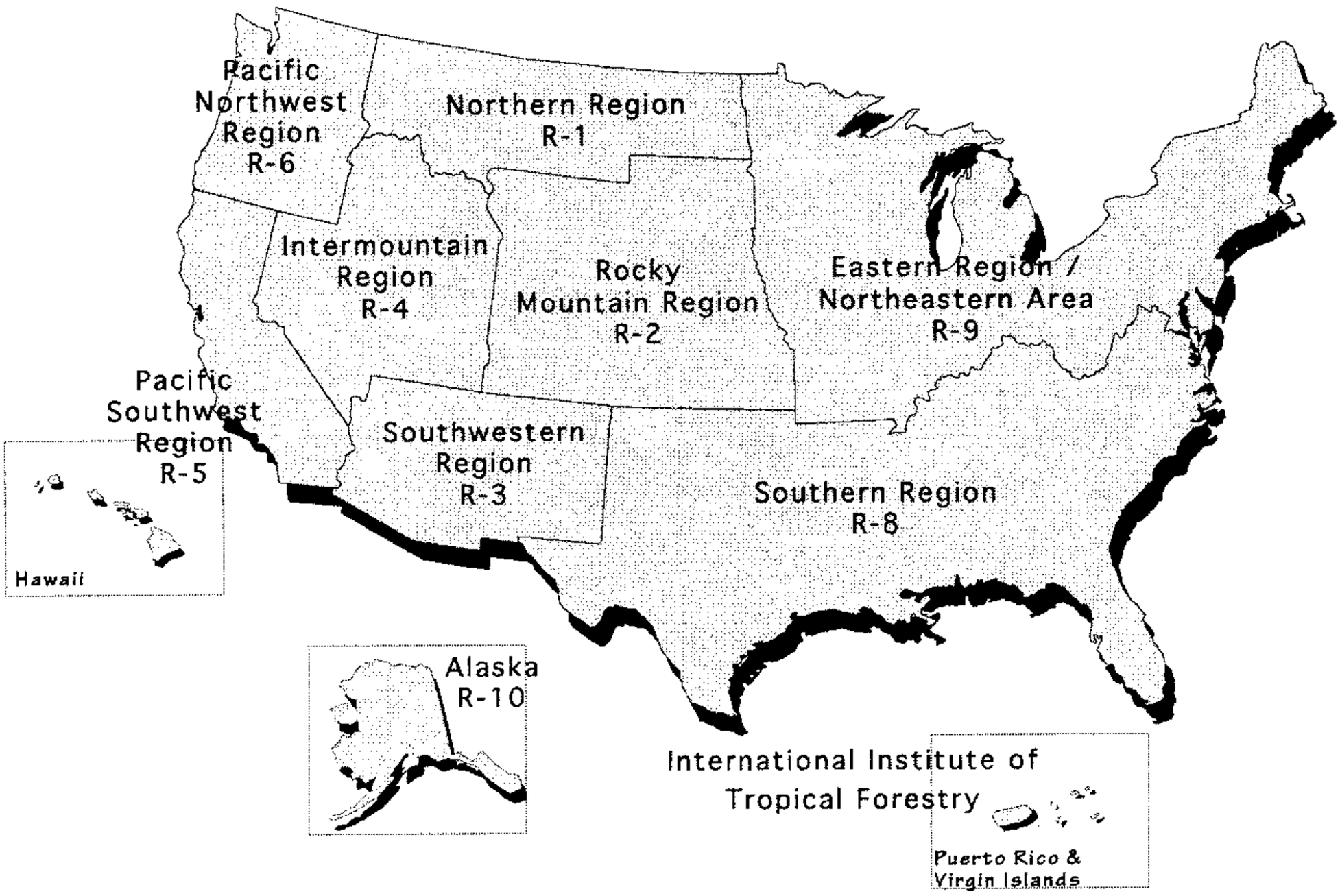
The information in this report is provided by the Forest Health Protection Program of the USDA Forest Service. This Program serves all Federal lands, including the National Forest System and the lands administered by the Departments of Defense and Interior. Service is also provided to tribal lands. The program also 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 Forest Service program specialists.

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

The Forest Service also prepared "America's Forests: 1997 Health Update" that highlights major forest health concerns. The report also deals with exotic (nonnative) pests, the rural-urban-wildland interface, and the effects of weather and air pollution on forests.

The report is available on the Internet at:

www.fs.fed.us/foresthealth/fhnpc.html.



USDA Forest Service Regions and Area

Copies of this report are available from:
USDA Forest Service
Forest Health Protection, AB-2S
P.O. Box 96090
Washington, DC 20090-6090
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This report is also available on the Internet at:
www.fs.fed.us/foresthealth/fhnpc.html

CONTENTS

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 in the West. Nationwide, these forests provide economic, social, and environmental benefits. Native and nonnative (exotic) insects and diseases as well as abiotic influences all affect the health and productivity of the forests.

Highlighted below, and in part 1 of this report, 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 increased from 7.3 million acres in 1996 to 8.5 million acres in 1997.

Mountain pine beetle - affected acreage increased from 300,000 acres in 1996 to 329,000 acres in 1997, but beetle activity remains low.

Spruce budworm - defoliated 38,000 acres of trees in Alaska and 347,000 acres of trees in the Great Lakes area in 1997.

Western spruce budworm - defoliation continues at less than half a million acres for the fifth consecutive year.

Spruce beetle - active infestations in Alaska declined by about 50 percent to 544,000 acres. Spruce beetle activity was generally low in the West.

Insects: Nonnative

Asian long-horned beetle - about 700 shade trees removed and destroyed in New York. A quarantine is in effect. At this writing (July 1998) the beetle has just been found in Chicago.

Gypsy moth (European) - defoliation decreased from 200,000 acres in 1996 to 47,000 acres in 1997; the lowest acreage since 14,000 acres defoliated in 1959. Thousands of moths were trapped in Illinois and Wisconsin and small numbers of moths were being caught in traps in several western States.

Common European pine shoot beetle - is a threat to Christmas tree growers. The beetle was discovered in 1992 in Ohio. By 1995 the beetle was found in eight States from New York to Illinois. The beetle was found in 65 additional counties within the infested States in 1996 and two additional counties in 1997.

Hemlock woolly adelgid - was introduced into Virginia in 1950 and has spread north into southern New England and poses a serious threat to the Eastern hemlock. The insect was found in North Carolina for the first time in 1995. Adelgids were found in two additional North Carolina counties in 1996. In 1997 two new infested counties in West Virginia and one in Pennsylvania were found.

Pink hibiscus mealybug - was first discovered on the island of Grenada in the Caribbean in 1994 and has spread to 16 islands. It is a threat to the mainland. The mealybug feeds on a wide variety of host plants. At this writing (October 1998) it has been found on the main island of Puerto Rico.

Diseases: Native

Fusiform rust - is the most damaging disease of pines in the South, affecting an estimated 13.7 million acres of pine.

Dwarf mistletoes - native parasitic plants that grow on conifers, are the most serious disease of trees in the West. An estimated 30.6 million acres of conifers are infected.

Root diseases - are among the most serious pests in the West, especially in areas where root diseases and bark beetles work together.

Diseases: Nonnative

White pine blister rust - introduced around the turn of the century, now occurs throughout most of the ranges of the five-needled pines, including eastern white pine, western white pine, sugar pine, and high-elevation whitebark pine causing extensive tree mortality. In 1990, blister rust was found in New Mexico and is threatening the viability of southwestern white pine.

Beech bark disease - is the result of an attack by the beech scale followed by invasion of a fungus. The scale and probably the fungus were introduced into North America about 1890. The disease is found killing beech trees from Maine to Pennsylvania, with outlying spots in Virginia, West Virginia, North Carolina, and Tennessee.

Diseases: Origin Unknown

Dogwood anthracnose - first found in the 1970's is now found in 21 eastern States, as well as Washington, Oregon, and Idaho. The disease kills both woodland and ornamental dogwoods.

Butternut canker - is found throughout the range of butternut. Trees exhibiting resistance are being propagated for study.

Conditions by Agent

Part 2 of this report provides more detailed information about these insects and diseases 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

European form

Lymantria dispar was intentionally brought to America from France in 1869 to start a silk industry. The moth escaped and continues to spread to the south and west. Currently all or parts of 15 States and the District of Columbia are considered generally infested. The infested States extend from New England to Virginia, West Virginia, Ohio, and Michigan. Also Wisconsin and Illinois reported trapping 91,491 and 34,838 male moths respectively, but no defoliation was observed in either State.

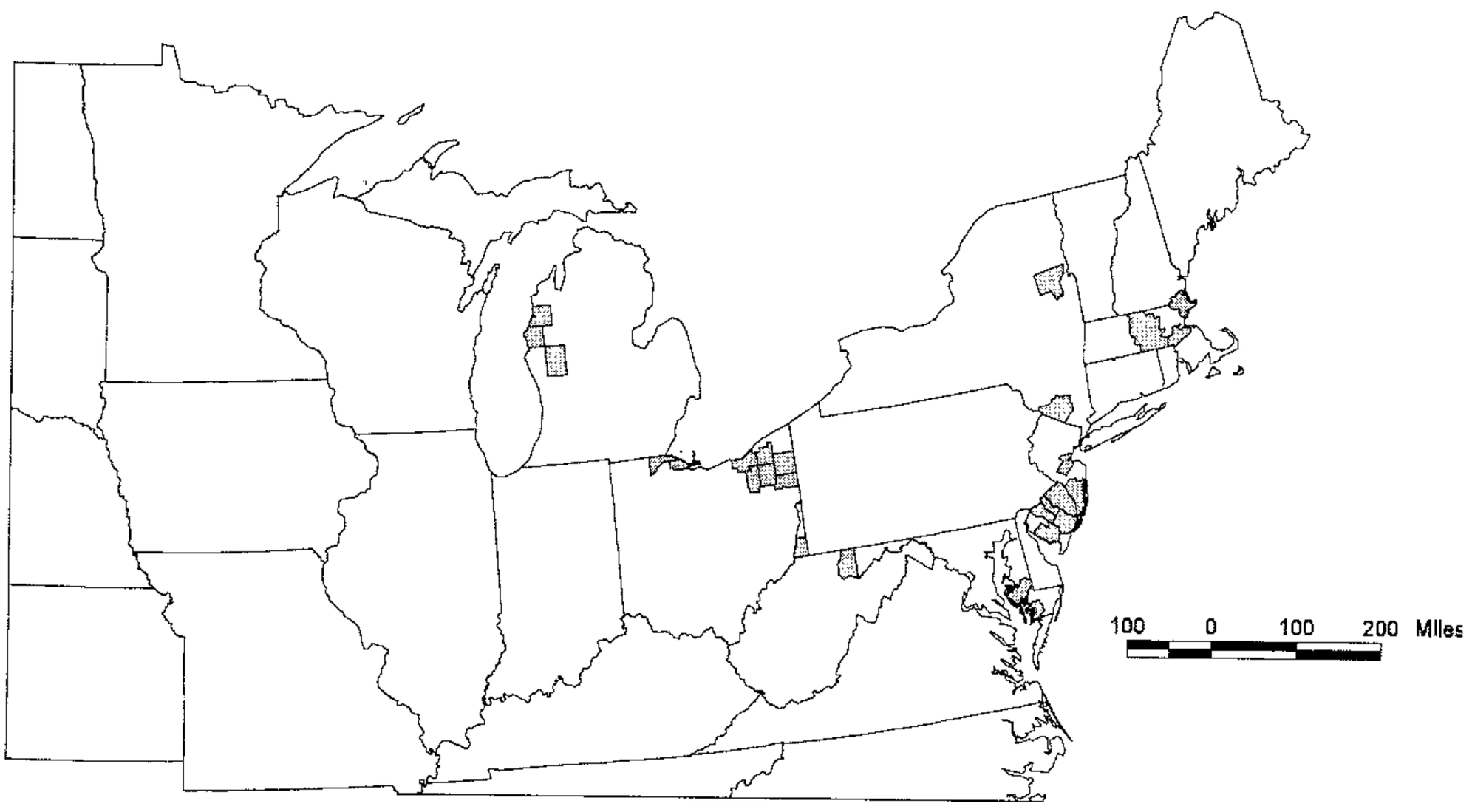
Defoliation in the East decreased from 200,000 acres in 1996 to 47,000 acres in 1997. This is the lowest acreage of defoliation since the 14,467 acres defoliated in 1959. The decline is apparently a continuing effect of an *Entomophaga maimaiga* fungus epidemic in 1996.

Gypsy moths continue to be trapped across the South and West. An apparent reintroduction of the moth was found in the Salt Lake City area of Utah; treatment is proposed for 1998. Eradication projects were carried out in Washington and Oregon in 1997 and more projects are planned for 1998.

Asian form

The Asian form of the moth was accidently introduced into Oregon and Washington on board cargo ships arriving from the Russian Far East in 1991. In 1997 in Washington, two Asian forms were trapped; one Russian Far East strain and one Central Siberian strain. The Asian form of the moth was also accidently introduced into North Carolina on board a cargo ship loaded with military equipment returning from Germany. That infestation has been eradicated.

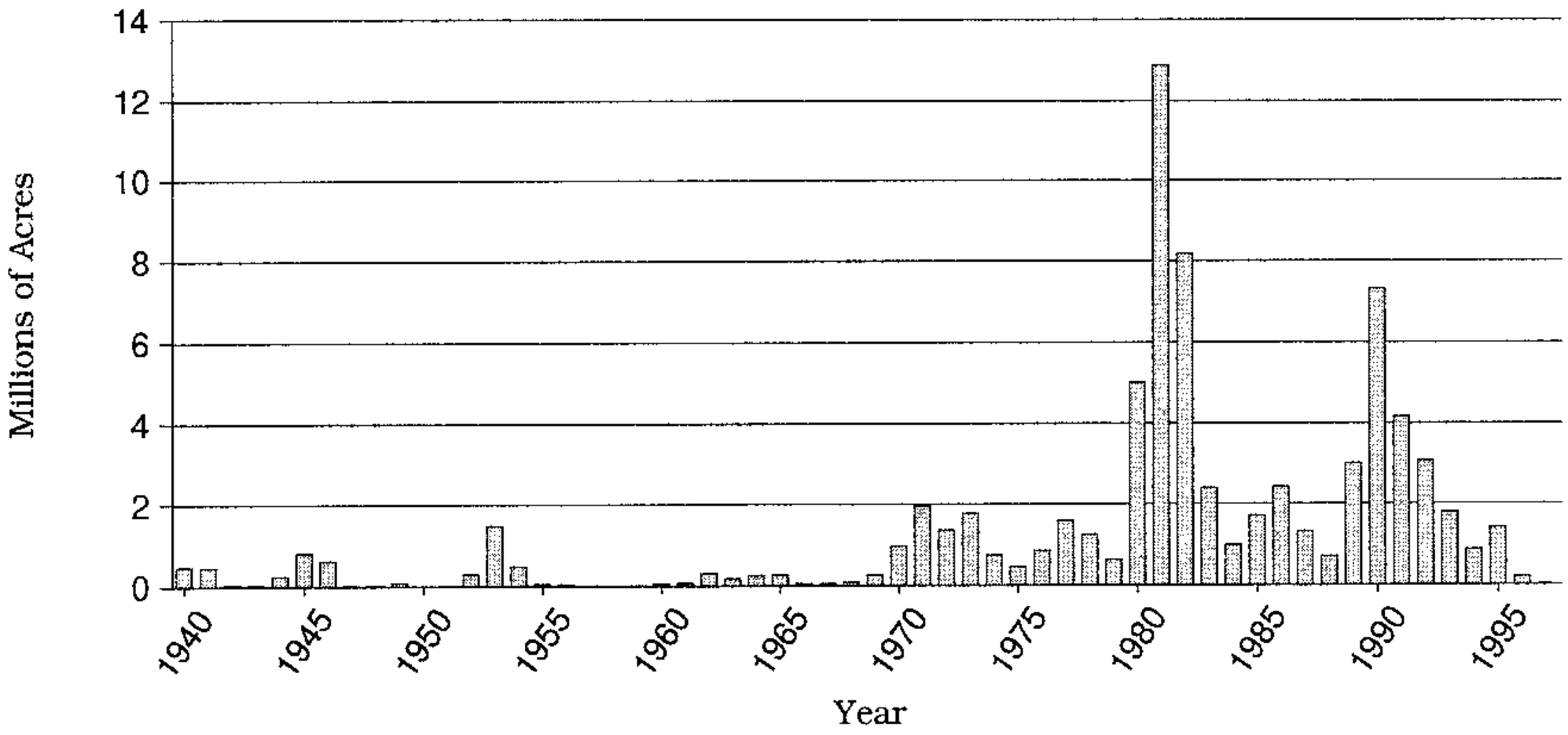
Counties Where Gypsy Moth (European) Defoliation Reported, 1997



Acres of Aerially Detected Gypsy Moth (European) Defoliation, 1993-1997

State	1993	1994	1995	1996	1997
Connecticut	0	0	2,700	1,400	0
Delaware	26,700	60,700	65,500	500	0
Maine	50,700	1,700	0	100	0
Maryland	68,900	93,200	93,900	11,200	700
Massachusetts	88,700	76,700	8,700	7,000	100
Michigan	399,300	97,300	85,900	5,000	36,900
New Hampshire	10,100	8,100	1,700	0	0
New Jersey	27,700	17,800	39,600	27,800	1,900
New York	2,000	500	200	16,300	2,200
Ohio	600	100	34,400	49,000	5,000
Pennsylvania	318,100	18,000	132,500	6,700	0
Rhode Island	0	400	0	4,000	0
Vermont	0	0	0	0	0
Virginia	589,100	452,500	849,000	0	0
Washington, DC	0	0	0	0	0
West Virginia	202,500	53,400	103,000	70,700	500
Total	1,784,400	880,400	1,417,100	199,700	47,300

Gypsy Moth (European) Defoliation, 1940-1997



Southern Pine Beetle

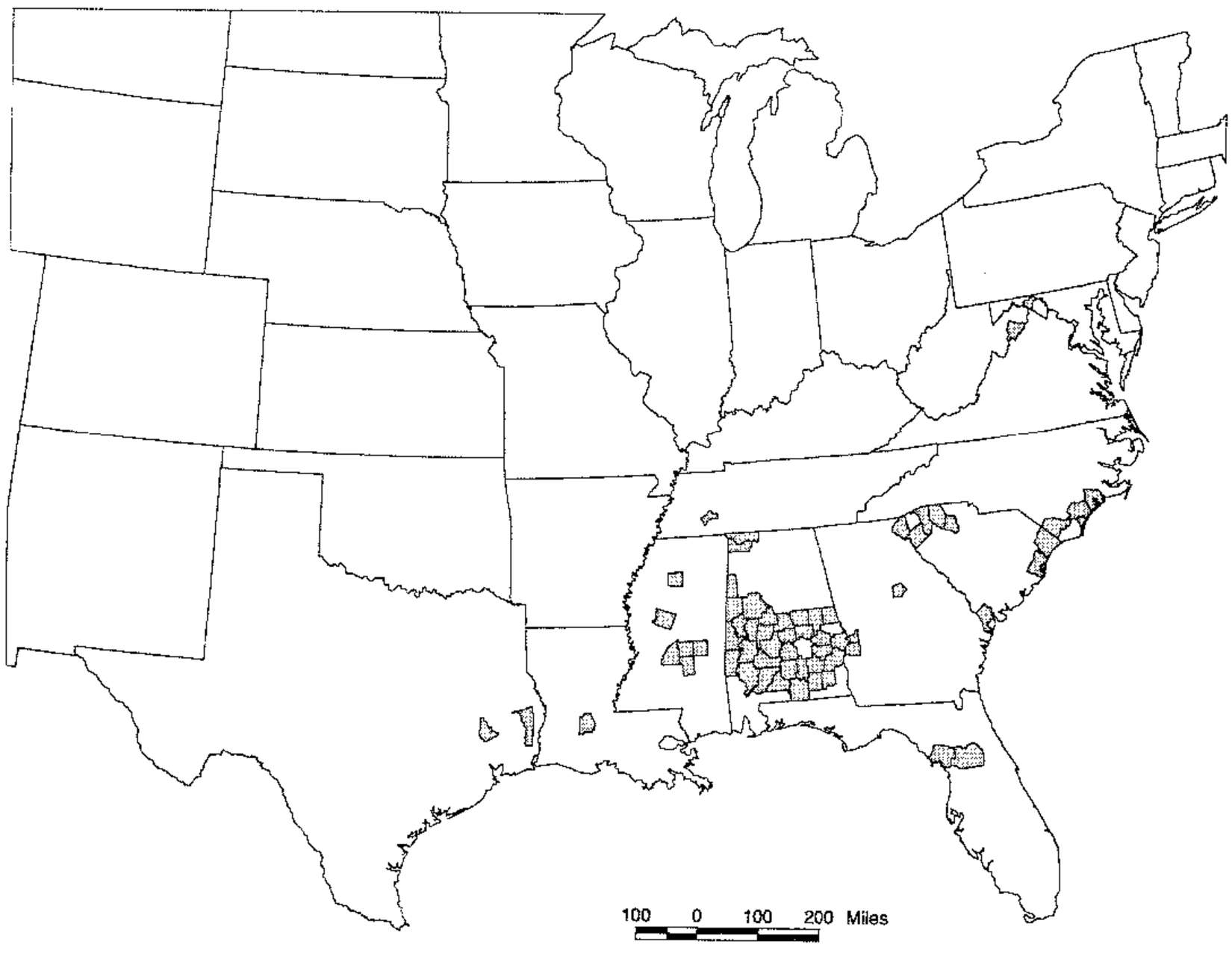
Dendroctonus frontalis, a native insect, is the most destructive of the eastern species of bark beetles. Southern pine beetle populations are epidemic in some parts of the South almost every year. Annually, this beetle destroys timber trees worth millions of dollars and also affects recreation areas, shade trees, and general aesthetics. Infestations usually start in trees weakened by disease, lightning strikes, excessive age, storm damage, or other stress factors.

Acreage in the South affected by the southern pine beetle increased in 1997 following a major decline in 1996. Populations started 1997 at very low levels, but by mid-summer beetle populations made a comeback. Outbreak levels* were reported in North and South Carolina, Georgia, Florida, Alabama, Mississippi, and Texas.

The southern pine beetle outbreak on North Carolina's coastal plain is in an area affected by Hurricanes Bertha and Fran in 1995. In Florida the outbreak is in the north-central part of the State; the farthest south in Florida that the beetle has been recorded.

*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 Reported, 1997

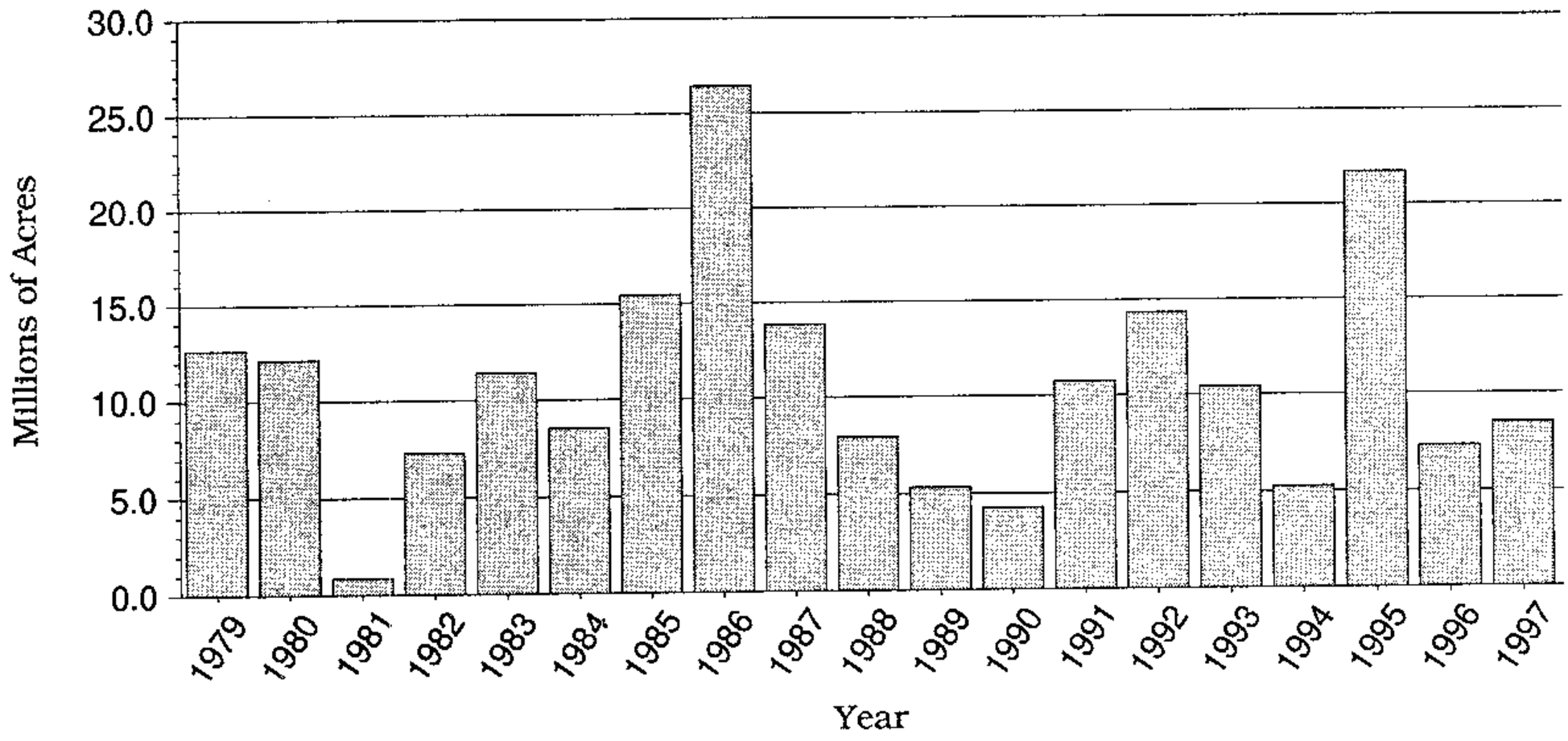


Acres (in thousands) of Southern Pine Beetle Outbreaks in Southern Region (R-8), 1993-1997*

State	1993	1994	1995	1996	1997
Alabama	2,753.4	2,951.4	6,552.4	1,177.9	4,535.5
Arkansas	649.1	429.6	2,112.9	1,420.6	0.0
Florida	0.0	97.1	736.0	0.0	401.1
Georgia	587.3	315.4	1,326.0	101.3	312.9
Kentucky	0.0	0.0	0.0	0.0	0.0
Louisiana	2,291.9	0.0	2,908.8	165.3	110.0
Mississippi	331.5	689.6	2,714.3	1,150.9	892.1
North Carolina	569.6	47.9	2,755.6	747.1	702.3
Oklahoma	0.0	0.0	0.0	0.0	0.0
South Carolina	366.4	332.8	2,542.9	2,496.6	843.0
Tennessee	173.0	148.6	0.0	41.2	30.3
Texas	1,106.8	238.3	0.0	0.0	649.6
Virginia	1,584.6	0.0	27.0	0.0	0.0
Total	10,413.6	5,250.7	21,675.9	7,300.9	8,476.8

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

Southern Pine Beetle Outbreaks in Southern Region (R-8), 1979-1997*



* Does not include Delaware, Maryland, or West Virginia, which are in the Eastern Region (R9)/Northeastern Area.

Mountain pine beetle

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

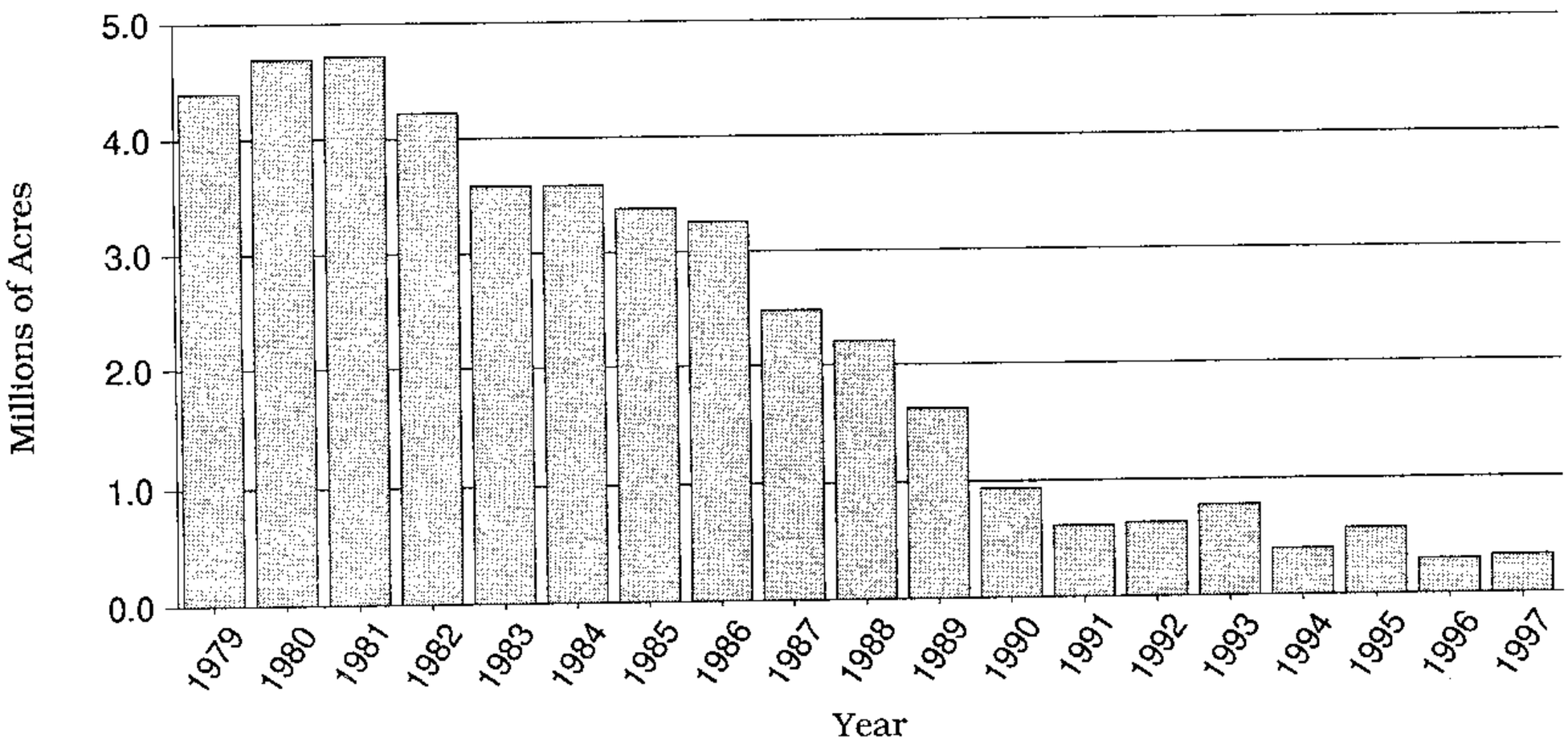
In 1997, beetle affected acreages increased in seven of the 11 reporting States, however, affected acreages remained low. In Arizona, California, and New Mexico the widely scattered trees or very small locations do not show up well on the map. Increased numbers of trees killed per acre were also reported. Some of the increased beetle activity was reported as associated with recent wildfire activity. Other beetle activity was associated with weather favorable to beetle buildup or increased amounts of susceptible lodgepole pine.

Mountain Pine Beetle Outbreak Areas, 1997

Acres (in thousands) of Mountain Pine Beetle Outbreak, 1993-1997

State	1993	1994	1995	1996	1997
Arizona	0.0	0.2	0.2	2.2	10.0
California	121.0	115.0	58.9	25.1	15.2
Colorado	0.0	1.2	4.7	12.8	22.2
Idaho	43.7	7.8	13.9	33.4	54.0
Montana	43.4	19.2	31.3	27.6	33.4
New Mexico	1.4	2.8	0.4	1.1	0.1
Oregon	345.6	161.1	234.4	112.6	82.3
South Dakota	13.6	1.4	2.6	2.2	9.4
Utah	10.0	18.7	20.9	24.6	20.9
Washington	200.3	76.4	205.9	56.7	74.7
Wyoming	2.8	1.6	2.3	1.7	6.7
Total	781.8	405.4	575.5	300.0	328.9

Mountain Pine Beetle Outbreaks, 1979-1997



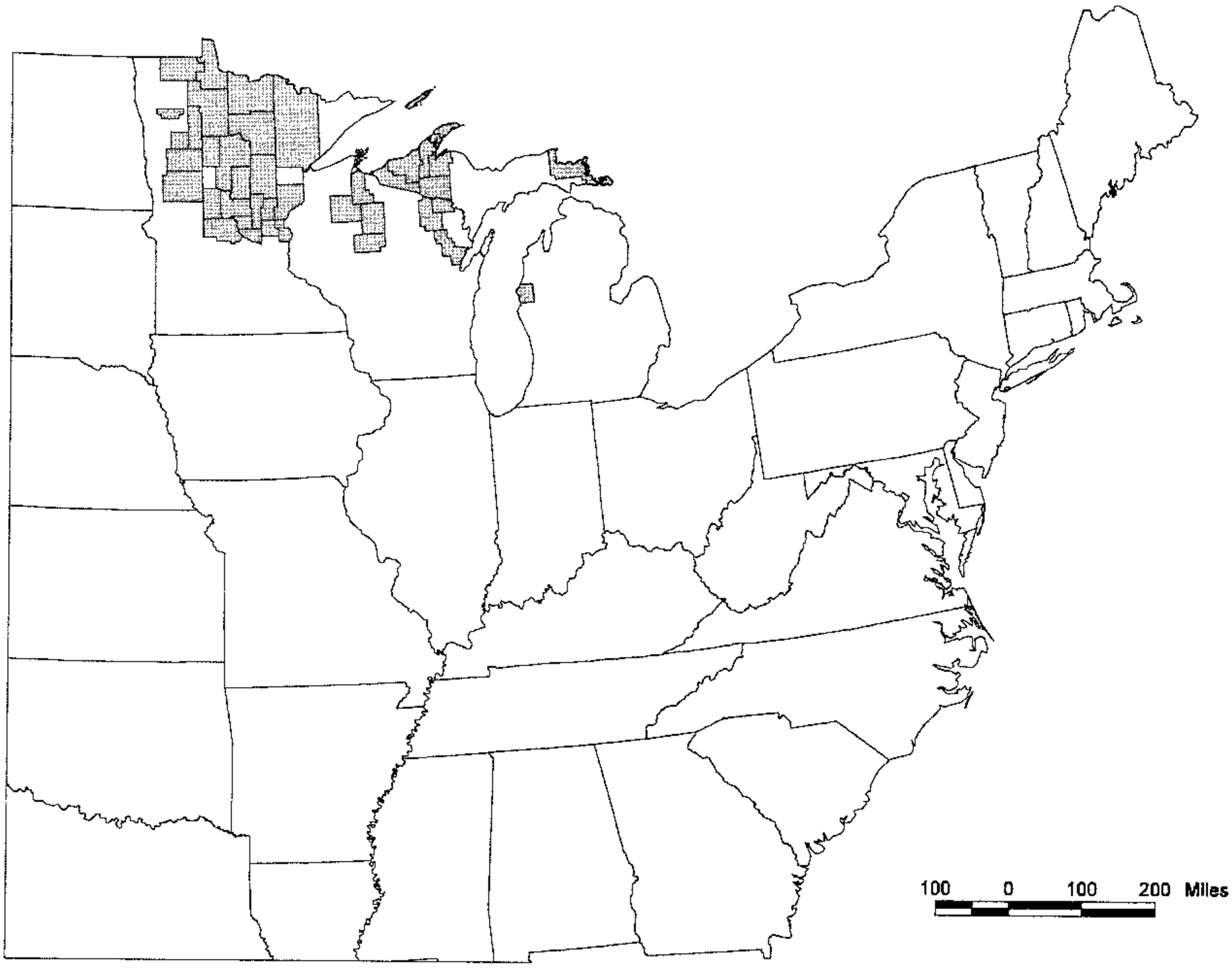
Spruce budworm

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

In Alaska, the acreage of defoliation declined for the second consecutive year. The 1997 decline was 84 percent from 236,000 acres to 38,000 acres indicating that the outbreak has collapsed.

In the East, all of the reported activity was in the Great Lakes area; 80 percent in Minnesota, and 92 percent of that on State and private lands. The Ottawa National Forest in Michigan experienced over 61,000 acres of defoliation. Six other national forests and Isle Royal National Park received less than 6,000 acres of defoliation each. The outbreak in Pennsylvania collapsed.

Counties Where Spruce Budworm Defoliation Reported in Eastern United States, 1997



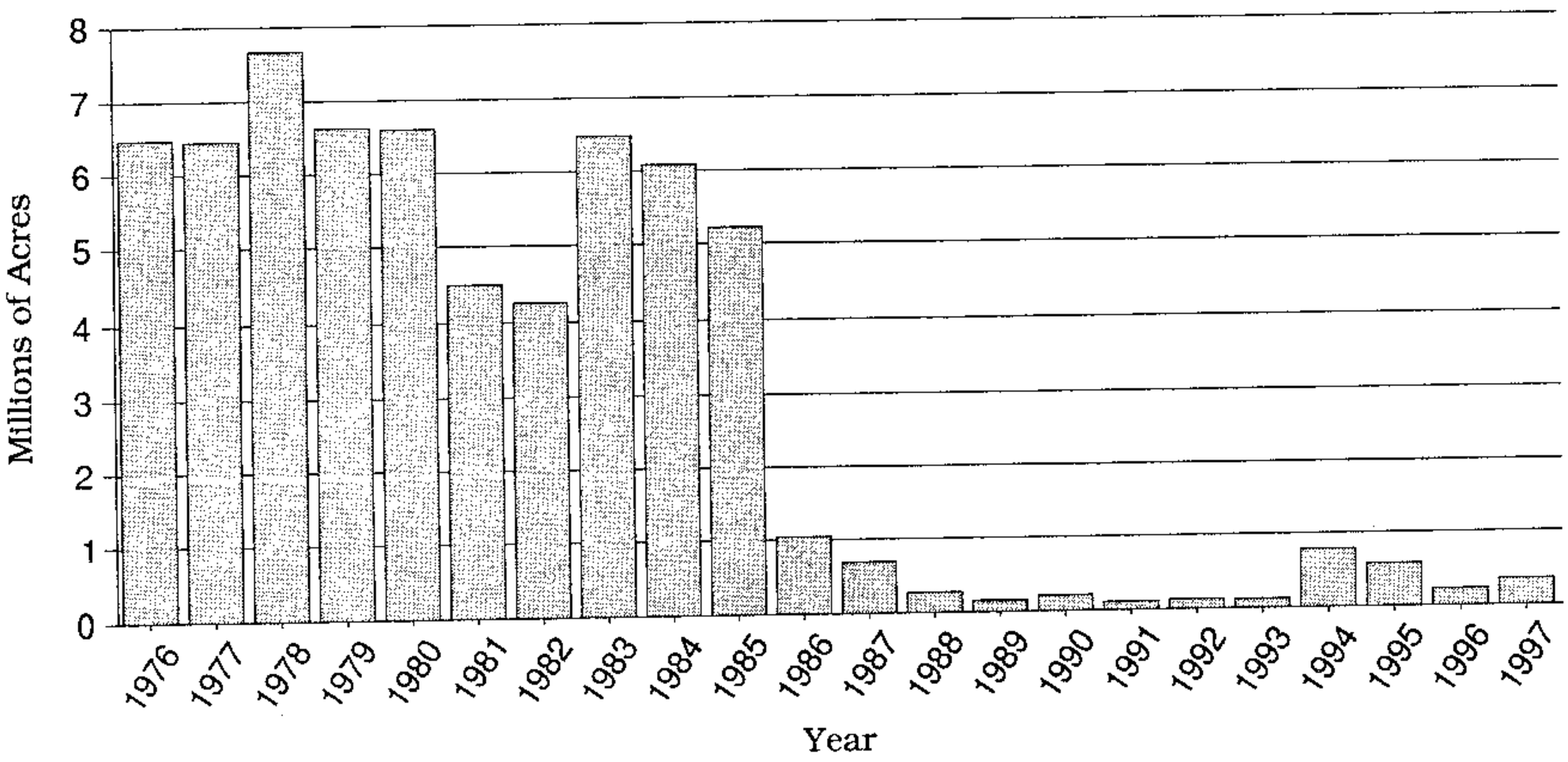
Acres (in thousands) of Aerially Detected Spruce Budworm Defoliation in Eastern United States, 1993-1997

State	1993	1994	1995	1996	1997
Maine	0.0	0.0	0.0	0.0	0.0
Michigan	0.0	6.8	51.2	12.9	61.6
Minnesota	116.0	770.5	505.0	207.6	276.2
New Hampshire	0.0	0.0	0.0	0.0	0.0
New York	0.0	0.1	0.4	0.0	0.0
Pennsylvania	0.0	0.0	0.0	2.0	0.0
Vermont	0.0	0.0	0.0	0.0	0.0
Wisconsin	0.0	1.0	12.5	0.0	9.6
Total	116.0	778.4	569.1	222.5	347.4

Acres (in thousands) of Aerially Detected Spruce Budworm Defoliation in Alaska, 1993-1997

State	1993	1994	1995	1996	1997
Alaska	33.0	232.5	279.1	235.9	38.4

Spruce Budworm Defoliation in Eastern United States, 1976-1997



Western spruce budworm

Choristoneura occidentalis defoliation remains generally low throughout the West. In 1995 no budworm defoliation was observed in Montana and northern Idaho for the first time since aerial surveys began in 1948. No budworm defoliation was observed in 1996 and again 1997, however, trap catches were up significantly in 1997. In Colorado, there is chronic budworm activity which is the direct result of stand conditions complicated by the exclusion of wildfire.

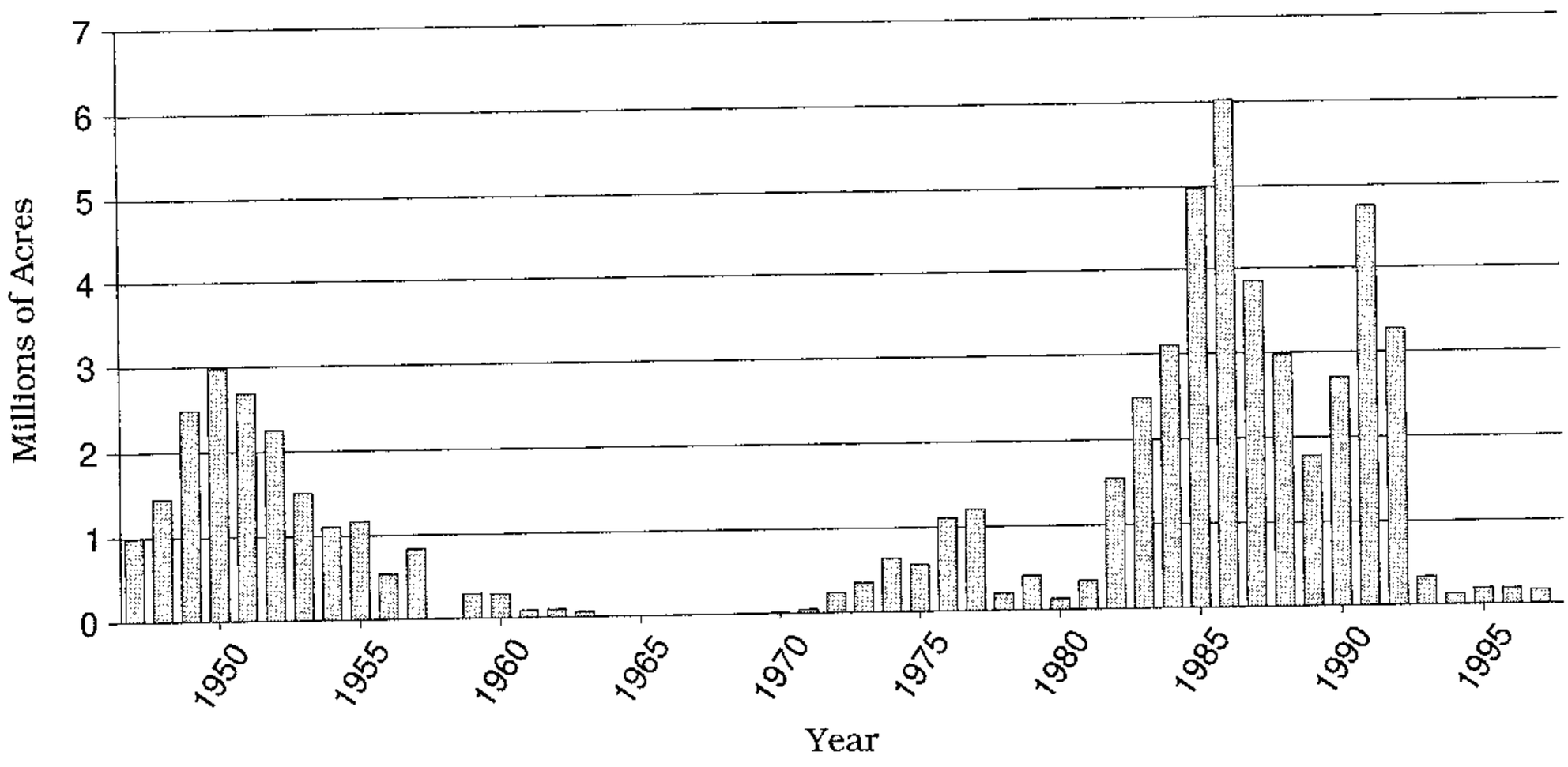
The largest outbreak areas were in New Mexico and Washington. In New Mexico the defoliation occurred on the Carson National Forest, and on State and private lands. In Washington most of the defoliation was detected on the Glenwood reporting area and the Yakima Indian Reservation. In Washington there was an observable intensification of cumulative defoliation in some areas.

Western Spruce Budworm Defoliation Areas, 1997

Acres (in thousands) of Aerially Detected Western Spruce Budworm Defoliation, 1993-1997

State	1993	1994	1995	1996	1997
Arizona	0.0	0.0	7.0	3.0	1.1
California	0.0	0.0	0.0	0.0	0.0
Colorado	1.2	0.0	97.0	21.8	0.0
Idaho	0.9	0.0	0.0	0.0	0.0
Montana	44.2	2.4	0.0	0.0	0.0
New Mexico	66.4	369.2	183.8	123.9	197.1
Oregon	87.7	37.4	14.9	1.0	0.0
Utah	0.0	0.0	0.0	0.0	0.0
Washington	243.8	85.4	175.1	183.2	165.9
Wyoming	2.5	1.1	0.0	0.0	0.0
Total	446.7	495.5	477.8	332.9	364.1

Western Spruce Budworm Defoliation in Pacific Northwest Region (R-6), 1947-1997



Hemlock woolly adelgid

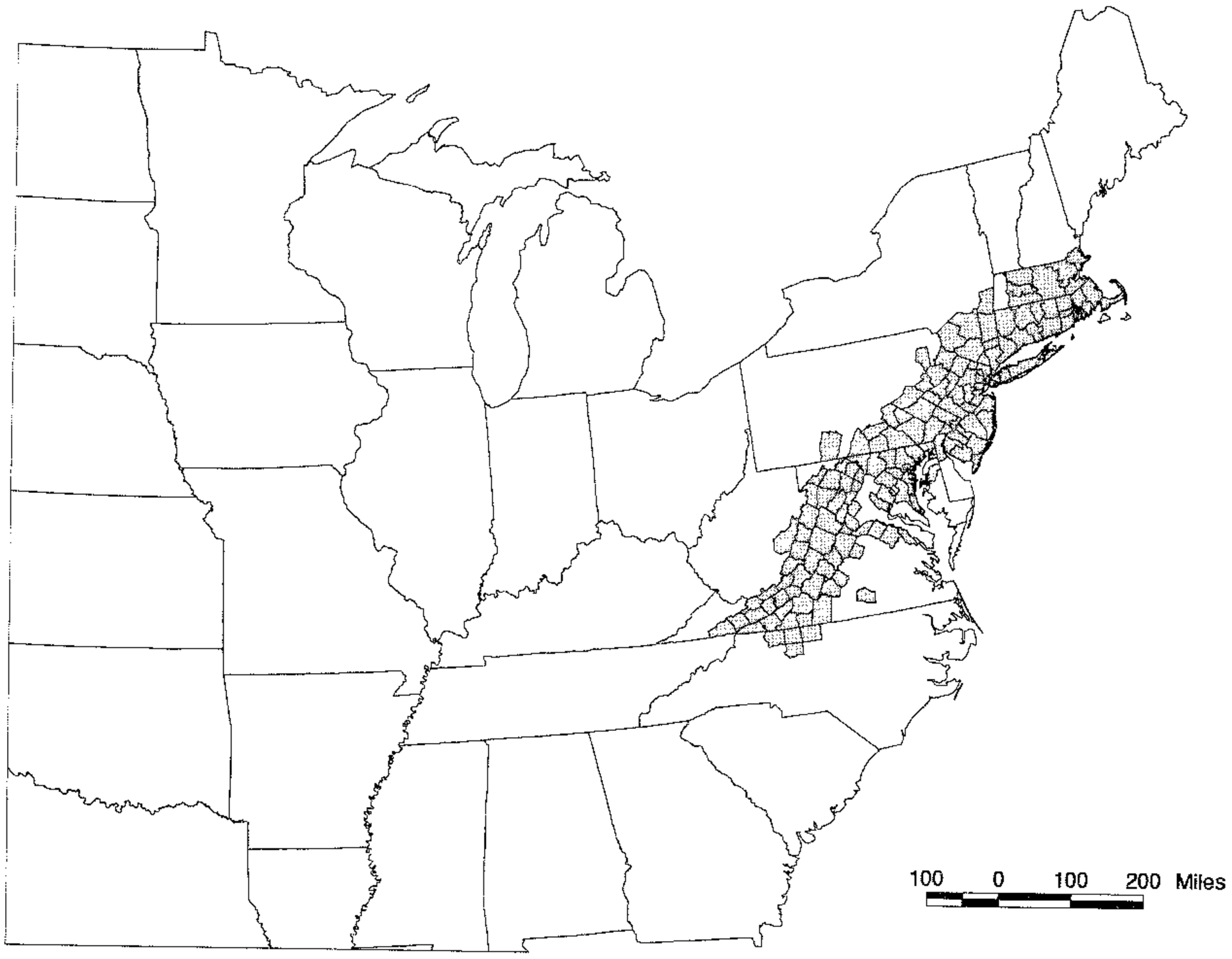
Adelges tsugae was introduced into the West Coast from Asia in 1924 and found in British Columbia, Washington, Oregon, and California. The adelgid does very little damage in western forests, but sometimes kills ornamental trees.

In the East, however, the adelgid poses a serious threat to the eastern hemlock; killing hemlocks in 3 to 5 years. In 1950, the insect was introduced into the East coast near Richmond, Virginia, and has spread north into southern New England.

In North Carolina and Virginia, adelgid populations continue to build and intensify but no new counties were reported. In the North, the adelgid infestation expanded into two new counties in West Virginia and one in Pennsylvania.

The eastern hemlock has important aesthetic qualities in scenic areas, campgrounds, and recreation areas. The loss of the eastern hemlock from stream banks is a threat to populations of trout because shade from the trees helped maintain cool water temperatures.

Counties Where Hemlock Woolly Adelgid Reported, 1997

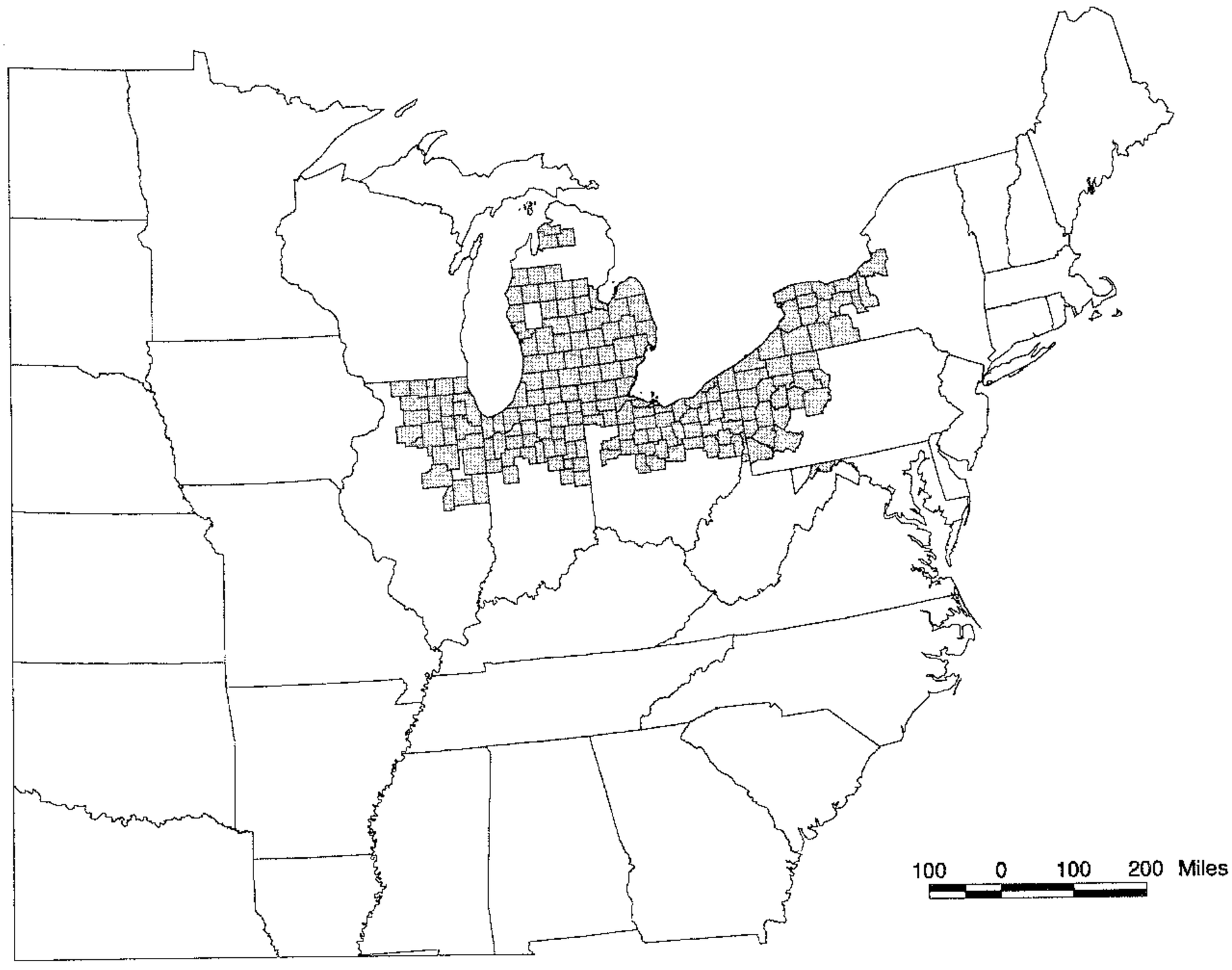


Common European pine shoot beetle

Tomicus piniperda is an introduced insect discovered near Cleveland, Ohio, in 1992. In April 1995, beetles were found in Maryland and West Virginia as well as the previously reported States--Illinois, Indiana, Michigan, New York, Ohio, and Pennsylvania. The beetle continues to spread as infestations were found in an additional 65 counties in 1996. Two additional counties were added to the Illinois list in 1997. The beetle has also been found in 10 counties in Ontario, Canada.

The beetle prefers Scotch pine but feeds on other pines as well. Thus far, the beetle is a problem mainly for Christmas tree growers. A native of Europe and Siberia, the beetle causes serious damage to trees in burned over areas and areas experiencing severe drought. Because of the damage potential to trees in the United States, infested counties have been placed under State and Federal quarantine to prevent movement of this beetle to new areas. In 1994, Mexico set a quarantine on shipment of Christmas trees from infested counties of the United States into Mexico.

Counties Where Common European Pine Shoot Beetle Reported, 1997



Spruce beetle

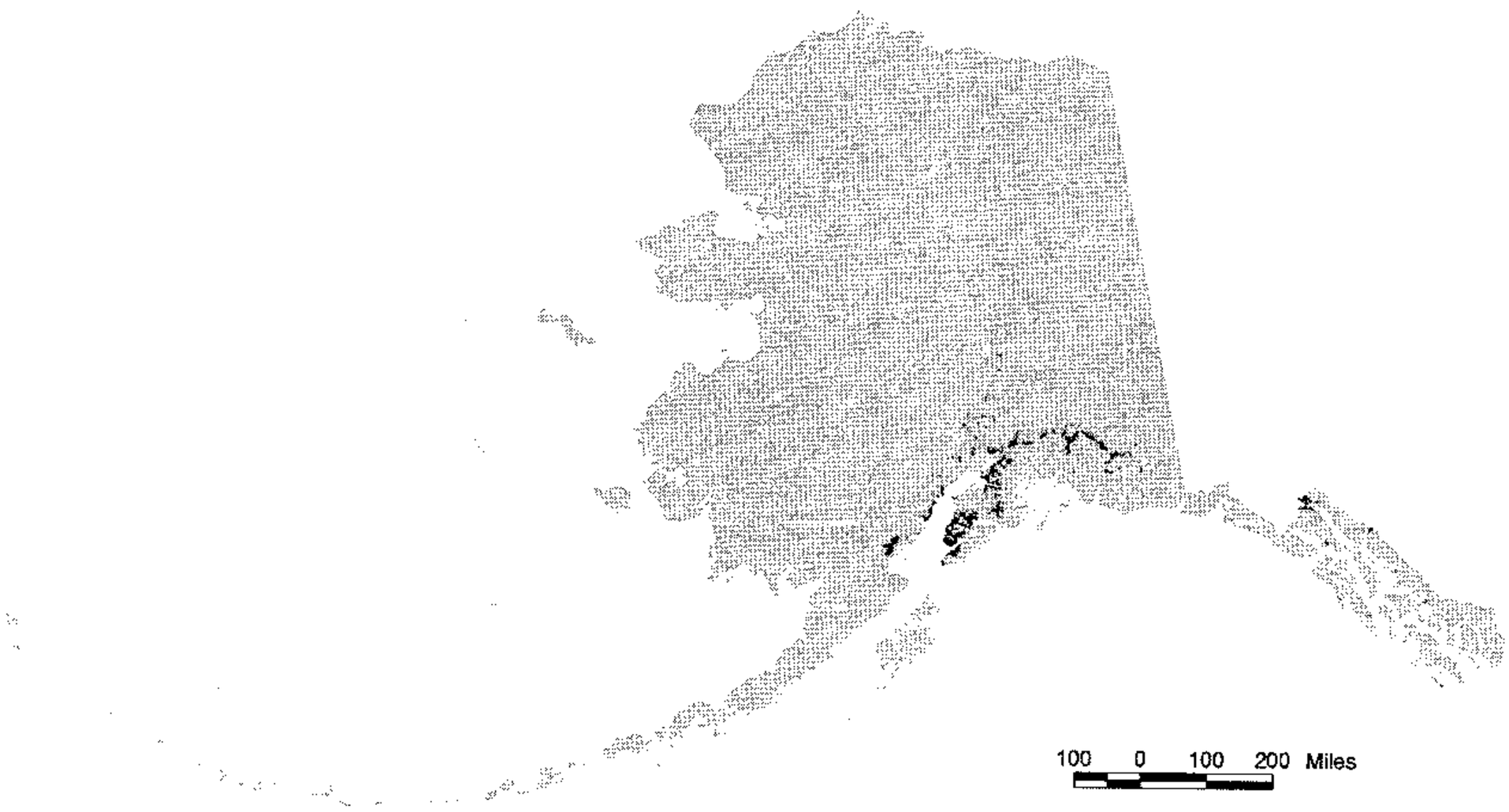
Dendroctonus rufipennis is a native insect that occurs across northern North America and south in the Rocky Mountains to Arizona. Spruce beetle is the most significant mortality agent of mature spruce. Beetle populations also build up in windthrown trees. Besides killing merchantable trees, infestations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

The active infestations in Alaska declined about 50 percent from 1996 to 544.3 thousand acres. About 2.3 million acres have been infested over the last 10 years. Although the outbreak appears to have subsided, there remain areas with susceptible host that could support high beetle populations.

Elsewhere in the West, beetle populations were generally low. In Colorado, beetle activity appears to be increasing as a result of a number of windthrow events in the past few years.

In Maine, the infestation that began in 1994 continues to kill aging trees on some coastal islands.

Spruce Beetle Active and Newly Infested Areas in Alaska, 1997



Disease Conditions Highlights

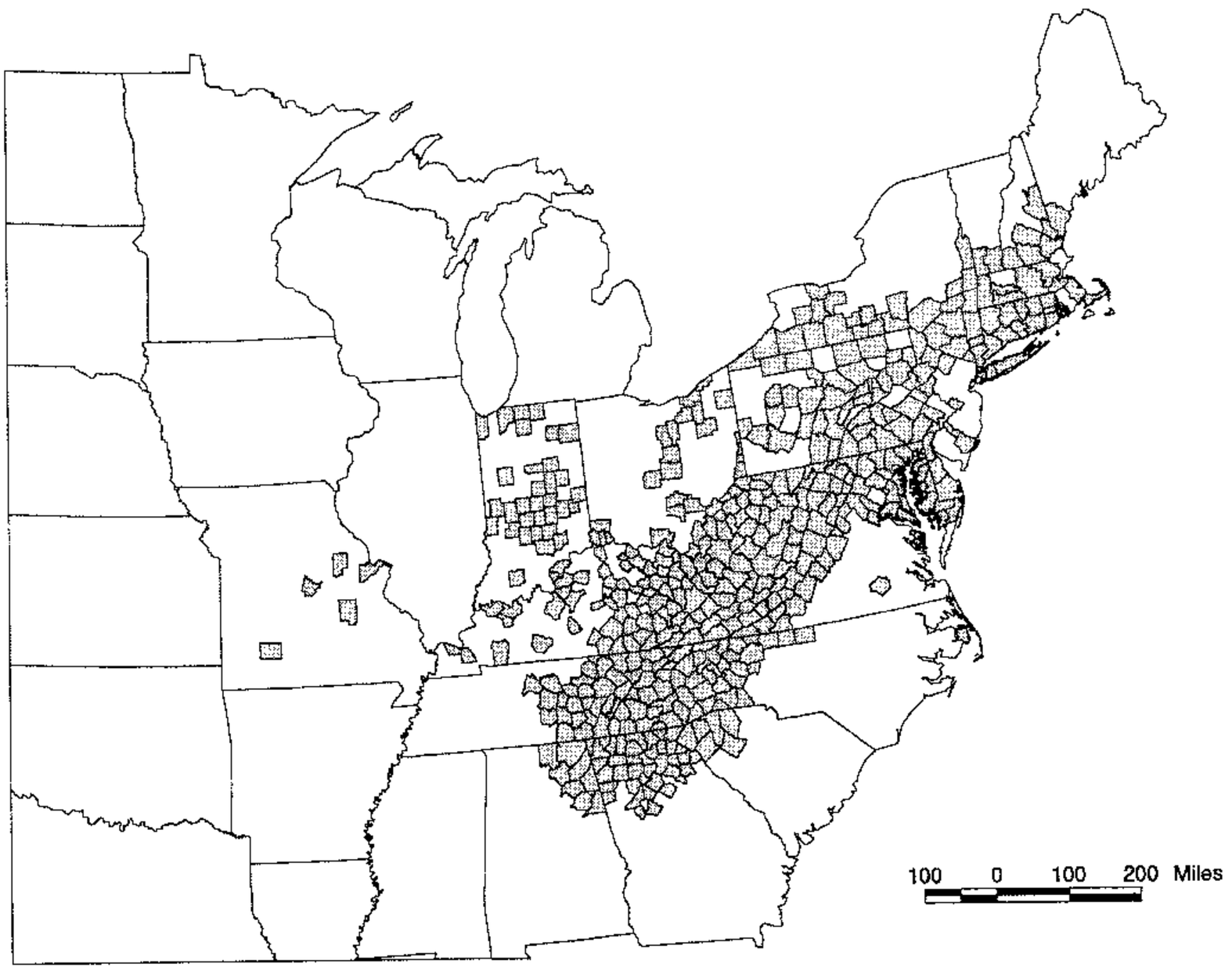
Dogwood anthracnose

Discula destructiva, the fungus that causes dogwood anthracnose, is of unknown origin. A new fungus may have been introduced or a previously innocuous fungus may have become a significant pathogen. The disease was first discovered in the Pacific Northwest in 1976 and is now confirmed in Idaho, Oregon, and Washington.

In the East, the fungus was first found in southeastern New York in 1978. The range of dogwood extends from southern Maine to Florida and west to Michigan and eastern Texas. By 1987, this disease was found in nine eastern States from Massachusetts to Georgia, and by 1994 it was confirmed in 21 States from Maine to Alabama and west as far as Indiana and Missouri. Infected nursery shipments are implicated in the most recent western spread, but in Indiana at least, native stands are now infected. No new infested States were reported in 1997, and the incidence of the disease declined across the Northeastern States. In the Southeastern States most of the dogwood above the 3,000 foot level and in cool shaded areas below that elevation have died. Dogwood trees in the sun at lower elevations are doing well. Control measures are available for ornamental trees but are not practical in the general forest.

Although the Pacific dogwood is more susceptible than the eastern dogwood, drier summers in the West reduce the number of infection cycles. Although significant mortality has occurred in the Pacific Northwest, the problem is not as severe as it is in the East.

Eastern Counties Where Dogwood Anthracnose Reported, 1997



Beech bark disease

Beech bark disease results when bark, attacked and altered by the beech scale, *Cryptococcus fagisuga*, is invaded and killed by a fungus *Nectria coccinea* var. *faginata*. The scale and probably the fungus were accidentally brought to Nova Scotia, Canada, about 1890. By 1932, the disease was killing trees in Maine. In 1981, a 70,000 acre area was found infested in northeastern West Virginia and mortality was reported in northern Virginia by the mid-1980's. 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), about 300 miles southwest of its previously known distribution. In 1996, the scale was found in a second county in Tennessee. The range of American beech is from Maine to northwestern Florida west to the eastern parts of Wisconsin and Texas. Considerable beech mortality has occurred in the Northeast south to Pennsylvania.

The disease continues to intensify within the currently infested isolated areas in North Carolina, Tennessee, and Virginia. The killing front continues to expand in West Virginia.

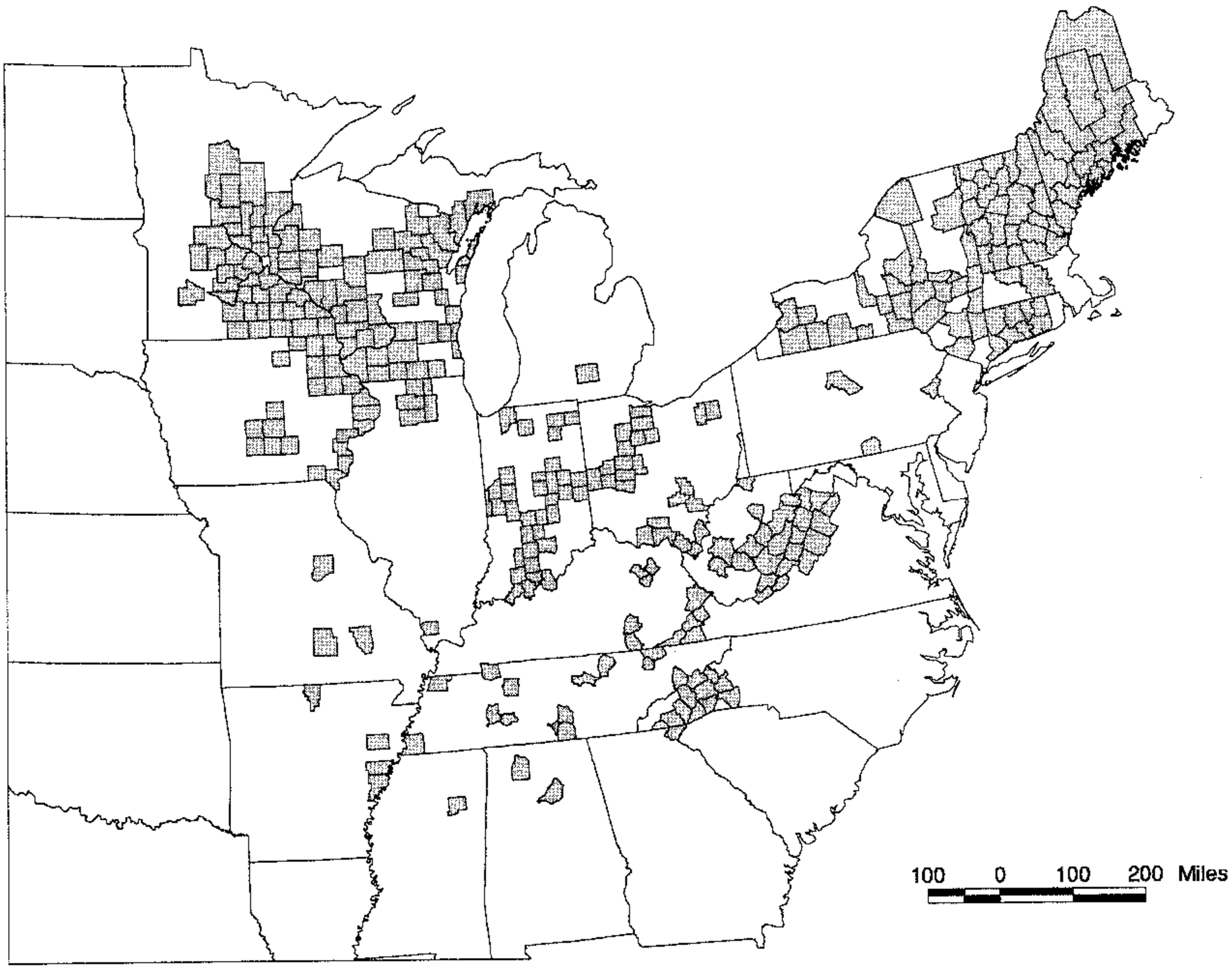
Counties Where Beech Bark Disease Reported, 1997

Butternut canker

Sirococcus clavigignenti-juglandacearum is the fungus that causes butternut canker; the origin is unknown. Symptoms of the disease have been recognized since the early 1900's, but the casual fungus was not identified until the late 1970's. The range of butternut is from Maine to Georgia on the east, to Minnesota and Arkansas on the west.

The disease is found throughout most of the range of butternut and is a serious threat to the survival of the species, killing large trees, saplings and regeneration. It is estimated that 77 percent of the butternut trees in North Carolina and Virginia have been killed. Trees exhibiting resistance to the disease have been found in five States from Virginia to Arkansas, and these trees are being propagated for host resistance studies. There are no known control measures.

Counties Where Butternut Canker Reported, 1997



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 important in both plantations and natural stands.

An estimated 13.7 million acres of pines are affected. Acres are classified as affected if more than 10 percent of the trees have potentially lethal cankers. Georgia is the most seriously affected State, with 4.6 million acres (49 percent), of the host type affected.

Acres (in thousands) Affected by Fusiform Rust, 1997*

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 (88)	0.0	0.0	166.9	166.9
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
Total	356.1	254.8	13,127.1	13,738.0

* Acres with greater than 10 percent infection.

Dwarf mistletoes

Arceuthobium spp. are parasitic plants that invade the branches of host trees. These pest species are associated with much of the tree mortality in the West. Conifers on about 30.6 million acres of western forests are infected. Dwarf mistletoe infection reduces tree growth and seed crops, and kills tops, branches, and entire trees. Growth loss totals about 180 million cubic feet of wood annually. Most of the volume loss is caused by 7 of the 19 dwarf mistletoe species; those on Douglas-fir, lodgepole pine, true fir, western hemlock, western larch, and 2 species on ponderosa pine.

In the past, fire helped reduce the incidence of dwarf mistletoes. Fire control has had the inadvertent effect of allowing dwarf mistletoes to increase in severity.

Acres (in thousands) in the West Affected by Dwarf Mistletoes, 1997

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)	2,276.0	69.0	1,911.0	4,256.0
Colorado (96)	638.0	---	---	638.0
Idaho - North (70-80)**	478.0	10.0	224.0	712.0
Idaho - South (94)**	2,672.5	---	---	2,672.5
Montana (70-80)	1,694.0	123.0	600.0	2,417.0
New Mexico (97)	1,440.0	348.0	581.0	2,369.0
Nevada (94)	49.5	---	---	49.5
Oregon (67)	1,137.0	43.0	2,760.0	3,940.0
Utah (94)	395.9	---	---	395.9
Washington (97)	2,703.3	505.0	4,270.0	7,478.3
Wyoming (97)	553.5	---	---	553.5
Total	18,137.7	1,772.0	10,711.0	30,620.7

* 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

Cherry scallop shell moth,
Hydria prunivorata

Region 9/Northeastern Area: Michigan, New Hampshire, New York, Ohio, Vermont, West Virginia, Pennsylvania

Host(s): Beech, black cherry

Cherry scallop shell moth populations declined significantly in 1997. Defoliation occurred in West Virginia (1,370 acres), Michigan (1,513 acres), and Ohio (565 acres). No activity was reported in New Hampshire, New York, Pennsylvania, or Vermont.

Cypress looper,
Anacamptodes pergracilis

Region 8: Florida

Host(s): Baldcypress, pondcypress

Although very little defoliation by this insect was evident anywhere in 1996, following the widespread outbreak of 1995, high populations reappeared in the summer of 1997 in Glades County, causing noticeable (greater than 30 percent) defoliation over 15,000 acres.

Douglas-fir beetle,
Dendroctonus pseudotsugae

Region 1: Idaho, Montana, Wyoming

Host(s): Douglas-fir

The area infested by Douglas-fir beetle increased nearly 25 percent from the 7,300 acres affected in 1996 to almost 9,500 acres in 1997. In those affected stands, more than 26,000 Douglas-fir were killed. Of the infested acres, 4,100 were recorded in northern Idaho; 4,000 in western Montana; and the remaining 1,400 acres in Yellowstone National Park. Though there was an overall increase in infested acres in 1997, populations are generally low, likely in response to the significant amounts of moisture received during the winter of 1996-97. However, large amounts of winter damage (windthrow and snow breakage) may lead to population increases in areas where blowdown is not salvaged in a timely manner. The potential for expanding populations and additional tree mortality in 1998, without judicious salvage efforts, are high in parts of northern Idaho and western Montana.

Region 2: Colorado, Wyoming

Host(s): Douglas-fir

About 2,500 trees were killed in the South Platte River drainage at the edge of areas heavily defoliated from 1993 through 1995 by the Douglas-fir tussock moth. In the same river drainage, many scorched and green trees at the perimeter of the 1996 Buffalo Creek fire were heavily infested. Both beetle populations in the South Platte drainage are expected to increase in 1998. Near Poncha Pass a reported 250 trees were killed in 1997. The outbreak in western Colorado reported in 1996 was not resurveyed in 1997. It was thought to be declining in 1996, but presumably continued in 1997 over an area west of Rifle to Douglas Pass and into Utah. In

southwestern Colorado, overall activity has declined with less concentrated mortality reported on the San Juan National Forest, as well as on the San Isabel National Forest. Douglas-fir beetle killed trees increased slightly on the Shoshone National Forest, Wyoming. A total of 1,680 trees were killed in 1997, mostly on the Wapiti Ranger District along the north fork of the Shoshone River.

Region 3: Arizona, New Mexico

Host(s): Douglas-fir

Douglas-fir beetle-caused tree mortality increased from 835 acres in 1996 to 4,455 acres in 1997. In Arizona, Douglas-fir beetle-caused mortality occurred on the Apache-Sitgreaves (3,665 acres), and Coconino (60 acres) National Forests and the Navajo (195 acres) and Fort Apache (535 acres) Indian Reservations. No Douglas-fir beetle activity was detected in New Mexico.

Region 4: Idaho, Utah, Wyoming

Host(s): Douglas-fir

Mortality decreased regionwide, with 21,700 trees killed in 1997 compared to 62,700 in 1996. Outbreaks were located on the Sawtooth, Boise, Salmon-Challis, Caribou, Targhee, and Payette National Forests in southern Idaho. In Utah, tree mortality increased with 12,600 trees killed in 1997. Outbreaks were located on the Manti-LaSal, Ashley, Dixie, Fishlake, Uinta, and Wasatch-Cache National Forests. Mortality on the Bridger-Teton National Forest in western Wyoming decreased from 1,500 trees in 1996 to 900 trees in 1997.

Region 5: Northern California

Host(s): Douglas-fir

Blowdown and damage from the storm of December 1995 did not result in increased attacks of this beetle in 1997.

Region 6: Oregon, Washington

Host(s): Douglas-fir

Douglas-fir beetle activity was detected on fewer acres, but at a greater intensity. Activity was reported on 8,600 acres averaging one tree/acre in 1997 as compared to 9,700 acres with an average of 0.80 tree/acre in 1996. Increased levels of activity were detected on the Colville, Mt. Baker-Snoqualmie, and Umatilla National Forests. Predisposing tree stresses caused by repeated years of defoliation by western spruce budworm, drought, and overstocking may result in relatively high levels of Douglas-fir beetle activity in the next few years despite 3 years of normal precipitation. Increased Douglas-fir beetle mortality is expected in the summer of 1998 due to a windstorm on December 12, 1995, and extensive flooding during February 1996.

Douglas-fir tussock moth, *Orgyia pseudotsugata*

Region 1: Idaho, Montana

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

Douglas-fir tussock moth populations increased in 1997, but are still at relatively low levels. No aerially visible defoliation was detected, nor were any larvae found at those sites that were sampled. Moth catches in pheromone traps were at increased levels in Idaho, but down slightly in Montana. At 68 sites in Idaho, 1,298 moths were caught in 1997 compared to 128 in 1996.

The Montana trap catch, from 33 sites, totaled only 8 moths in 1997; down from 12 in 1996. Some minor defoliation was observed on ornamental trees in Kalispell, MT, but none was noted in forested areas. Based on trap catches and observations, populations may be expected to increase somewhat in 1998.

Region 2: Colorado

Host(s): Douglas-fir

No activity was detected in Colorado in 1997 with exception of the chronic infestations in older Denver neighborhoods. An early warning system using pheromone traps in the South Platte river drainage detected no problem areas. Areas heavily defoliated from 1993 to 1995 have experienced a Douglas-fir beetle outbreak resulting in additional significant mortality in and around the defoliated areas that will likely continue in 1998.

Region 4: Idaho, Nevada, Utah

Host(s): Douglas-fir, true firs

No visible defoliation from Douglas-fir tussock moth was observed in the Region during 1997.

Region 5: Northern California

Host(s): White fir

Data were collected from 142 plots in the pheromone detection survey program and catches of male moths were down from 1995 and 1996 at most plots. High trap catches and defoliation are not anticipated within most areas to be monitored in 1998. However, a potential outbreak has been detected on 23,000+ acres on the Sequoia National Forest and the Sequoia/Kings Canyon National Parks. Egg mass surveys will be conducted in this area in 1997.

Region 6: Oregon, Washington

Host(s): Douglas-fir, true firs

Following a 3-year low of 2,900 acres reported in 1995, we observed no Douglas-fir tussock moth activity in the Region for the second straight year.

Fall cankerworm, *Alsophila pometaria*

Region 4: Utah

Host(s): Gamble oak

Defoliation on gamble oak (*Quercus gambellii*) occurred along the Wasatch Front in northern Utah from Spanish Fork to Brigham City. Approximately 4,900 acres of moderate to heavy defoliation ranging from less than one to several hundred acres were observed in the spring of 1997. This is the fourth consecutive year of this defoliation.

Region 9/Northeastern Area: Massachusetts, Michigan, Pennsylvania

Host(s): Oaks, red maple, red oak

The defoliation that occurred in Massachusetts in 1996 collapsed as anticipated, in 1997. In Michigan, reports of isolated, small areas of defoliation by this pest were reported in Chippewa,

Insects: Native

Delta, Dickenson and Schoolcraft Counties. No additional defoliation was reported in Pennsylvania following a small outbreak that occurred in southeast Pennsylvania in 1996.

Fall hemlock looper,
Lambdina fiscellaria

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

Host(s): Beech, eastern hemlock, sugar maple, yellow birch

About 20,000 acres were defoliated in 1997 in New York. When in outbreak status, other species besides the primary host, hemlock, are defoliated. In Maine and New Hampshire, no damage or significant populations were reported.

Fir engraver beetle,
Scolytus ventralis

Region 1: Idaho, Montana

Host(s): Grand fir, subalpine fir

Whole-tree mortality and top-kill attributable to fir engraver beetle increased markedly in northern Idaho in 1997. Though not confirmed, that increase may have been in response to unusually high amounts of moisture received during late winter and early spring and resulting stress in some low-elevation grand fir stands. Fall surveys in 1997 indicated that most fir engraver beetle-killed mortality in northern Idaho occurred on soils with a perched water table. In those areas, uncharacteristic flooding has been experienced during fall 1995, spring 1996, and again in 1997. It is believed that the flooding caused grand fir trees to become physiologically stressed, making them more susceptible to beetle attacks. Supporting that notion is the lack of root disease in most areas where fir engraver beetle-caused mortality is high. Endemically, root diseases are often associated with beetle-caused mortality. During 1997, in northern Idaho, approximately 115,000 acres were infested and slightly more than 71,000 trees were killed. Though representing a significant increase over the 19,000 acres infested in 1996, it is still considerably less than the 242,000 acres reported in 1995. Most of those infested stands were located on the Idaho Panhandle and Nez Perce National Forests, and surrounding State and private land. In western Montana, populations remained nearly endemic--only about 500 beetle-killed trees were recorded on 860 acres, most of which were found on the Lolo and Kootenai National Forests. If the hypothesis regarding perched water tables is correct, high mortality may continue in 1998. Otherwise, we might anticipate a reduction in infested area throughout the region as precipitation returns to more normal levels.

Region 4: California, Idaho, Nevada, Utah

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

Regionwide mortality decreased significantly with 22,600 trees killed in 1997 compared to 46,400 trees in 1996. Most of this decrease can be attributed to a decline in tree mortality on the Toiyabe National Forest and on Federal, State and private lands in the Tahoe Basin Management area. In southern Idaho mortality remained low with 300 trees killed. Fir engraver beetle activity in Utah increased with 20,000 trees killed in 1997 compared to 12,300 trees killed in 1996. The largest outbreak was located on the Manti-LaSal National Forest where 9,800 trees were killed. Activity was also located on the Uinta, Dixie, and Fishlake National Forests.

Region 5: California

Host(s): White fir, red fir

True fir mortality was greatly reduced in the Klamath Mountains and the Northern California Coast Ranges and continued to decrease across most of the southern Cascades. Mortality related to this engraver has returned to background rates in most of the Sierra Nevada. Top-kill and mortality are much lower on the Modoc Plateau than that recorded for the past 5 years. In southern California damage was most noticeable on Palomar Mountain, San Diego County.

Region 6: Oregon, Washington

Host(s): True firs

Fir engraver activity within the Region decreased from 377,600 acres in 1996 (2.15 trees/acre) to less than 26,000 acres in 1997 (0.82 trees/acre). Following 3 years of approximately normal precipitation, mortality levels remain highest in areas that have experienced drought, defoliation by Douglas-fir tussock moth or western spruce budworm, or are infected with root disease. Many of the most heavily infested areas are pine sites, which, due to selective logging and fire exclusion, now have a large component of true fir.

Dramatic decreases in observed mortality were reported on the Deschutes, Winema, and Fremont reporting areas with less than one half of one percent of 1996 levels. The Umatilla reporting area experienced a two and half fold increase in reported fir engraver caused mortality. Other areas of significant acreage's of detected fir engraver activity include the Wallowa-Whitman and Wenatchee National Forests.

Forest tent caterpillar, *Malacosoma disstria*

Region 8: Florida, North Carolina, Louisiana, Texas

Host(s): Oak, tupelo gum, other hardwoods

The outbreak of forest tent caterpillar in west central Florida, which began in 1994, continued to persist, expand, and in places, dramatically increase or decrease in intensity during the spring of 1997. Severe levels of defoliation to primary hosts (i.e., water, laurel, and live oaks) were more prevalent and widespread than in preceding years in portions of Highlands, Manatee, Orange, Osceola, Pinellas, and Sarasota counties. Outbreaks were especially troublesome in urban areas of Bradenton, Kissimee, Sarasota, and St. Petersburg. Long-standing outbreaks subsided in portions of Hardee, Hillsborough, and Polk counties. Mass emergence of larvae from overwintering egg masses in early February was notably earlier than the March emergence of previous years, presumably due to a mild winter and corresponding early spring foliage flush.

In Louisiana, over 230,000 acres of, primarily, tupelo gum were defoliated in forested wetlands. St. Charles, St. John the Baptist, Ascension and Livingston parishes were affected.

In North Carolina, the forest tent caterpillar defoliated an estimated 25,000 acres along the Roanoke River near Williamston. The Houston, Texas (Harris County), area also experienced an outbreak in 1997, possibly brought on by 1996's dry weather followed by a wet spring.

Region 9/Northeastern Area: Illinois, Maryland, Minnesota, New Hampshire, Rhode Island, West Virginia

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

Small outbreaks totalling 1,364 acres were reported in 1997. The last large occurrence of forest tent caterpillar was in 1994.

Fruittree leafroller,
Archips argyrospilus

Region 5: Southern California

Host(s): California black oak

Defoliation was light to moderate in areas of the San Bernardino Mountains commonly infested by fruittree leafroller. Oak mortality is not anticipated.

Region 8: Louisiana

Host(s): Bald cypress

The fruittree leafroller defoliated baldcypress over an area of 525,000 acres in southeastern and south central Louisiana. Although the predominant impact is loss of growth, repeated annual defoliation has resulted in significant crown dieback and mortality of sapling/pole-sized cypress. Jefferson, St. Charles, St. John The Baptist, Ascension, James, Lafourche, Assumption, St. Martin, Terrebonne, St. Mary, Iberia, St. Martin, Iberville and West Baton Rouge parishes were affected.

Jackpine budworm,
Choristoneura pinus

Region 2: Nebraska

Host(s): Jack pine

Outbreak populations were found in jack pine stands on the Nebraska National Forest near Halsey. Approximately 300 acres of heavy defoliation and 500 acres of light defoliation occurred. The outbreak is expected to continue in 1998.

Region 9/Northeastern Area: Michigan, Minnesota, Wisconsin

Host(s): Jack pine

In 1997, more than 300,000 acres were defoliated throughout the Lake States Region. More than 120,000 acres were reported on State and private land in Wisconsin. In addition, over 50,000 acres were defoliated on the Huron National Forest, over 4,000 acres on the Ottawa National Forest, and 3,300 acres on Chequamegan National Forest. In Michigan, jack pine budworm populations were at outbreak levels for the first time in 8 years in the northern peninsula. Heavy defoliation was detected on 25,229 acres. Only 111 acres of defoliation occurred in Minnesota in 1997. Mortality from defoliation in previous years occurred over 33,000 acres of State and private land in Minnesota, and on 10,000 acres in Wisconsin. Over 9,400 acres of land on the Ottawa National Forest were affected.

Jeffrey pine beetle,
Dendroctonus jeffreyi

Region 4: California, Nevada

Host(s): Jeffrey pine

A significant decline in Jeffrey pine beetle activity was observed on the Toiyabe National Forest and Tahoe Basin Management area with only 300 trees killed in 1997 compared to 4,100 trees in 1996.

Region 5: California

Host(s): Jeffrey pine

Jeffrey pine mortality remains moderate to high on the west side of the Lassen National Forest and in Lassen Volcanic National Park. Some areas have had mortality for four consecutive years. Moderate to high rates were also found in specific areas on the east side of the Tahoe National Forest. However, Jeffrey pine mortality continued to decline throughout most of the central and southern Sierra Nevada. Mortality associated with Jeffrey pine beetle was low in southern California.

Lodgepole needleminer, *Coleotechnites milleri*

Region 5: Yosemite National Park

Host(s): Lodgepole pine

Populations have increased around Tenaya Lake in Yosemite National Park and new areas of defoliation are expected within 2 to 4 years. Extensive areas of heavy defoliation exist both north and south of the heavy visitor-use zone along the Highway 120 corridor; continued defoliation and mortality is anticipated. The mountain pine beetle is expected to infest and kill weakened trees.

Mountain pine beetle, *Dendroctonus ponderosae*

Region 1: Idaho, Montana

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

Mountain pine beetle populations increased significantly again in 1997. In 1996, more than 53,300 acres had been infested--in all host species and on lands of all ownerships. In 1997, that figure increased to just over 72,000 acres, on which more than 347,000 trees were killed. Nearly three-quarters of those beetle-killed trees were lodgepole pine. The area infested in the Region was nearly evenly distributed between northern Idaho and western Montana--more than 37,000 acres being on the Idaho Panhandle (St. Joe) National Forest, and nearly 35,000 acres being recorded in western Montana, most on the Lolo National Forest. Beetle populations have increased over the past few years in response to favorable weather conditions and an increasingly susceptible amount of lodgepole pine, which is growing into size and age classes preferred by the beetle, throughout northern Idaho and western Montana. Populations remain quite active, and are likely to increase on the Lolo National Forest in Montana, and parts of the Idaho Panhandle National Forest in northern Idaho.

Region 2: Colorado, South Dakota, Wyoming

Host(s): Limber pine, lodgepole pine, ponderosa pine

Across Colorado, mortality attributed to mountain pine beetle increased for the third consecutive year. Aerial surveys in 1997, covering approximately the same area as in 1996, showed an increase of two and a half times statewide. The largest, most intense mountain pine beetle outbreak is in and around the Vail Valley. Dramatically increased mountain pine beetle activity was documented around Lake Granby and in several areas along the Front Range, including both sides of Hwy. 285 between Bailey and Grant, and the Cache la Poudre canyon between Mishawaka and Idlewilde, extending north to the Red Feather Lakes area. Smaller areas of concern along the Front Range include the following: the area south and east of Highways 36 and 7, respectively, running all the way to North St. Vrain Creek; in and around Estes Park, including Rocky Mountain National Park; both sides of Four Mile Creek west of Boulder, running north to

Jamestown; near Horsetooth Reservoir and the Stove Prairie Road; the White Ranch (Jefferson County Open Space); the southern Tarryall Mountains; an area in the Rampart Range between Strontia Springs Reservoir, Nighthawk, Campbell Mountain and Pine Nook; the Black Forest east of Interstate 25; and in and around the communities of Nederland, Blackhawk, Eldorado Springs, Evergreen, Shaffers Crossing, Indian Hills, and Larkspur. Several of these Front Range areas had no detectable mountain pine beetle activity in 1996. Mountain pine beetle activity continued and increased throughout the upper Arkansas Valley, especially on the shores of Twin Lakes and in a large area west of Highways 24 & 285 along the lower slopes of the Sawatch Range between Clear Creek Reservoir and Highway 50.

Large numbers of ponderosa pine, and some lodgepole pine, are being affected. Mortality has increased approximately 500 percent. Estimates derived from aerial survey data indicate that over 5,100 ponderosa and 500 lodgepole pine were killed in 1997 on the Sawatch landscape. Significant mountain pine beetle activity also continued on Derby Mesa on the east side of the Flat Tops, near Dillon/Silverthorne, on the northern half of the Uncompahgre Plateau, and on the east side of the Wet Mountains near Rye and Colorado City, although mountain pine beetle activity in this last area may have actually decreased in 1997. An outbreak in the Vail Valley on the White River National Forest has expanded dramatically; with 3,425 trees being infested in 1996 to over 8,000 additional lodgepole pine being killed in 1997. Activity is expected to continue and even possibly increase in 1998. Predictions are that, baring unusual weather, mountain pine beetle populations in Colorado will increase again in 1998. Aerial survey detected 838 trees killed in ponderosa pine forest along the eastern edge of Bighorn National Forest of Wyoming and 5,219 in the Black Hills of South Dakota, the latter a four-fold increase over 1996. Carbon and Weston Counties in Wyoming, continue to experience mountain pine beetle activity mainly in ponderosa pine. In Johnson County, Wyoming, 230 ponderosa pine were killed by mountain pine beetle but both lodgepole and ponderosa pine are being attacked.

Region 3: Arizona, New Mexico

Host(s): Ponderosa pine

Mountain pine beetle-caused ponderosa pine mortality increased from 3,295 acres in 1996 to 10,080 acres in 1997. Most of this mortality occurred in the Grand Canyon National Park (10,000 acres). Smaller areas of mountain pine beetle-caused tree mortality also occurred on the Kaibab National Forest (10 acres) and the Arizona Strip District (Bureau of Land Management, 15 acres) in Arizona and on the Santa Fe National Forest (55 acres) in northern New Mexico.

Region 4: Idaho, Nevada, Utah, Wyoming

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

Mountain pine beetle-caused mortality increased from 29,100 trees in 1996 to 35,000 trees in 1997. The largest outbreak in the Region was located on the Payette National Forest in southern Idaho where 7,500 lodgepole pine trees were killed. Some of this mortality was associated with recent wildfire activity. Elsewhere in southern Idaho significant mortality occurred on the Caribou and Sawtooth National Forests. Small outbreaks occurred on the Boise, Salmon-Challis, and Targhee National Forests. In Utah 10,000 trees were killed during 1997 opposed to 29,100 trees in 1996. The largest outbreaks were located on the Dixie and Manti-LaSal National Forests where 3,900 and 1,100 ponderosa pine trees were killed respectively. Smaller outbreaks were located on most other national forests in Utah. On the Bridger-Teton National Forest in western Wyoming 1,900 lodgepole pine trees were killed in 1997.

Mortality of whitebark and limber pine attributed to mountain pine beetle attack continued to occur with 6,100 trees killed in the Region. The largest outbreaks were on the Payette National Forest in southern Idaho with 2,800 trees killed, the Bridger-Teton National Forest in western Wyoming, and the Manti-LaSal National Forest in Utah.

Region 5: California

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

Scattered pine continue to be killed in northern California. Sizes range from large, older sugar pine in the Klamath Mountains to 4- to 10-inch ponderosa and lodgepole pine in the Southern Cascades. Highest concentrations were found in lodgepole pine on the Truckee Ranger District, Tahoe National Forest. Except for the southern end of the Lake Tahoe Basin, beetle activity was generally low in the central and southern Sierra Nevada.

Region 6: Oregon, Washington

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

Acres affected by mountain pine beetle decreased from 170,252 acres with an average of 3.45 trees/acre in 1996 to 157,089 acres with an average of 2.16 trees/acre in 1997. Decreased activity was detected in the whitebark, western white, and lodgepole pine hosts. Increased activity was detected in ponderosa and sugar pine hosts. The aerial survey has mapped single tree mortality in sugar pine due to concern over their gradual removal from stands in southern Oregon. Approximately 420 large sugar pine trees were mapped in southern Oregon during the 1997 aerial survey. Areas most heavily affected by mountain pine beetle include Federal lands within the Deschutes, Fremont, and Okanogan reporting areas. Over 7,000 acres of lodgepole pine on State lands in the Loomis block of north-central Washington were affected. Dense stand conditions continue to predispose areas to mountain pine beetle infestations.

Pandora moth,
Coloradia pandora

Region 6: Oregon

Host(s): Lodgepole pine, ponderosa pine

The current pandora moth infestation in central Oregon began in 1986 and grew with each successive generation until 1994, when pines on 369,100 acres experienced some level of defoliation. A naturally occurring virus was noted throughout the infested area in 1994. We believe that this virus brought about the collapse of the pandora moth population since only 12,300 acres were defoliated in 1996. The defoliation produced by the larvae has caused concern, but trees are only bare for a short time until the current year's growth of needles appears later in the summer. We anticipate the long-term effects of the infestation will be minimal, with very low tree mortality in some areas. Field evaluation is planned for the spring of 1998 to determine if a special aerial survey is warranted.

Pine engraver beetles,
Ips spp.

Region 1: Idaho, Montana, Wyoming

Host(s): Lodgepole pine, ponderosa pine

Though pine engraver populations increased substantially over 1996 levels they remained at nearly endemic levels throughout the Region in 1997. An increase in moisture over the past 2 years has resulted in less weather-induced stress, and a resultant decrease in beetle populations. Still, there may have been a few low-elevation ponderosa pine stands that experienced sufficient moisture to weaken some trees. In northern Idaho, in 1997, fewer than 1,600 ponderosa pines were killed on 270 acres; and another 375 acres showed approximately 2,400 lodgepole pines killed as a result of engraver beetle activity. In Montana, 900 ponderosa pines and 340 lodgepole pines were killed on 155 and 358 acres, respectively. In 1996, engraver beetle-caused mortality had been recorded on just over 100 acres. Nearly normal precipitation during winter 1997-98

throughout typically dry and often susceptible ponderosa pine stands in western Montana and northern Idaho, should result in continuing low populations of engraver beetle-caused damage in 1998. In addition, land managers are becoming increasingly aware of the need for proper slash management during late winter and early spring logging in ponderosa pine stands. That, too, should help reduce losses to engraver beetles.

Region 2: Colorado, South Dakota, Wyoming

Host(s): Ponderosa pine, lodgepole pine, spruce

Ips spp. activity continued along the Front Range of Colorado, with reports from the U.S. Air Force Academy and near construction sites in Douglas and Jefferson counties. On the Gunnison Ranger District of the Grand Mesa-Uncompahgre-Gunnison National Forest, *Ips* spp. increased due to available and suitable host material resulting from windthrow events and prescribed burning activity. Although this situation is not serious at the present time, future monitoring is warranted. *Ips* spp. were also responsible for scattered, but significant mortality of pinõn pines, particularly on the Grand Mesa-Uncompahgre-Gunnison and San Juan National Forests. Near Salida, Colorado, over 5,000 pinõn pines were lost to the "pinõn decline" condition. Much of this mortality was associated with black stain root disease. Small pockets of *Ips* spp. in ponderosa pine in the Black Hills of South Dakota continued to be observed; heavily infested down trees were present in areas of blowdown. There was also a noticeable increase in activity of *Ips* spp. attacking spruce in the Black Hills.

Region 3: Arizona, New Mexico

Host(s): Ponderosa pine, pinyon pine

Ips-killed ponderosa pines decreased from 30,230 acres in 1996 to 25,085 acres in 1997. In Arizona, tree mortality was detected on the Coconino (11,800 acres), Coronado (80 acres), Kaibab (610 acres), Prescott (1,205 acres), and Tonto (4,990 acres) National Forests; Fort Apache (40 acres), San Carlos (3,530 acres) and Navajo (460 acres) Indian Reservations; and Grand Canyon National Park (15 acres). On State and private land in Arizona, *Ips*-killed tree mortality was detected on 1,240 and 680 acres, respectively. In New Mexico, *Ips*-caused tree mortality occurred on the Carson (120 acres) and Lincoln (265 acres) National Forests and on approximately 50 acres of private ownerships in northern New Mexico.

In Arizona, pinyon pine mortality resulting from *Ips* beetle attacks (*Ips confusus*) was detected on the Coconino (12,810 acres) and Kaibab (1,255 acres) National Forests and adjacent and nearby private (3,355 acres) lands. No pinyon *Ips* activity was detected in New Mexico.

Region 4: Idaho, Nevada, Utah

Host(s): Lodgepole pine, ponderosa pine

Mortality due to pine engraver beetle remained static throughout the Region. Activity is often associated with western pine beetle. In Utah, populations were found in slash of ponderosa and lodgepole pine.

Region 5: California

Host(s): Pines

Activity of pine engravers was generally low in northern and north coastal California. Populations of the California fivespined *Ips* remained highly active in storm breakage and logging slash in the Volcano plantation, Tahoe National Forest. However, beetles have not moved into standing residual trees. Activity was also generally low in the central and southern Sierra Nevada. There was some activity in Coulter pine plantation in southern California and in the Central California Coast Ranges. The pinyon *Ips* continues to attack pinyon pines with black stain root disease in the eastern San Bernardino Mountains.

Region 6: Oregon, Washington

Host(s): Ponderosa pine

Pine engraver activity increased slightly over 1996 levels. The majority of activity was detected on Federal and private lands in central and northeastern Oregon. Field checks in northeastern Oregon suggest that some pine engraver beetle activity is coded as mountain pine beetle during the annual Regionwide aerial survey.

Region 8: Regionwide

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

Three species of pine engraver beetles, *I. avulsus*, *I. grandicollis*, and *I. calligraphus* occur in the South. In Florida, the incidence and magnitude of pine engraver infestations increased to significant levels from late October through December 1997 throughout north and north central Florida following unusual and prolonged drought. Infestations were most severe in recently thinned stands. Pine engraver beetle activity was also high in the piedmont areas of North Carolina, Virginia, and Georgia.

Pine reproduction weevil,
Cylindrocopturus eatoni

Region 5: California, Sierra Nevada section

Host(s): Ponderosa pine

Young saplings and seedlings on 4,000 to 5,000 acres of pine plantations have been killed or damaged on the Groveland Ranger District, Stanislaus National Forest. This is about 50 percent of the acres planted since 1988. Mortality ranges up to 38 percent of current stocking; about 1,500 acres had mortality greater than 5 percent in 1997. High damage rates are expected to continue in 1998.

Pine sawflies,
Neodiprion spp.
Diprion spp.

Region 8: Florida, Louisiana, Tennessee, Texas, Virginia

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

In Florida, high populations of the redheaded pine sawfly (*Neodiprion leconteii*) continued to cause noticeable to severe defoliation to all ages of longleaf pine in the Seminole Springs area of Lake County. Scattered defoliation was also reported throughout east Texas by redheaded pine sawflies, and black-headed pine sawflies, *N. excitans*.

Heavy defoliation by the loblolly pine sawfly (*N. taedae taedae*) was scattered across northern middle and west Tennessee. Defoliation of loblolly pines by the loblolly pine sawfly has occurred on approximately 3,000 acres, primarily in Caldwell Parish, with lesser amounts in LaSalle and Winn Parishes, Louisiana.

Severe, but scattered defoliation by Hetrick's pine sawfly, *N. hetricki*, occurred over a six county area in southeastern Virginia. One 30-acre pine plantation was treated to prevent defoliation.

Roundheaded pine beetle,
Dendroctonus adjunctus

Region 3: Arizona, New Mexico

Host(s): Ponderosa pine

Roundheaded pine beetle-caused tree mortality increased nearly two fold from 9,340 acres in 1996 to 18,435 acres in 1997. Mortality from roundheaded pine beetle attacks in Arizona occurred on the Fort Apache Indian Reservation and totaled 6,650 acres. In New Mexico, roundheaded pine beetle-killed trees were detected on the Lincoln National Forest (6,575 acres) and Mescalero Apache Indian Reservation (5,210 acres).

Region 4: Utah

Host(s): Ponderosa pine

Ponderosa pine mortality is being caused by this beetle on the Dixie and Manti-LaSal National Forests.

Southern pine beetle,
Dendroctonus frontalis

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

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

In 1997, southern pine beetle populations declined for the second year in a row following the record-setting outbreak in 1995. In 1997, the number of infestations (spots) decreased by 30 percent (from 17.4 thousand to 12.1 thousand spots). However, the number of affected acres increased by 17 percent (from 7.3 million to 8.5 million acres). The number of beetle infestations decreased in Arkansas, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, and Tennessee. They increased in Alabama; Florida, Georgia, Texas, and Virginia.

Southern pine beetle populations started 1997 at incredibly low levels. In mid-summer beetle populations made a dramatic comeback. There were outbreak populations along the coast of North Carolina, South Carolina, and Georgia; the Oconee National Forest (piedmont of Georgia); north central Florida (Marion and Levy counties); central and south Alabama; several of the National Forests in Mississippi; and east Texas.

The southern pine beetle outbreak in North Carolina is in the coastal plain in an area affected by Hurricanes Bertha and Fran in 1995. Many of the pines were stressed by the effects of salt-water spray and still have thin crowns. In Florida, the southern pine beetle outbreak is occurring in north-central part of the State near Ocala. This is the farthest south that southern pine beetle has been documented within the State, yet 1997 had record setting losses for the State. Southern pine beetle killed almost 8,000 acres and the outlook is for continued problems. In Texas, southern pine beetle made a comeback after 2 years of low activity. During the month of August over half of the total infestations for the year were detected. The majority of the spots occurred in the southeastern corner of the State. In all of the southern pine beetle outbreaks, active infestations were treated and pine beetle activity was closely monitored.

In 1997, there were federally funded southern pine beetle suppression projects on the National Forests in Texas, Mississippi, Alabama, North Carolina, Ouachita (AR) National Forest, Kisatchie (LA) National Forest, Ocala (FL) National Forest, and Chattahoochee-Oconee (GA) National Forests, Alligator River (NC) National Wildlife Refuge, and Dare County (NC) Bombing Range. There were cooperatively funded suppression projects in the States of Texas, Alabama, Mississippi, Arkansas, Florida, South Carolina, and North Carolina. It is anticipated that the number of suppression requests will increase in 1998.

Region 9/Northeastern Area: Delaware, Maryland, West Virginia

Host(s): Loblolly pine

Aerial surveys in 1997 detected no damage in Maryland and Delaware. West Virginia, however, reported 11 trees infested in the eastern portion of the State.

Spruce beetle, *Dendroctonus rufipennis*

Region 1: Idaho, Montana

Host(s): Engelmann spruce

Spruce beetle populations once again remained low throughout the Region in 1997, though there was a slight increase in infested area in western Montana. In northern Idaho, slightly more than 140 infested acres were recorded. Most occurred as small and scattered groups of Engelmann spruce on the Idaho Panhandle and Nez Perce National Forests. In western Montana, the infested area increased from 1,300 acres infested in 1996, to just over 1,500 acres in 1997. Those infested acres were found on the Gallatin, Flathead, and Kootenai National Forests, and in Yellowstone and Glacier National Parks. Nearly 2,500 trees were killed throughout the Region. A potentially serious outbreak on the Flathead National Forest was averted through aggressive salvage of infested trees and the judicious use of pheromone-baited funnel traps and trap trees. Those populations, on the Tally Lake Ranger District, appear to have returned to endemic levels.

Region 2: Colorado, Wyoming

Host(s): Engelmann spruce

No spruce beetles were found in the 400 acre blowdown of 1996 near Dunkley Pass, Colorado. Monitoring will occur in 1998 both there and in the area of the 20,000 acre Routt Divide blowdown of 1997. In southern Colorado, spruce beetle activity appears to be on the increase as a result of a number of windthrow events in the past several years. Although attempts to manage spruce beetles are underway in several locales, ever increasing amounts of windthrown spruce are adding to the potential for large-scale outbreaks. Significant amounts of susceptible host material are present on the Grand Mesa-Uncompahgre-Gunnison, Rio Grande, and San Juan National Forests. Although there have been several large events (the twister blowdown on the Rio Grande - 600 acres) there is concern over the more numerous scattered groups of blowdown. These smaller spots have a greater potential to develop into major centers of mortality and are difficult to monitor. Efforts to manage these types of spruce beetle situations are expected to increase in the next several years. In Wyoming, a large pocket of spruce beetle mortality was identified in the Sierra Madres. Approximately 500 trees over 17 acres were killed. Scattered mortality due to susceptible blowdown host material supported activity in the Sunlight Basin and South Pass areas as well.

Region 3: Arizona, New Mexico

Host(s): Spruce

Spruce beetle-caused tree mortality increased over twofold from 615 acres in 1996 to 1,650 acres in 1997. In Arizona, spruce beetle-killed trees were detected on the Kaibab National Forest (415 acres). In New Mexico, spruce beetle-caused tree mortality was detected on the Carson (300 acres), Cibola (230 acres), Santa Fe (510 acres), and Lincoln (150 acres) National Forests and Mescalero Apache (45 acres) Indian Reservation.

Insects: Native

Region 4: Idaho, Utah, Wyoming

Host(s): Spruce

Spruce beetle mortality decreased slightly from 1996 levels with 70,700 trees killed Regionwide. The largest infestations were located in Utah where 69,900 trees were recorded. Mortality was heaviest on the Dixie, Fishlake, and Manti-LaSal National Forests. No significant mortality was observed in southern Idaho National Forests or on the Bridger-Teton National Forest in western Wyoming.

Region 5: Northwestern California

Host(s): Sitka spruce

No activity reported.

Region 6: Oregon, Washington

Host(s): Engelmann spruce

All reported mortality in Oregon and Washington in 1997 was in Engelmann spruce. Reported trees killed decreased from 31,800 in 1996 to approximately 6,500 trees in 1997. Over 88 percent of all trees reported killed were on National Forest System lands. Seventy-two percent of the reported tree mortality occurred within wilderness areas on the Okanogan and Wenatchee National Forests. In other areas, spruce beetle activity was lightly scattered in the host type. Low levels of spruce beetle activity are due, in part, to the gradual removal of preferred host trees by previous infestations.

Region 10: Alaska

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

Active spruce beetle infestations declined by more than half, from 1.1 million acres in 1996 to 563,700 acres in 1997. Many spruce stands, especially on the Kenai Peninsula and in the Copper River Valley, are now 80 to 90 percent dead and have little or no susceptible host material remaining to support further spruce beetle activity. It may be tempting to draw the conclusion that the spruce beetle epidemic is over in Alaska, however, it would be premature to do so. Spruce beetle activity continues in many side drainages in those areas already identified as well as the west side of Cook Inlet and Mat-Su Valley. Renewed activity is also occurring in residual stands heavily impacted by spruce beetle in the 1970's and 1980's.

Although the current level of spruce beetle infestation has declined, the spruce beetle has impacted 2-3 million acres of forested land over the past 10 years. Projects are underway to respond to the effects of this infestation. Congress charged a task force on the Kenai Peninsula, along with State and Private Forestry, with designing an action plan to deal with the results of the infestation and begin ecosystem recovery.

To date, the most heavily impacted areas are the Kenai Peninsula, the Copper River Valley, Turnagain Arm, especially the Municipality of Anchorage, and the Haines area in southeast Alaska. In 1997, land ownerships affected continue to be predominantly State and private land at 263,200 acres (47 percent), native corporation lands at 143,300 acres (25 percent), and Federal lands other than National Forest System 142,500 acres (25 percent). Approximately 10,100 acres were reported for the Chugach National Forest (2 percent) and 4,600 acres for the Tongass National Forest (1 percent).

Region 9/Northeastern Area: Maine

Host(s): Red spruce, white spruce

The outbreak of spruce beetle that began in 1994 on the coastal islands and along the central coastal areas of Maine continued. The outbreak caused another 30-50 percent mortality on 2,660 acres, and greater than 50 percent mortality on 450 acres. This acreage is an increase from the 2,160 acres mapped in 1996. Mortality occurred to aging trees over 15 inches in diameter growing on poor sites with shallow, rocky soils. The isolated nature of these trees and rapid decay following death severely limited salvage opportunities, although spruce on Isleboro, Butter, and Eagle Islands was salvaged in 1997.

Spruce budworm, *Choristoneura fumiferana*

Region 10: Alaska

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

White spruce defoliation by spruce budworm declined for the second year in a row in interior Alaska . The 84 percent decline in acres from 236,000 acres in 1996 to 38,400 acres in 1997 is a clear indication that the budworm infestation in this area has run its course. Most of the defoliation (21,300 acres) occurred on privately owned land or on land owned by the State of Alaska. The balance of land affected by the spruce budworm (17,100 acres) was split between native corporation owned land and land managed by Federal agencies other than the Forest Service.

Entomologists and resource managers were concerned that multiple years of heavy defoliation of spruce by spruce budworm would weaken the trees and make them susceptible to *Ips* engraver beetle. Infestation of the stressed trees has not occurred so far. It is possible, however, that it may still happen and engraver beetle-caused tree mortality figures will increase.

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

Host(s): Balsam fir, white spruce

Significant areas of defoliation occurred on State and private lands in Minnesota (256,108 acres). Also in Minnesota, the Chippewa and Superior National Forests reported 1,626 and 18,431 acres of defoliation respectively. In Wisconsin, the Chequamegon National Forest reported 4,341 acres of spruce budworm defoliation and the Nicolet National Forest reported 5,245 acres of defoliation. In Michigan, 61,177 acres of defoliation occurred on the Ottawa National Forest, and to a lesser extent on the Hiawatha (71 acres) and Manistee (311 acres) National Forest. There were also 90 acres reported on the Isle Royal National Park in Michigan. The total defoliated area in 1997 for all ownerships was 347,400 acres. Populations remain low in Maine, New York, and Vermont. No moths were caught in pheromone traps placed in northern New Hampshire.

Western balsam bark beetle, *Dryocoetes confusus*

See Subalpine fir mortality complex.

Western pine beetle,
Dendroctonus brevicomis

Region 1: Idaho, Montana

Host(s): Ponderosa pine

As noted in low-elevation ponderosa pine stands, which are affected by other weather-dependent bark beetle species, some increases in western pine beetle-caused mortality was noted in 1997. Those increases may have been the result of moisture-induced stress and a proliferation of winter-damaged trees. Of the more than 9,200 acres infested Regionwide, nearly 8,400 of them were recorded in northern Idaho. In total, approximately 8,000 ponderosa pines were killed. Most infestations remained in widely scattered, small groups throughout the ponderosa pine type in both western Montana and northern Idaho. Most infestations occurred as small and scattered groups on the Bitterroot and Lolo National Forests, the Flathead Indian Reservation, and in the Garnet Mountain Range, in Montana; and on the Idaho Panhandle National Forest and adjacent lands of other ownerships in northern Idaho. Winter conditions of 1997-98 suggest decreasing populations could be anticipated in 1998.

Region 3: Arizona, New Mexico

Host(s): Ponderosa pine

Western pine beetle-caused tree mortality increased nearly twofold, from 6,480 acres in 1996 to 12,225 acres in 1997. Mortality in Arizona occurred on the Apache-Sitgreaves (7,630 acres) and Coconino (15 acres) National Forests and the Navajo (1,945 acres) and Fort Apache (1,815 acres) Indian Reservations and in New Mexico on the Cibola (35 acres) and Gila (785 acres) National Forests.

Region 4: Idaho

Host(s): Ponderosa pine

Western pine beetle activity remained static in southern Idaho with 4,900 trees killed in 1997 compared to 4,300 trees in 1996. Mortality was located on the Boise, Payette, and Sawtooth National Forests. Pine engraver beetle activity was frequently associated with western pine beetle infestation.

Region 5: California

Host(s): Coulter pine, ponderosa pine

Mortality associated with attacks by the western pine beetle was generally low in the Modoc Plateau, the Southern Cascades and the Sierra Nevada. Exceptions were generally limited to scattered, small pockets of mortality in overstocking stands. In southern California, a few trees were lost in the San Jacinto Mountains (Riverside County) and on the Los Coyotes Indian Reservation and Laguna Mountain (San Diego County).

Region 6: Oregon, Washington

Host(s): Ponderosa pine

Western pine beetle activity decreased substantially in both large and pole-sized ponderosa pines throughout much of the Region. Over 13,600 large trees were killed in 1996 compared to about 2,900 in 1997. Mortality in smaller, pole-sized trees decreased from 12,400 trees in 1996 to 4,300 trees killed in 1997. The only notable increase in large-tree mortality occurred on private lands in northeastern Washington. In pole-sized ponderosa pine, an increase in mortality was reported on private lands in the Glenwood reporting area and on the Yakima Indian Reservation.

Western spruce budworm, *Choristoneura occidentalis*

Region 1: Idaho, Montana

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

In 1995, for the first time since aerial detection began in 1948, budworm-caused defoliation was not found in the Northern Region. Once again in 1997, aerial detection flights recorded no budworm defoliation in the Region. There was, however, light defoliation noted on permanent plots in both Montana and Idaho. Pheromone trap counts were up significantly--from 35 moths in 1996 to 415 moths in 1997. Populations appear to be rebuilding slowly, but remain low. Increased defoliation may be expected in a few scattered areas where trap counts were above 4 or 5 moths per trap in 1997. Such a condition may be apparent on the Helena National Forest. Population recovery, to the pre-1994 condition, will take several more years. A major increase in population is not expected in 1998.

Region 2: Colorado, Wyoming

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

Currently, there are no major outbreaks of western spruce budworm within southern or southwestern Colorado, although there are areas with significant "chronic" budworm activity. There are a number of stands scattered throughout the mixed conifer type of the San Isabel, Grand Mesa-Uncompahgre-Gunnison, Rio Grande, and San Juan National Forests, which have had many consecutive years of defoliation by budworm. This activity is thought to be a direct result of stand conditions complicated by fire exclusion. Budworm defoliation is expected to continue in these susceptible stands until these stand conditions change.

Region 3: Arizona, New Mexico

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

Western spruce budworm defoliation increased nearly twofold, from 126,985 acres in 1996 to 198,165 acres in 1997. In Arizona, western spruce budworm defoliation was detected on 1,090 acres of susceptible host type on the Kaibab National Forest. In New Mexico, western spruce budworm defoliation was detected on the Carson (156,325 acres), Santa Fe (20,230 acres), Gila (240 acres), and Lincoln (40 acres) National Forests; the Santa Clara Indian Reservation (280 acres); and on 19,960 acres of mixed State and private lands in northern New Mexico.

Region 4: Idaho, Utah, Wyoming

Host(s): Douglas-fir, true firs

No visible defoliation from spruce budworm was observed in the Region during 1997.

Region 6: Oregon, Washington

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

Areas of visible defoliation decreased from approximately 191,000 acres in 1996 to 166,000 acres in 1997. Over 92 percent of the area reported with visible defoliation caused by western spruce budworm occurred within the Glenwood Reporting area and on the Yakima Indian Reservation. Although there was a slight decrease in the number of reported acres affected, there was an observable intensification of cumulative defoliation in the mapped areas. A decrease in the affected acres on the Yakima Indian Reservation was accompanied by greater overall damage on the affected acres. Similarly, the Gifford Pinchot National Forest had little change in the number of defoliated acres from 1996, but experienced more severe damage. A new center of light defoliation was detected on approximately 770 acres of the Colville Indian Reservation. The greatest

increase in acreage affected occurred within the Glenwood Reporting area and slight increases in both affected acres and intensity of damage were reported on the Colville and Wenatchee National Forests.

Insects: Nonnative

Asian longhorned beetle,
Anoplophora glabripennis

Region 9/Northeastern Area: New York

Host(s): Birch, horse chestnut, Norway maple, red maple, silver maple

Removal of infested trees and surveys for Asian long-horned beetle continues in quarantined areas of New York. Approximately 700 shade trees have been removed. New York City Parks Department will be planting 400 trees in addition to the 255 street trees planted in 1997.

Australian longhorned borer,
Phoracantha recurva

Region 5: Southern California

Host(s): Eucalyptus spp.

This eucalyptus borer was first found in 1995 in a laboratory colony of *P. semipunctata* maintained by the Department of Entomology, University of California, Riverside. It is now found in Riverside, San Bernardino, Orange, San Diego, and Los Angeles counties. Life cycle and field data indicate that this species may become the dominant eucalyptus borer in at least some parts of California. The effect of a second eucalyptus borer on California's eucalyptus trees is unclear, but *P. recurva* is attacked by the same biological control agents that have been reared and released by Riverside entomologists for suppression of *P. semipunctata.*

Balsam woolly adelgid,
Adelges piceae

Region 1: Idaho

Host(s): Grand fir, subalpine fir

Balsam woolly adelgid populations continue to expand and intensify at many locations in northern Idaho. The estimated 56,300 acres infested in 1997, more than doubling the 24,000 acres recorded in 1996. Actual infested acres may be higher as some infested areas may not yet be displaying crown symptoms. Areas with the heaviest infestations occur on the Idaho Panhandle, Clearwater, and Nez Perce National Forests and adjacent State, private, and Bureau of Land Management land. Subalpine fir of all ages and size classes are killed. Extensive gouting and bole infestations occur on grand fir, but only regeneration in the grand fir type has suffered mortality. 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 the balsam woolly adelgid will continue in 1998. Damage assessment surveys are planned in the near future.

Region 6: Oregon, Washington

Host(s): True firs

The balsam woolly adelgid kills trees slowly by infesting the twigs and branches, or quickly by infesting the bole. It also causes gouting of branch tips. Balsam woolly adelgid activity was observed on 9,400 acres in 1997, a decrease of 4,300 acres from 1996 reported levels. The majority

of activity was reported in the Olympic National Park, which reported a two-fold increase in the number of acres visibly affected.

Region 8: North Carolina, Virginia

Host(s): Fraser fir

Fraser fir has a limited range and occurs predominately on the highest mountains in the southern Appalachians. This forest type occurs in pure stands on the highest peaks or mixed with red spruce at lower elevations. Since the introduction of the balsam woolly adelgid, approximately 64,700 acres of Fraser fir have been affected. The insect will attack trees of all age classes, but prefers the older fir trees. Adelgid populations were again high in 1997.

Region 9/Northeastern Area: West Virginia

Host(s): Balsam fir, Fraser fir

Activity remains at relatively low levels. In West Virginia, 20 forest stands are monitored for indications of damage from balsam woolly adelgid.

Common European pine shoot beetle, *Tomicus piniperda*

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

Host(s): Scotch pine, white pine

Common European pine shoot beetle was detected in two new counties throughout the Northeastern Area in 1997: Putnam and Bureau counties in Illinois.

Eucalyptus longhorned borer, *Phoracantha semipunctata*

Region 5: California, Hawaii (Maui)

Host(s): Eucalyptus spp.

This cerambycid is found as far north as Red Bluff and is killing blue gum in the San Francisco Bay Area as well as southern California. In Hawaii, the combined effects of drought and borer attacks are causing quick die-off. Drought is the dominant factor influencing population buildup in Hawaii.

Gypsy moth (Asian), *Lymantria dispar*

Region 6: Oregon, Washington

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

The 1997 gypsy moth survey trap catches included one Russian Far East strain of the Asian gypsy moth and one Central Siberian strain. Eradication projects are planned for 1998 at the two sites where the above moths were trapped.

Region 8: North Carolina, South Carolina

Host(s): Hardwoods

The isolated infestation that was discovered in 1993 at the Military Ocean Terminal at Sunny Point, North Carolina, is now considered to be officially eradicated. No Asian gypsy moths have been trapped in the past 2 years.

Gypsy moth (European), *Lymantria dispar*

Region 1: Idaho, Montana, North Dakota, Wyoming

Host(s): Hardwoods

Cooperative detection monitoring for the gypsy moth with APHIS, State Departments of Agriculture, Forestry, and Lands continued in 1997. A network of strategically located pheromone-baited traps were placed throughout all States in Region 1. In 1997, two gypsy moths were caught in a single trap at Mammoth Campground in Yellowstone National Park. No other moths were caught on Federal lands, however a single moth was caught in North Dakota and a few moths were trapped in isolated locations in Wyoming. Intensive delimitation surveys conducted on non-Federal lands in Missoula, MT, and Cheyenne, WY, failed to detect established populations. The trapping program will continue as usual in the Region next year with the addition of a delimitation survey at Mammoth Campground.

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

Host(s): Hardwoods

Surveys continued Regionwide on State, private, and Federal lands. In Colorado, a total of 130 detection traps were deployed on National Forest System land with no catches. A total of 1,787 detection traps were deployed on State and private land in Colorado, with 97 delimitation traps being deployed around four 1996 catch sites. The State of Colorado reported only two single male catches for 1997 (one in a Fort Collins detection trap and one in a Lafayette delimitation trap). In Wyoming, detection traps were deployed but caught no moths. An additional 100 delimitation traps were placed on F. E. Warren Air Force Base around the three positive trap sites of 1996. Five moths were trapped in Wyoming, two at Warren Air Force Base in Cheyenne, two in Yellowstone National Park and one in Sheridan. No catches were made in Nebraska or Kansas. Four moths were trapped in South Dakota in Pennington and Meade counties.

Region 3: Arizona, New Mexico

Host(s): Hardwoods

No adult male gypsy moths were captured in Arizona or New Mexico in 1997.

Region 4: Idaho, Nevada, Utah

Host(s): Various deciduous species

The gypsy moth was first detected in Utah in 1988. Between 1989 and 1993 approximately 72,000 acres of Federal, State, and private lands were treated with *Bacillus thuringiensis* (Bt). In 1995, after 2 years of intensive trapping resulting 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 Wasatch-Cache National Forest. The moths are thought to have been reintroduced by the movement of household goods from an infested area as opposed to being a residual population. The Utah Department of Agriculture, in cooperation with the USDA Forest Service, proposed treatment of 801 acres of private

lands and 115 acres of Federal lands in 1998. An integrated pest management approach will be used for eradication including treatment with Bt, mass trapping, and quarantine, if necessary.

Region 5: California

Host(s): Many different trees and ornamentals

One individual male moth was trapped by personnel of the Department of Food and Agriculture, Division of Plant Industry, in each of six counties in 1997 -- Contra Costa, El Dorado, Kern, Nevada, Riverside, and San Diego. There were no reported properties with egg masses or pupal cases.

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, five eradication projects totaling 893 acres were conducted using ground and aerial applications of *Bacillus thuringiensis* (Bt). In one of the ground application sites, Dimilin was also used in the immediate area where egg masses were found. The gypsy moth survey in 1997 resulted in trap catches of 69 individuals; two were identified as Asian gypsy moths. Eradication projects are planned for 1998 at the two Asian gypsy moth sites and one site where European gypsy moths were caught.

In Oregon, an eradication project was conducted using three aerial applications of Bt on 70 acres. Thirty moths were trapped in Oregon, and all have been identified as the European strain. Two sites, one in Beaverton (22 acres) and one in Lake Oswego (13 acres) are proposed for eradication using two ground applications of Bt followed by mass trapping. New introductions are expected to continue as long as moth populations in the east persist and people move from the generally infested area to the Pacific Northwest.

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

Host(s): Hardwoods

No noticeable gypsy moth defoliation occurred in Virginia in 1997. This is the apparent continuing after effect of an *Entomophaga maimaiga* fungus epidemic, which virtually wiped populations out throughout its eastern range.

In North Carolina, an isolated gypsy moth infestation was identified in and around the town of Highlands (Macon and Jackson counties). An eradication project will be initiated in 1998.

Meanwhile, in Tennessee, male trap catches were the lowest since 1990. Nevertheless, a new infestation was discovered in Overton County. The 1996 Scott County infestation was reduced by 96 percent through aerial application of *Bacillus thuringiensis*.

Follow-up trapping was continued on the 1993-95 gypsy moth eradication project in north central Arkansas. Only a limited number of male moths were caught. Trapping will continue, but no treatments are planned in 1998.

The gypsy moth Slow-the-Spread (STS) Pilot Project is a cooperative project conducted jointly by the Forest Service Region 8 (North Carolina and Virginia) and Region 9/Northeastern Area (West Virginia and Michigan). Treatments to slow the rate of spread of the gypsy moth continue along the expanding front in the 7-million acre project area. During 1997, a total of 29,482 acres were treated as part of STS; 4,405 acres of private land in North Carolina, 18,457 acres of private land in Virginia, and 6,370 acres of private land in West Virginia, and 250 acres of national forest land in Virginia and West Virginia. About 63 percent of the area was treated with the biological

insecticide, *Bacillus thuringiensis*, 37 percent with a mating disruptant specific to gypsy moth and 1 percent using mass trapping.

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

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

For a description of the joint Region 8 and Region 9/Northeastern Area Slow-the-Spread Pilot Project see the paragraph above.

Gypsy moth defoliation continued to decline throughout the Northeastern Area in 1997. West Virginia reported the most dramatic decrease, down to only 473 acres from 70,726 in 1996. Massachusetts reported a drop from approximately 7,000 acres in 1996 to only 114 acres in 1997. In Maryland, defoliation decreased from 11,332 to 676 acres. In Michigan, gypsy moth defoliated 36,900 acres in 23 countries. After an increase in 1996, to approximately 50,000 acres, Ohio reported a decrease to just over 4,956 acres in 1997. New Jersey and New York both reported substantial decreases, from 27,755 to 1,910 acres and from 16,825 to 2,230 acres, respectively. Mortality caused by previous gypsy moth defoliation was reported in Massachusetts (400 acres), Ohio (2,100 acres), and Michigan (9,000 acres). In Connecticut, Maine, New Hampshire, and Vermont, populations remained at low, endemic levels and no defoliation was reported. Some States deployed pheromone traps and reported the number of male moths caught: Illinois (34,838) and Wisconsin (91,491).

Hemlock woolly adelgid, *Adelges tsugae*

Region 8: North Carolina, Virginia

Host(s): Eastern hemlock

There were no additional counties infested in 1997, although hemlock woolly adelgid populations continued to build and intensify within the outbreak counties, with officials predicting noticeable increases in 1998. The insect threatens the entire range of eastern hemlock, and is found throughout Virginia wherever hemlock is found in abundance. It is also found in four counties in western North Carolina. The USDA Forest Service is working with the New Jersey Department of Agriculture to introduce a predacious beetle as a biological control.

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

Host(s): Eastern hemlock

The hemlock woolly adelgid infestation expanded to two new counties in West Virginia, and one in Pennsylvania. The range of the previous infestation extended from Massachusetts to North Carolina, and to West Virginia. The most significant damage from hemlock woolly adelgid has been reported in New Jersey and New York. In New Jersey, the hemlock woolly adelgid was found throughout the State.

Larch casebearer,
Coleophora laricella

Region 1: Idaho and Montana

Host(s): Western larch

In 1997, visible defoliation caused by larch casebearer occurred in isolated patterns in many western larch stands throughout northern Idaho and western Montana. Heavy defoliation did not occur over areas large enough to be detected during aerial surveys; however, more defoliation was noted through ground observations than had been seen for the past several years. Surveys conducted during 1997 showed low parasitism rates in casebearer populations, compared to similar surveys conducted during the 1970's--the last time populations were extremely high. Rates of 3 to 13 percent in 1997 compared with previous rates of 40 to 65 percent. Additional surveys indicated that some areas may have moderate to heavy defoliation in 1998. Monitoring of population levels and parasitism rates will continue in 1998.

Region 4: Idaho

Host(s): Western larch

Western larch on the Payette National Forest were defoliated by the larvae of this exotic moth. Defoliation also occurred in residential areas of McCall and Cascade, Idaho.

Region 6: Eastern Oregon, Washington

Host(s): Western larch

After years of negligible damage, larch casebearer-caused defoliation of western larch was observed in portions of the Blue Mountains in 1996. The Regionwide aerial survey mapped 166 acres on private lands within the Wallowa-Whitman Reporting Area in 1997. Introduced parasites released in the Pacific Northwest in the early 1960's and established years ago, along with a couple of needle diseases on larch, helped maintain low levels of casebearer for many years. As casebearer populations declined, so did the introduced parasite. Parasites are expected to respond to the increasing casebearer population, although there may be several more years of defoliation before they increase to effective levels. Accurate assessment of the casebearer situation would require extensive aerial surveys in early June (rather than later in the summer when the Regionwide survey is done).

Region 9/Northeastern Area: New York

Host(s): Larch

The insect continues to be present in New York. Some discoloration was reported on about 200 acres.

Larch sawfly,
Pristiphora erichsonii

Region 9/Northeastern Area: Maine

Host(s): Larch

Larch sawfly populations decreased noticeably in 1997, defoliating about 710 acres in Maine. In 1996, about 5,000 acres were defoliated.

Region 10: Alaska

Host(s): Eastern larch

Larch sawfly activity in interior Alaska also declined from 607,000 acres in 1996 to 268,000 acres in 1997. This is the fifth consecutive year of defoliation along the Tanana River from Big Delta to the confluence with the Yukon River including Fairbanks; limited mortality is occurring. Defoliation occurred on Federal land other than National Forest System (130,300 acres), State or private owned land (107,700 acres), and native corporation land (30,000 acres). This infestation appears to be waning both in acreage and intensity.

Pink hibiscus mealybug,
Maconellicoccus hirsutus

IITF: U.S. Virgin Islands

Host(s): Acacia, avocado, citrus, hibiscus, mahoe, sorrel, soursop, sugar apple, teak (This is a non-specific pest, there are over 120 genera of host plants)

The Pink hibiscus mealy bug was first discovered on the island of Grenada in 1994. It has since spread to 16 islands within the Caribbean Sea and South America. Its rapid spread through the Caribbean islands indicates how easily the insect can be transported and demonstrates its adaptability to a variety of host plants and environments. The insect has been reported in the U.S. Virgin Islands on St. Croix, St. Thomas, and St. John, and in Puerto Rico on the islands of Vieques and Culebra. However, at this writing it has been found on the main island also. There have been unconfirmed reports that Jamaica, Dominican Republic, and Cuba are also infested. It is moving in the direction of Florida.

Damage in areas with extensive infestations such as Grenada is severe. Mortality of forest trees and impacts to the island's watersheds have been reported. Damage on St. Thomas is primarily to the urban forest, and to ornamental plantings on Culebra and Vieques. Ownership affected is municipal, State, Federal, and private landowners. The values affected include economic development, recreation, aesthetics, timber, and agriculture. Drought is determined to be a contributing factor. The life cycle is approximately 1 month, and each female lays around 600 eggs. It's spread is rapid and devastating. Chemical control is ineffective, and biological control with parasitic wasps is underway.

Spruce aphid,
Elatobium abietinum

Region 3: Arizona

Host(s): Spruce

The spruce aphid was first reported in the southwest in late 1988 on the Apache Indian Reservation in Arizona. Defoliation occurred again in the winter of 1989-1990 with estimates up to 100,000 acres. The populations were low in 1990 and 1991 and undetected until the winter of 1995-1996. In 1996, 10,780 acres were detected increasing to 27,970 acres in 1997. Defoliation occurred on both the Apache-Sitgreaves National Forest (11,805 acres) and the Fort Apache Indian Reservation (16,165 acres).

Diseases: Native

Annosus root disease, *Heterobasidion annosum*

Region 1: Idaho, Montana

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

Annosus root disease is common in ponderosa pine stands on the Flathead Indian Reservation and in other western Montana locations. It is widespread on Douglas-fir and true firs on the Clearwater, Nez Perce, and the Idaho Panhandle National Forests in Idaho.

Region 2: Colorado, Nebraska

Host(s): Jack pine, ponderosa pine, white fir

Annosus root disease has scattered distribution in white fir in the mixed conifer type throughout southern Colorado. In campgrounds, the disease creates hazardous conditions by increasing the probability of tree failure. In 1997, sanitation removal projects were implemented at Amphitheater and Vallecito Campgrounds (Ouray Ranger District, Uncompahgre National Forest and Columbine Ranger District, San Juan National Forest, respectively). The disease was also identified as a management concern at the Sparks Timber Sale area on the Pagosa Ranger District, San Juan National Forest.

Region 3: Arizona, New Mexico

Host(s): True firs, ponderosa pine

Root diseases and their associated pests may be responsible for about one-third of the conifer mortality in the Region. Annosus root disease accounts for about 20 percent of this mortality.

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

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

This root disease fungus can be found throughout the Region, but mostly as a decay organism. The fungus is occasionally damaging to young, planted stands of ponderosa pine on droughty soils.

Region 5: California

Host(s): Conifers, some hardwoods

Five evaluations in mixed-conifer sites further validated the judgment that annosus root disease is well established in Sierra Nevada mixed-conifer stands and is commonly present in stands where trees have been cut.

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. Mortality is high where annosus root disease and

fir engraver beetles operate as a complex. The new regional vegetation inventory (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 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. 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): Loblolly pine, longleaf pine, slash pine, shortleaf pine, eastern white pine

Annosus root disease continues to cause losses throughout the south. Mortality and growth loss range from 2 percent to 25 percent of growing stock volume of managed high-risk stands. The disease is most often associated with thinned pine plantations on sandy well-drained sites, but can be found on a variety of sites, soils, and forest conditions. Bark beetle infestations often occur in infected stands. In South Carolina, at least 1,500 acres of loblolly pine were salvaged as a result of annosus root disease infection in 1997.

Region 9/Northeastern Area: Delaware, Maryland, Missouri

Host(s): Loblolly pine, shortleaf pine

Annosus root rot is a minor problem in the Northeastern Area. A few stands of shortleaf pine in Missouri were infected as well as a few stands of loblolly pine in Maryland and Delaware.

Armillaria root disease, *Armillaria* spp.

Region 1: Idaho, Montana

Host(s): Douglas-fir, other conifers

Armillaria root disease is widely distributed in northern Idaho and western Montana. The apparent increase of this root disease in parts of Region 1 is attributed, in part, to the increase in Douglas-fir and true firs resulting from fire control and selective harvesting of high-value pine and western larch early in the 20th century. It is also a major cause of mortality in young ponderosa pine plantations (15-25 years old).

Region 2: Colorado, South Dakota, Wyoming

Host(s): Engelmann spruce, hardwoods, lodgepole pine, ponderosa pine, subalpine fir, white fir

Armillaria root disease is the most common and damaging root disease in Region 2. In the spruce/fir cover type, the disease is commonly associated with the decline of subalpine fir caused by several bark beetles (Scolytus/Dryocoetes) throughout Colorado and Wyoming. In 1997, the disease was identified as a management concern in the Engelhart, Bar HL and Sparks Timber Sale Areas (Grand Junction Ranger District, Grand Mesa National Forest; Blanco Ranger District, White River National Forest; and Pagosa Ranger District, San Juan National Forest), and at the Wolf Creek Ski Area (Divide Ranger District, Rio Grande National Forest). In addition, a sanitation removal project was implemented at Vallecito and Purgatory Campgrounds (Columbine Ranger District, San Juan National Forest).

Region 3: Arizona, New Mexico

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

Armillaria spp. account for about 80 percent of root disease mortality across the Region. The disease is more prevalent in mixed conifer and spruce-fir forests than in ponderosa pine forests. Region 3 is tracking the long-term affects and spread of this and other root diseases on a number of sites using a series of permanent plots.

Region 4: Idaho, Nevada, Utah, Wyoming

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

Evidence of Armillaria root disease can be found throughout the Region functioning 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.

Region 5: California

Host(s): Conifers, some hardwoods

Armillaria spp. is suspected of killing Douglas-fir orchard trees at the Chico Genetic Resource Center. The fungus is definitely causing mortality to Chinese maples at another location within the Center property.

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. Mortality continues in both disturbed and undisturbed stands, indicating one or more especially virulent strains of the fungus. True firs and Douglas-fir sustain the most losses. However, in localized areas, ponderosa pine mortality is significant. In the Blue Mountains of Oregon, there is a several thousand-acre Armillaria-infected area. 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.

Region 9/Northeastern Area: Areawide

Host(s): Hardwoods

A variety of hosts continued to be affected throughout the northeast by various biological species of Armillaria.

Aspen leaf blights,
Ciborina whetzelii
Marssonina populi

Region 2: Colorado, South Dakota, Wyoming

Host(s): Aspen

Aerial surveys in Colorado detected over 17,800 acres of declining aspen and over 2,300 acres in Wyoming as a result of the unusually wet growing season.

Black stain root disease,
Leptographium wageneri
Ophiostoma wageneri

Region 2: Colorado

Host(s): Pinyon pine, ponderosa pine

Continues as a problem on pinyon pine in the southwestern corner of Colorado. Recent mortality was detected on Bureau of Land Management land south of Redvale, Colorado. The disease is also of major concern in recreation areas near McPhee Reservoir and at Mesa Verde National Park.

Region 3: New Mexico

Host(s): Pinyon pine, Douglas-fir

Both *Leptographium wageneri* var. *wageneri*, which infects pinyon, and *L. wageneri* var. *pseudotsugae*, which infects 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

This fungus causes mortality of pinyon pine on the Bureau of Land Management Burley District in Idaho, on the Humboldt and Toiyabe National Forests in Nevada, and on the Dixie and Manti-LaSal National Forests in Utah.

Region 5: California

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

Black stain root disease was identified at the Foresthill Seed Orchard (Placer County). This is the first detection of the disease at this location. Black stain and the pinyon *Ips* continue to cause mortality of singleleaf pinyon pine on about 5,500 acres on the Moutaintop and San Jacinto Districts, San Bernardino 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, especially in the southern part of the Region. In 1997, 824 acres of black stain root disease were mapped in the Coos-Douglas reporting area, almost entirely on private lands.

Dwarf mistletoes, *Arceuthobium* spp.

Region 1: Idaho, Montana

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

Lodgepole pine dwarf mistletoe infects 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. Dwarf mistletoe is locally heavy in ponderosa pine stands around Lake Coeur d'Alene and along the Spokane River drainage in northern Idaho. Douglas-fir dwarf mistletoe infects about .6 million acres (13 percent) of Douglas-fir, reducing growth by approximately 13 million cubic feet annually. Western larch dwarf mistletoe occurs on about .8 million acres (38 percent) of western larch stands, and reduces annual growth by over 15 million cubic feet.

Region 2: Colorado, Wyoming

Host(s): Lodgepole pine

Dwarf mistletoes cause the greatest disease losses in Region 2. Forest Health Management funded presuppression surveys and silvicultural control on six national forests including over 10,800 acres. Continuing emphasis is being placed on surveys at landscape scale and on suppression projects in developed recreation sites. Lodgepole pine dwarf mistletoe (*A. americanum*) impacts were assessed at the Ellison Mountain, Fawn Creek and Yellowjacket Ridge areas of the Blanco Ranger District (White River National Forest), the Thompson Flats area of the Leadville Ranger District (San Isabel National Forest), and at the proposed Texas Creek Campground on the Taylor River Ranger District, Gunnison National Forest.

Region 2: Colorado

Host(s): Douglas-fir

Douglas-fir dwarf mistletoe (*A. douglasii*) occurs mostly in the southern two-thirds of Colorado. The disease was identified as a management concern at the Wolf Timber Sale area on the Saguache Ranger District (Rio Grande National Forest) and at Vallecito and Pine Point Campgrounds on the Columbine Ranger District (San Juan National Forest).

Region 2: Colorado

Host(s): Ponderosa pine

Ponderosa pine dwarf mistletoe *(Arceuthobium vaginatum* subsp. *cryptopodium)* is the most common and damaging disease of ponderosa pine in Region 2. Losses amount to 885,000 cu. ft. annually. Suppression projects emphasized tree removal and pruning of infested trees in developed recreation sites. In 1997, Forest Health Management funded silvicultural control projects on the Salida Ranger District (San Isabel National Forest) and the Ouray Ranger District (Uncompahgre National Forest). Private landowners in the Black Forest and along the Front Range of Colorado are reporting concerns as a consequence of newly established residences in infested areas. The disease was also identified as a management concern at Ferris Canyon (Dolores Ranger District, San Juan National Forest) and at Middle Mountain Campground (Columbine Ranger District, San Juan National Forest).

Region 3: Arizona, New Mexico

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

Dwarf mistletoes are the most significant pathogens in the Southwestern Region. Over 1 million acres of National Forest System commercial timberlands in each State have some level of infection. The disease also affects several hundred thousand acres in noncommercial and reserved areas, woodlands, and other public and private forest lands. Region 3 is monitoring the disease on several sites using permanent plots. Over the past few years, the Region has been active in developing new management recommendations for this disease.

Region 4: Idaho, Nevada, Utah, Wyoming

Host(s): Douglas-fir, pines, western larch

Suppression projects continue to remove infected overstory trees; however this forest disease remains the most widespread and frequently observed disease within the Intermountain Region. Regional incidence by major host species is estimated as follows: lodgepole pine 50 percent, ponderosa pine 20 percent, and Douglas-fir 20 percent infected. These numbers represent the percentage of host stands having some level of infection.

Region 5: California

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

Dwarf mistletoes are infesting conifers on approximately 25 percent of the forested land in California with over 4 million acres of National Forest System lands affected. The distribution of dwarf mistletoe has not changed significantly over the past 30 years. Surveys for prioritizing suppression opportunities and future treatments were completed for 3,000 acres on the Shasta-Trinity National Forests and 10,000 acres on the Sequoia National Forest. Suppression projects were completed on three recreation sites on the Sequoia National Forest; the 5-year Dwarf Mistletoe Suppression Program continues in recreational areas of national forests in southern California.

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. All 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 central 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.

Region 10: Alaska

Host(s): Western hemlock

Hemlock dwarf mistletoe (*A. tsugense*) is the most important disease of western hemlock in unmanaged, old-growth stands throughout southeast Alaska as far north as Haines. The incidence of dwarf mistletoe varies from stands in which almost every western hemlock tree is severely infected to other stands in which the parasite is absent. Heavily infected trees have branch proliferations (brooms), bole deformities, reduced height and radial growth, less desirable wood characteristics, top-kill, and severely infected trees may die. These are all potential problems in stands managed for wood production; however, the disease also creates a greater diversity of forest structure and contributes unique wildlife habitat.

Diseases: Native

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

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

Endemic levels of infection of eastern dwarf mistletoe (*A. pusillum*) persisted in all these northern States.

Fusiform rust,
Cronartium quercuum f. sp. fusiforme

Region 8: Regionwide, except Kentucky

Host(s): Loblolly pine, slash pine

Fusiform rust is the most damaging disease of loblolly and slash pines in the South. Other pine species may also be affected, but little mortality or damage occurs. An estimated 13.7 million acres of loblolly and slash pine have at least 10 percent of the trees infected. Georgia is the most heavily impacted, with 4.6 million acres (49 percent of host type) affected. In South Carolina, many young stands were prematurely harvested throughout the State because of heavy fusiform rust infection in 1997.

Laminated root rot,
Phellinus weirii

Region 1: Idaho, Montana

Host(s): Douglas-fir, grand fir

Laminated root rot is very severe on parts of the Lolo and Kootenai National Forests in Montana, as well as the Idaho Panhandle National Forest in Idaho. Damage from laminated root rot has increased in recent years. This is attributed, in part, to the loss of root disease-tolerant western white pine to blister rust; an increase in Douglas-fir and true firs as a result of fire control; and selective harvesting of high-value, root disease tolerant pine and western larch early in the 20th century.

Region 5: Northwestern California

Host(s): Douglas fir, white fir, other conifers

Laminated root rot is limited to a few areas in northern California in the Klamath Mountains. No new infections were reported.

Region 6: Oregon, Washington

Host(s): Conifers

Laminated root rot is the most serious forest tree disease west of the Cascade Mountains in Washington and Oregon. Overall, an estimated 8 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 Cascades, 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.

Oak wilt,
Ceratocystis fagacaerum

Region 2: Kansas, Nebraska

Host(s): Oak species

A recurring disease that continues to be a serious problem in isolated areas, however, in Kansas, reports of the disease were lower than in 1996.

Region 8: Arkansas, Kentucky, North Carolina, South Carolina, Tennessee, Texas, Virginia

Host(s): Oaks, especially red oak group and live oak in Texas

Oak wilt continues to be epidemic in central Texas. The number of affected counties remains at 61. A cooperative oak wilt suppression project continues in central Texas. The U.S. Army Corps of Engineers has also implemented suppression efforts on recreational lands surrounding several lakes in central Texas. Oak wilt is endemic throughout the rest of the Southern Region.

Region 9/Northeastern Area: Iowa, Indiana, Minnesota, West Virginia

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

Oak wilt continued to cause mortality, particularly in suburban areas. It was the single, greatest forest pest problem in Iowa, with 2,380 acres of mortality reported. Minnesota also reported 5,528 acres of mortality. Oak wilt control programs continued in the Twin Cities of Minnesota. In Grant County, West Virginia, 20 trees were killed by oak wilt.

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

Region 10: Alaska

Host(s): All tree species

Heart rot causes more economic loss than all other diseases in Alaska. Roughly 30 percent of the old-growth timber volume in southeast Alaska is defective because of heart rot fungi. In the interior and south-central Alaska hardwoods, substantial volume loss can be expected in stands 80 years old or older. Sap rot decay routinely and quickly develops in spruce trees attacked by spruce bark beetles.

Heart rot fungi appear to be the primary agents that drive the canopy-gap process of disturbance in many old forests. They are vital agents that alter forest structure and succession, and directly enhance wildlife habitat. Specific heart rot levels can be achieved in managed forests by controlling the frequency and size of bole wounds and top breakage during stand entries. Ongoing studies examine the ecological roles of heart rot and the rate of wood decay in wounded trees.

Swiss needle cast,
Phaeocryptopus gaumannii

Region 6: Western Oregon, Washington

Host(s): Douglas-fir

Swiss needle cast, a fungus disease of Douglas-fir foliage, is endemic in Douglas-fir west of the Cascade Mountains. Over the last 15 years, distinctive yellowing, needle loss, and growth

reduction have been observed in coastal Douglas-fir plantations. A combination of favorable climate, plantation age, and genetics may be the cause of severe disease symptoms seen in recent years. In 1996, 130,000 acres of discolored Douglas-fir along the Oregon coast were mapped by a late spring, special aerial survey. In 1997, 395,000 acres were mapped, more than a 3-fold increase. Much of the increase may be due to warm, dry weather prior to and during the survey, which enhanced foliage discoloration and allowed for good survey visibility. 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 occurred in all Douglas-fir stands throughout the survey area. The 1997 survey showed more discoloration in mature trees than was seen in previous surveys.

Diseases: Nonnative

Beech bark disease,
Nectria coccinea var. faginata

Region 8: North Carolina, Tennessee, Virginia

Host(s): American beech

Beech bark disease was not found in any additional counties, but the disease continues to intensify within the currently infected areas. Beech bark disease was first reported in the Great Smoky Mountains National Park in 1994. However, the first mortality reported in the South was reported as early as the mid-1980's in northern Virginia. This is well outside of the previously known distribution. Increases in the associated beech scale, *Cryptococcus fagisuga*, proliferation continued in 1997.

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

Host(s): American beech

The killing front of this disease complex continued to expand through West Virginia. More than 868,000 acres have sustained mortality. The entire area represented by the advancing front (where the scale is present) comprised about 1.29 million acres. Scattered mortality still occurred in Vermont, and endemic infections remained throughout New England and previously infected States

Dutch elm disease,
Ophiostoma (=Ceratocystis) ulmi

Region 1: Idaho, Montana, North Dakota

Host(s): American elm

Dutch elm disease continued to spread in urban areas in 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 at the Knife River Indian Villages National Historic Site. In Idaho this disease is common in many communities along the Snake River in southern Idaho, but in the northern portion of the State has been reported only in Moscow. There, an aggressive treatment program has limited losses to less than 10 trees per year for the past several years.

Region 2: Colorado, Kansas, Nebraska, South Dakota

Host(s): Elm species

In Colorado, low levels of activity were reported statewide except for the known hotspots of Sterling (30 positive cases), Fort Morgan (11 positive cases), and Colorado Springs (28 positive cases). It is expected that the Blizzard of October 1997 will have produced elm broodwood material and potentially the Front Range will experience an increase of Dutch elm disease activity in the coming year. Kansas and Nebraska reported that Dutch elm disease continues as a major problem statewide and in Kansas is reported to be on the increase. In South Dakota, activity increased from 1996 levels.

Diseases: Nonnative

Region 8: Regionwide

Host(s): Elms, particularly American elm

Scattered to localized mortality continues to occur at generally low levels in urban and wild populations of elms.

Region 9/Northeastern Area: Areawide

Host(s): American elm

In Iowa, elms were affected on over 489 acres. Minnesota reported 223 acres of mortality in Otter Trail, Rice, and Wabasha counties. In Missouri 78 trees are known to be infected. The District of Columbia has over 700 American elms infected with the disease. Dutch elm disease remained common throughout all the Northeastern States.

White pine blister rust, *Cronartium ribicola*

Region 1: Idaho, Montana

Host(s): Western white pine, whitebark pine, limber 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. In moist habitat types, where white pine was historically the dominant species, it has been replaced by climax species such as grand fir, hemlock, and western redcedar. Efforts to restore white pine are concentrating on planting genetically improved stock. We are currently intensifying monitoring efforts to gain a better understanding of how well the improved stock is holding up in the field. In addition, pruning lower branches from natural regeneration is being conducted on a large scale because it can greatly improve survival in some areas. Blister rust is also causing extensive mortality in high-elevation five-needle pines. Recent surveys have found infection rates in whitebark pine regeneration of up to 90 percent. There is a growing concern that severe losses of whitebark pine may have significant impacts on water and wildlife in these fragile ecosystems.

Region 2: Colorado, Wyoming

Host(s): Limber pine, western white pine

No additional reports of infected western white pine nursery stock in Colorado since the reported introduction in 1996. In Wyoming, all areas with limber and whitebark pines are known to be infected with white pine blister rust. Disease levels are higher in the Sunlight area of the Shoshone National Forest, Tensleep Canyon of the Bighorn National Forest, Vedauwoo Campground on the Medicine Bow National Forest, and a remote stand of limber pine in the Black Hills, South Dakota.

Region 3: New Mexico

Host(s): Southwestern white pine

Blister rust occurs throughout most of the range of southwestern white pine (*Pinus strobiformis*) in the Sacramento, White, and Capitan Mountains of southern New Mexico. Roughly one-half million acres are affected. The disease has not been found in other parts of New Mexico or in Arizona. A hazard rating system is being developed for the outbreak area. In 1997, seed was collected from several resistant candidates for genetic testing.

Region 4: Idaho, Nevada, Utah, Wyoming

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

A formal survey of five-needled pines was conducted in 1995-1997 to quantify disease incidence and intensity, and determine site and stand characteristics of infected areas. An final report is forthcoming.

Region 5: California

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

Work continues on developing sources of sugar pine with major gene resistance and slow rusting resistance. The Region has identified a total of 1,045 rust resistant sugar pines. Work with other white pines was enhanced. Stands of whitebark pine at Mt. Rose (Douglas County, NV), Stevens Peak (Alpine County, CA), Sonora Pass (Mono County, CA), and Carson Pass (Alpine County, CA) were surveyed for rust infection. At Mt. Rose and Carson Pass, rust was observed in 83 percent of the clumps investigated. Within a clump, 34 percent of the stems were infected. At Stevens Peak, infection was less than 2 percent; no infections were found at Sonora Pass.

Region 6: Oregon, Washington

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

Within the Region, 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 Wallowa Mountains and in sugar pine in southwest Oregon where survey and impact data are not available. An attempt was made to aerially identify areas symptomatic of blister rust beginning in 1994. Although blister rust is known to occur extensively throughout the range of susceptible host type, observers mapped only 4,700 acres in Washington in 1996. Blister rust symptoms are difficult to distinguish from the more easily observed effects of mountain pine beetle. The bulk of the reported acreage fell within the Yakima Indian Reservation and the Gifford Pinchot, Okanogan, and Wenatchee National Forests.

In 1997, 2,924 acres with blister rust were mapped. 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. The majority of the detected blister rust was on the Okanogan, Deschutes, and Wenatchee National Forests, and the Yakama Indian Reservation.

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

Host(s): Eastern white pine

White pine blister rust continued to cause dieback and topkill in mature trees, and mortality of seedlings and saplings throughout the range of eastern white pine.

Diseases: Origin Unknown

Butternut canker,
Sirococcus clavigignenti-juglandacearum

Region 8: Alabama, Arkansas, Georgia, Kentucky, Mississippi, North Carolina, Tennessee, Virginia
Host(s): Butternut

This disease has been in the South at least 40 years. It is estimated that it has killed at least 77 percent of the butternuts in North Carolina and Virginia. The fungus kills large trees, saplings, and regeneration. Trees exhibiting resistance have been found in Arkansas, North Carolina, Tennessee, Kentucky, and Virginia. A cove with a large number of canker-free and cankered trees in Western North Carolina has been converted into a seed collection area, with potentially resistant trees being propagated by grafting and nut collection for host resistance studies. Additionally, disease-resistant seedlings are being propagated in an east Tennessee nursery. Butternut canker is projected 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). It is too early to project the benefits of selection and breeding. In 1997, a few individual trees in North Carolina appeared to be recovering from the disease. The reason for the apparent recovery is unknown.

Region 9/Northeastern Area: Northeastern Area
Host(s): Butternut

The disease remained a common cause of butternut mortality throughout the host range. In West Virginia, surveys were initiated to isolate potentially resistant trees.

Dogwood anthracnose,
Discula destructiva

Region 8: Alabama, Georgia, Kentucky, North Carolina, South Carolina, Tennessee, Virginia
Host(s): Flowering dogwood

Dogwood anthracnose is now found in 241 counties in the South. The disease is primarily found in the mountains, foothills, and upper Piedmont. Damage is most severe above 3,000 feet in elevation where all the flowering dogwoods have died or are dying. Below that elevation, flowering dogwoods are severely affected in cool shaded areas while trees in the sun are doing well. The fungus has spread to the upper Piedmont and part of the Coastal Plain, but the impact has been minor.

Region 9/Northeastern Area: Areawide
Host(s): Flowering dogwood

Although this fungus remained present throughout the Region, the incidence of this foliage disease has declined sharply across the Northeastern States. This was due primarily to spring weather conditions unfavorable to fungus spread.

Pitch canker,
Fusarium subglutinans

Region 5: Coastal California

Host(s): Bishop pine, Douglas-fir, Monterey pine, Monterey X knobcone, other ornamental pines

The total number of counties with pines infected with pitch canker remained at 17. However, the disease continues to spread and intensify in all three of California's native Monterey pine stands and within ornamental plantings throughout the infested area. An intensive survey of the Cambria native stand (2,500 acres) found pitch canker to be more prevalent than previously thought.

The California Board of Forestry established the Coastal Pitch Canker Zone of Infestation with the intent of slowing the spread of the pathogen. The zone covers the 17 counties plus 4 adjacent counties (23.1 million acres) and is the first zone ever declared for a pathogen.

Port-Orford-cedar root disease,
Phytophthora lateralis

Region 5: California

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

Monitoring plots were established along Fish Creek (Humboldt County) to determine the rate of spread and disease development in a newly infested drainage. Along another creek, observations began on the efficacy of host removal for reducing the risk of disease spread. No areas with root disease were found upstream and upslope from the lone infection site south of Dunsmuir in the Sacramento River drainage.

Region 6: Oregon

Host(s): Port-Orford-cedar

Evidence of the disease was reported over a total of 21,000 acres in 1994. Within these areas, mortality was distributed in scattered pockets or individual trees. On National Forest System lands, slightly less than 10 percent of all Port-Orford-cedar is infected. Over 4,000 killed Port-Orford-cedar on about 3,800 acres were mapped by the 1997 aerial survey.

Declines and Complexes

Aspen defoliator complex

Region 3: Arizona, New Mexico

Host(s): Aspen

Aspen defoliation caused by this complex of insects, diseases - including large aspen tortrix *(Choristoneura conflictana)*, western tent caterpillar *(Malacosoma californicum)*, and marssonina leaf blight *(Marssonina populi)* - and abiotic factors decreased slightly from 35,650 acres in 1996 to 25,465 acres in 1997. Defoliation on Federal lands in Arizona occurred on the Apache-Sitgreaves (820 acres), Coconino (305 acres), Coronado (50 acres), Kaibab (910 acres), and Tonto (160 acres) National Forests; Navajo (25 acres) and Fort Apache (460 acres) Indian Reservations; and private ownerships (20 acres). In New Mexico, aspen defoliation was detected on the Carson (10,185 acres), Cibola (2,080 acres), Santa Fe (5,550 acres), and Lincoln (960 acres) National Forests; Mescalero Apache (280 acres) and Santa Clara (120 acres) Indian Reservations; and private ownerships (3,540 acres) in northern New Mexico.

Elm yellows

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

Host(s): American elm, slippery elm

Thousands of elms scattered over more than 250,000 acres in West Virginia were showing symptoms or were killed by this disease. Nearly 40,000 acres in Pennsylvania also had damaged shoots and foliage. Ohio reported symptoms and mortality.

Limber pine decline

Region 1: Montana

Host(s): Limber pine

During the mid-1990's, limber pine found in a scattered pattern across eastern Montana began showing signs of general decline. Most notable were stands on the Lewis & Clark National Forests. In some stands, nearly 100 percent mortality was observed. Several insect and disease agents were identified in those stands, and likely have contributed to their decline of the species. Other factors, such as climatic change and encroachment of other plant species may also be contributing to this overall decline. In 1997, a total of 1,325 acres, on lands of all ownerships, were recorded as in a State of "decline" during the annual aerial survey.

Native insect complex

Region 3: Arizona, New Mexico

Host(s): True firs

Tree mortality caused by fir engraver beetle *(Scolytus ventralis)* and western balsam bark beetle *(Dryocoetes confusus)* was detected on 4,410 acres in 1997 compared to 2,820 acres in 1996. Tree mortality on Federal lands in Arizona occurred on the Apache-Sitgreaves (920 acres), Coconino (1,660 acres), Coronado (65 acres) and Kaibab (895 acres) National Forests; Fort

Apache (245 acres) Indian Reservation; and Grand Canyon National Park (5 acres). In New Mexico, fir engraver beetle-caused mortality occurred on the Cibola (45 acres), Santa Fe (75 acres), Gila (295 acres), and Lincoln (205 acres) National Forests.

Northern hardwood decline

Region 8: Regionwide

Host(s): Eastern hardwoods, white conifers, various bioindicator species

Investigations are underway in southern Virginia to determine the cause of reported mortality and dieback to the northern hardwood forest type at relatively high elevations near the Mt. Rogers area. While some have speculated that the cause is air pollution, results of the investigation at this writing are inconclusive. Preliminary surveys show less than 1 percent of the forest type affected.

Oak decline

Region 8: Regionwide

Host(s): Oaks, hickories, associated hardwoods

Oak decline is a syndrome resulting in dieback and mortality of dominant and codominant mature oaks. Causal factors are stressors such as drought, frost, defoliation by insects, and secondary agents such as Armillaria root disease and two-lined chestnut borer (*Agrilus bilineatus*). Host, age, and site conditions also play a role. Analysis of forest inventory data in 12 southern States shows that 3.9 million acres of upland hardwood forest are affected by oak decline. This amounts to 9.9 percent of the susceptible host type. Average annual mortality volume of oaks on affected sites was 45 percent higher than on unaffected areas. Some of the oak decline reported is in areas previously heavily defoliated by the gypsy moth. Oak decline and gypsy moth interact; pre-existing oak decline increases mortality after gypsy moth defoliation. Also severe defoliation can induce oak decline in previously unaffected areas. No new local or widespread occurrences of severe decline were reported in 1997.

Region 9/Northeastern Area: Missouri

Host(s): Oaks

Mortality due to oak decline was limited to 5 acres in Missouri in 1997.

Subalpine fir decline

Region 2: Colorado, Wyoming

Host(s): Subalpine fir

Aerial surveys detected declining subalpine fir on over 69,100 acres in Colorado and 28,500 acres in Wyoming. This decline is a complex of several bark-infesting insects and root diseases.

Subalpine fir mortality complex

Region 1: Idaho, Montana

Host(s): Subalpine fir

Western balsam bark beetle populations once again caused significant amounts of tree mortality in high-elevation subalpine fir stands on several forests in the Region in 1997. Although the infested area decreased from 53,500 acres recorded in 1996, to slightly more than 47,500 acres in 1997; more beetle-killed subalpine firs were noted. Perhaps only one of a complex of pests responsible for reported mortality, which likely includes root diseases and other secondary bark beetles, western balsam bark beetle is the most conspicuous and most aggressive of that complex. And because of the virulent fungus it carries, it is quite capable of killing its host in the absence of other pests. Of the infested area recorded, approximately 4,200 acres were in northern Idaho, principally on the Idaho Panhandle and Nez Perce National Forests. Of the remaining 43,300 acres, just over 30,100 were in western Montana--most on the Beaverhead and Gallatin National Forests. Another 13,200 acres were located in Yellowstone National Park. An estimated 101,000 subalpine firs were killed, Regionwide, in 1996--recorded as faders in 1997.

Region 2: Colorado, Wyoming

Host(s): Subalpine fir

Subalpine fir mortality was common in the spruce/fir cover type of Colorado due to a complex of factors that is as yet not well understood, but which is under investigation. Additional factors include Armillaria root disease and possibly other biotic and abiotic influences that collectively are referred to as 'subalpine fir decline.' Mortality estimates are complicated by the fact that dead subalpine fir retains its needles longer than other conifer species. Subalpine fir decline continues to be the most widespread damage agent detected in Colorado's and Wyoming's forests. Levels of mortality vary greatly, with some stands losing a significant proportion of the fir component over the course of several years. This subalpine fir decline is occurring throughout the Intermountain West and, in the Rocky Mountain Region, is most concentrated in the West Elks, the Grand Mesa, the Flat Tops, the Elkhead Mountains, the Williams Fork Mountains (Blue River drainage), the Gore Range, the Park Range and Wyoming's Medicine Bow and Sierra Madre Mountains. In Wyoming, on the Wapiti and Clarks Fork Ranger Districts of the Shoshone National Forest an estimated 6,332 trees were affected in 1997. On the Bighorn National Forest a total of 9,866 trees were affected.

Region 4: Idaho, Utah, Wyoming

Host(s): Subalpine fir

Subalpine fir decline and mortality continue to occur throughout the host type in the Region. Ground examinations suggest a complex of factors are involved in this mortality. These factors include: twig beetles, secondary bark beetles, wood borers, engraver beetles, root diseases, cankers, rusts, and environmental conditions. In 1997 this complex resulted in the death of 133,300 trees throughout the Region compared to 121,200 in 1996. This mortality complex is the most widespread cause of visible mortality in the Region.

Yellow-cedar decline

Region 10: Alaska

Host(s): Yellow-cedar

Decline and mortality of yellow-cedar persists as one of the foremost forest problems in southeast Alaska. About 475,000 acres of decline have been mapped during aerial surveys. This acreage figure is amended annually as GIS capabilities improve. Concentrated mortality occurs in a wide

band from western Chichagof and Baranof Islands to the Ketchikan area, primarily on National Forest System lands (457,600 acres). All research suggests that some site condition, probably associated with poorly-drained anaerobic soils, is responsible for initiating and continuing cedar decline. The intense canopy mortality causes change in forest structure, composition, and succession. The large acreage of dead yellow-cedar and the high value of its wood suggest opportunities for salvage. Studies are on-going to determine mill-recovery, strength, and durability of these decay resistant dead trees.

Seed Orchard Insects and Diseases

Coneworms,
Dioryctria amatella
Dioryctria clarioralis
Dioryctria disclusa
Dioryctria merkeli

Region 8: Regionwide

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

Coneworms continued to cause damage in seed orchards across the South. Data from the Southwide Coneworm Survey indicated substantial populations of the three primary species: the webbing coneworm, *Dioryctria disclusa*, the southern pine coneworm, *D. amatella*, and the loblolly pine coneworm, *D. merkeli*. Impact was intensified due to a sparse cone crop for all pine species this year.

Filbertworm,
Cydia latiferreana
Acorn weevils,
***Curculio* spp.**
***Conotrachelus* spp.**
Acorn worm,
Valentinia glandulella
Gall wasps,
Cynipoidea

Region 8: Arkansas

Host(s): White oak

These insects are responsible for substantial destruction of the white oak acorn crop on monitored research plots on the Ouachita and Ozark National Forests. Acorn weevils and filbertworms are the primary pests of white oak in the areas studied.

Pitch canker,
Fusarium subglutinans

Region 8: Regionwide

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

Cone collection, storage, and seed extraction methods have been found to cause contamination of pine seeds by *Fusarium subglutinans*. The USDA Forest Service and Auburn University are examining some of these interactions in shortleaf and longleaf pines in hopes of developing strategies for increasing seed efficiency by reducing contamination.

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

Region 1: Idaho, Montana

Host(s): Conifers

Cone and seed insects are very significant in the Region's blister rust resistant western white pine seed orchards. They are also a concern in orchards of other tree species and in wild stands where seed of high quality trees is collected. Cone and seed insects have recently been found having an impact on the seed of whitebark pine, an important high elevation tree species. The insects causing the most damage are the western conifer seed bug, *Leptoglossus occidentalis*, the cone beetle, *Conophthorus ponderosae*, and the coneworm, *Dioryctria abietivorella*. Cone beetle populations were so high in the Coeur d'Alene white pine seed orchard in 1996 that an early insecticidal spray treatment is planned for April 1997. Annual mid-summer spray treatments to control seed bugs have occurred in that orchard for the past several years.

Nursery Insects and Diseases

Charcoal root disease,
Macrophomina phaseolina

Region 5: California

Host(s): Douglas-fir, giant sequoia, pinyon pine, red fir, sugar pine, white fir

Mortality of red fir seedlings at the Placerville Nursery (El Dorado County) decreased from about 15 percent of the 2-0 crop to less than 1 percent in 1997. Damage to other species (1-0 seedlings) was also reduced to low rates.

Cranberry girdler moth,
Chrysoteuchia topiaria

Region 1: Idaho, Montana

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

The cranberry girdler moth, *Chrysoteuchia topiaria*, has been a continuous problem in the Coeur d'Alene bareroot nursery as insect populations immigrate from surrounding grass fields. The larvae damage root crowns of Douglas-fir, western larch, and spruce bareroot seedlings. Insecticidal sprays were used to control the moths in 1997.

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

Region 6: Oregon

Host(s): Conifers

The nurseries experienced approximately 5-percent mortality to damping-off. Fumigation, deep watering, and delayed fertilization helped control damping-off. High air temperatures (80 degrees F) exacerbated by dark-colored grit in containers, along with a high incidence of *Fusarium* spp. on stratified seed, combined to cause unusually high losses in one greenhouse.

Region 8: Regionwide

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

Damping-off is one of the most common disease problems that face southern nurseries. The loss of seedlings to damping-off is highly variable from year-to-year due to the interaction of pathogenic fungi (species of *Fusarium*, *Pythium*, *Rhizoctonia*, and *Phytopthora*) and environmental conditions. Seedling losses can be severe when germination is slow due to cold, wet, weather. In 1997, 500,000 loblolly seedlings were lost in a South Carolina State nursery due to this interaction of abnormal climate, *Phytophthora*, and *Fusarium*.

Fusarium root disease,
Fusarium spp.

Region 1: Idaho, Montana

Host(s): Conifers

The most common and damaging diseases of conifer seedlings in nurseries in the Region in 1997 were root diseases caused by *Fusarium* spp. These fungi cause damping-off and root diseases on many different conifer hosts in bareroot and container nurseries. The most common soil-borne pathogen species in bareroot nurseries is *F. oxysporum*, although several other species that are potentially pathogenic are also commonly isolated from infested soil and diseased seedlings. The major pathogen in container nurseries is *F. proliferatum*, although *F. oxysporum* and several other fusaria occur at high levels in some nurseries. Although all conifer species are susceptible, most damage occurred on Douglas-fir, western larch, western white pine, and Engelmann spruce.

Region 4: Idaho, Utah

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

This disease causes low levels of mortality primarily of 1-0 conifer seedlings at the Lucky Peak Nursery, Boise National Forest, Idaho and the Lone Peak Nursery in Utah.

Region 6: Oregon

Host(s): Conifers

The nurseries experienced 4-6 percent mortality due to root and shoot Fusarium infections during the 1-0 year. Cooling by irrigation helped to limit losses.

Gray mold,
Botrytis cinerea

Region 1: Idaho, Montana

Host(s): Conifers

Botrytis cinerea was prevalent on nursery seedlings at several locations and causes high levels of damage to container-grown seedlings, especially western redcedar and western larch.

Lygus bug,
Lygus spp.

Region 8: South Carolina

Host(s): Conifers

Seedling damage from lygus bug feeding resulted in the loss of 60,000 loblolly pine seedlings in South Carolina.

Pythium root rot,
***Pythium* spp.**

Region 1: Idaho, Montana

Host(s): Conifers

Pythium root disease (caused mostly by *P. irregulare* and *P. ultimum*) occurred at most bareroot nurseries and was also found in container seedlings. Damage was usually minor and mitigated by improving water drainage in soil and container media. Recent efforts to find alternatives to methyl bromide soil fumigation in production of bareroot stock have indicated that following nursery fields with periodic tilling for at least one growing season prior to planting conifer seeds helps reduce soil pathogen levels so that high quality seedlings often can be produced without fumigation. Incorporating cover and green manure crops prior to sowing often increases soil pathogens and reduces seedling production and quality. Further efforts should evaluate efficacy if biological control agents to protect young germinants from disease.

Region 4: Idaho, Utah

Host(s): Douglas-fir, spruce

Pythium root rot along with Phytophthora root rot (caused by *Phytophthora* spp.) occur infrequently on seedlings and in soil at the Lucky Peak Nursery, Boise National Forest, Idaho, and the Lone Peak Nursery in Utah. Infection results in patch mortality and culling of 2-0 seedlings.

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

Region 8: Regionwide

Host(s): Conifers

This disease caused the loss of about 250,000 longleaf pine seedlings at the Taylor Nursery in South Carolina

Root disease,
Cylindrocarpon destructans

Region 1: Idaho, Montana

Host(s): Western white pine

Root disease caused by *Cylindrocarpon destructans* caused important losses to container-grown western white pine at several nurseries.

Storage molds

Region 6: Oregon

Host(s): Conifers

One-one Douglas-fir transplants from lots lifted during warm weather in January had 4 percent mortality due to storage molds. Seedlings were lifted when plant moisture stress was high and then were refrigerated for an extended period of time.

Tip dieback,
Sirococcus strobilinus
Sphaeropsis sapinea
Phoma eupyrena

Region 1: Idaho, Montana

Host(s): Conifers

Tip dieback caused by *Sirococcus strobilinus*, *Sphaeropsis sapinea*, and *Phoma eupyrena* occurred on bareroot seedlings at several nurseries. Ponderosa pine and lodgepole pine were the most commonly affected species.

Abiotic Damage

Air pollution

Region 5: California

Host(s): Jeffrey pine, ponderosa pine

Overall, the visible effects of ozone were less in 1997 than they were in 1995 on 26 monitoring plots on the Sierra National Forest; 77 percent of the plots showed either less chlorotic mottle or no change in injury rating. However, needle retention on branches was reduced.

Region 9/Northeastern Area: Missouri

Host(s): Oaks

In Iron County, Missouri, 289 acres of discoloration was caused by sulfur dioxide emissions.

Drought effects

Region 3: Arizona

Host(s): All species

Drought damage was detected on a total of 957 acres in 1997, compared with over 61,000 acres the previous year. Damage was observed on the Coconino (520 acres) and Coronado (437 acres) National Forests.

Region 5: California

Host(s): Conifers, some hardwoods

No damage reported in 1997 completing the downward trend reported in 1996.

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

Host(s): American beech, bigtooth aspen, chestnut oak, northern red oak, other hardwoods and softwoods, paper birch, white ash, white oak, white pine

In 1997, areas of beech and other hardwoods in northwestern Maine continued to show symptoms of decline due to several factors, including drought. An estimated 1,800 acres were affected. In New York, 56,095 acres of hardwood forest had symptoms of drought related decline and 9,524 acres were affected in Vermont. In Minnesota, mortality occurred in 126 acres in Todd County.

Flooding/high water

Region 5: Northern California
Host(s): Riparian trees

The floods of 1997 damaged trees along riparian areas in northern California.

Region 9/Northeastern Area: Minnesota, Vermont
Host(s): Red maple, red spruce, other hardwoods

Flooding, partially caused by beaver dams, caused dieback and decline on over 11,248 of acres in Vermont. In western Minnesota, 37,268 acres of trees were affected by high water resulting from spring floods, much of which occurred along the Red River.

Ice damage

Region 1: Idaho
Host(s): All species

On November 19, 1996 a severe winter storm passed through northern Idaho, and produced freezing rain in lower elevations and heavy snow at higher elevations. The ice buildup caused millions of dollars of losses in urban areas as trees and power poles were broken and uprooted in a 30 mile swath from Spokane, Washington, to Wallace, Idaho. Although complete loss assessments in the forest are not yet known, preliminary evaluations have estimated 10-20 million board feet of timber has been affected. Park and recreation areas along Lake Coeur d'Alene have been severely damaged; nearly 300,000 board feet of timber is being salvaged from 80 acres of Tubb's Hill, a park managed as a natural area in downtown Coeur d'Alene. The ice was followed by several unusually wet snow storms that caused many roofs to collapse in several northern Idaho communities, and also caused additional storm damage in forests throughout the Region.

Region 9/Northeastern Area: Iowa, Massachusetts
Host(s): American beech, Atlantic white-cedar, bur oak, elms, maples

Iowa reported 58,000 trees had broken or dead branches on several tree species due to ice and snow. There were 280 acres of damage in Massachusetts.

Wind

Region 2: Colorado
Host(s): Engelmann spruce

On October 25, 1997, Engelmann spruce trees on 20,000 acres of the Routt National Forest were blown down by 120 mile per hour winds. The area is referred to as the Routt Divide Blowdown with 12,000 acres in wilderness areas and 8,000 acres in nonwilderness areas.

Region 9/Northeastern Area: Iowa, Massachusetts, Michigan, Minnesota, New Hampshire, New York
Host(s): American beech, hemlock, maples, oaks, pines, red maple, red pine, sugar maple, white pine

Scattered areas of wind damage occurred in 1997. In New Hampshire, 75 acres were affected by severe winds near Greenfield. In Massachusetts, 606 acres of forestland were damaged, 1,890

acres in Minnesota, and 50 acres in New York. Scattered wind damage also occurred in Iowa. In Michigan, red pine was damaged on 1,400 acres.

Weather damage

Region 1: Idaho, Montana

Host(s): All species

Our forest environments are constantly being changed by natural forces such as high winds, fire, drought, and above normal precipitation. Recent record heavy snow, wind, rain, and ice have caused severe to scattered damage throughout the Region. Preliminary indications are that these weather events have broken limbs, tops, and uprooted trees over many thousands of acres. Expe-rience has shown that following such events, forest managers can expect forest insect popula-tions to increase in most tree species. These populations are likely to infest the damaged trees in the spring of 1997, and caused tree mortality in 1998 and beyond.

Region 5: California

Host(s): Douglas-fir, Pacific madrone, ponderosa pine.

Hail damage was observed east of Clair Engle (Trinity) Lake where several sections of Douglas-fir were stripped of foliage. North of Highway 36 near Forest Glen (Trinity County) and north of Scott Valley (Siskiyou County), hail damaged several hundred acres, primarily plantations.

Region 9/Northeastern Area: Iowa, Minnesota, Vermont

Host(s): Hardwoods, pine, spruce

Discoloration due to frost conditions occurred on 570 acres of hardwoods in Vermont. There was discoloration of pine and spruce due to winter injury; 1,000 acres in Iowa, 970 acres in Min-nesota, and about 250 acres in Vermont.

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 forest 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 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 but 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 non-stocked 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]