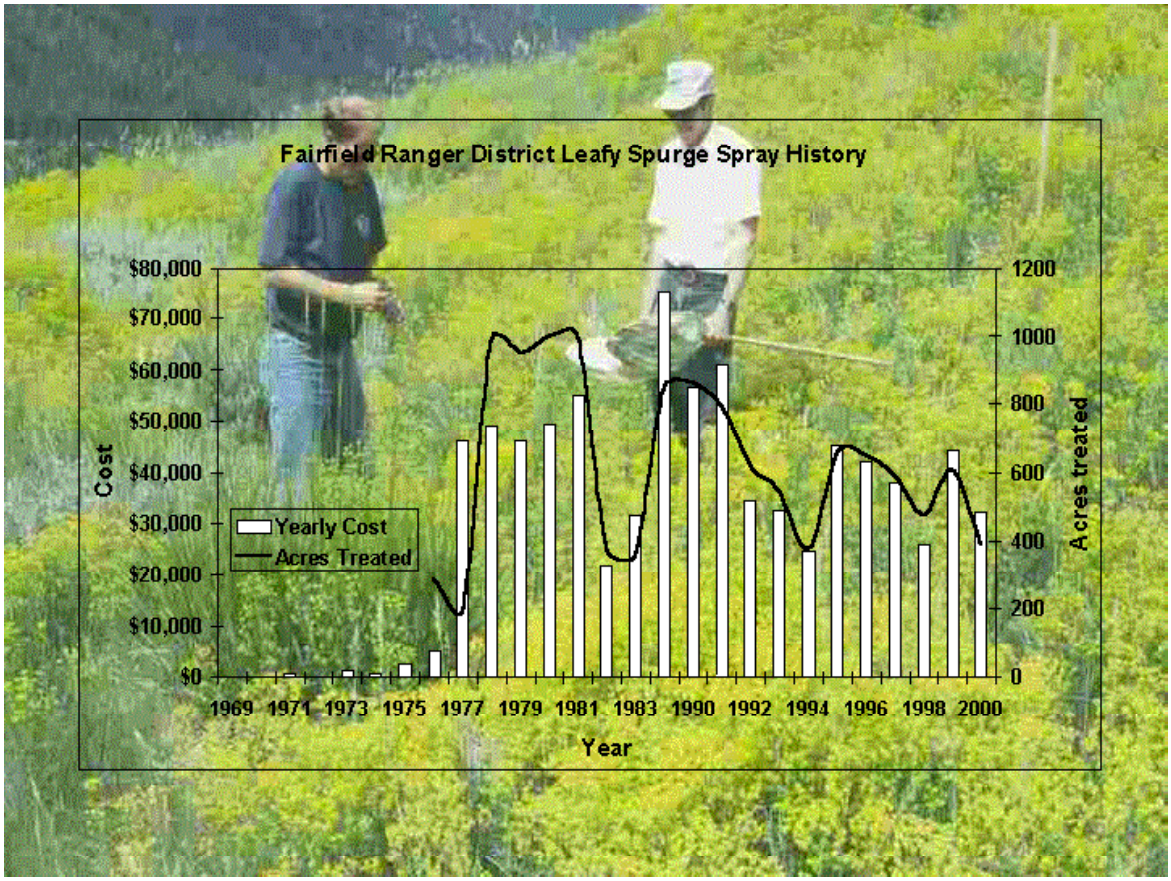
FOREST INSECT AND DISEASE CONDITIONS

in the Intermountain Region

2000



Compiled by:

J. Hoffman

Forest Health Protection
State and Private Forestry
USDA Forest Service
Intermountain Region
Ogden, Utah

Cover story:

In 1958, an isolated area of leafy spurge (*Euphorbia esula* L.), was discovered on the Fairfield Ranger District of the Sawtooth National Forest in central Idaho. The new noxious weed infestation was at least 100-miles from the nearest previously known infestation. Ten years later, the patch of infested area had grown to 20-acres in size. From 1970 to 2000, a total of nearly 13,000 acres have been sprayed at a cost of almost a million dollars.

In the 1990's, with spraying costs averaging over $40,000 annually on just one Ranger District, Idaho land managers looked for alternatives to the herbicide spraying. Currently five methods are used to manage leafy spurge: prevention, plant competition, physical control, chemical control, and biological control.

In 1998, a special technology development project was initiated in this area to develop guidelines for the effective release of a biological control agent, *Aphthona* spp., which have proven effective at reducing leafy spurge populations in other parts of the western United States. A final analysis of the project effectiveness is due at the end of the 2001 season.

See the "Special Project Update" section for more information.

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www.fs.fed.us/r4/health/cond00fm.htm or from the Boise Field Office at

the address on page iii.

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INTRODUCTION

This report summarizes the status of forest insect and disease activity in the Intermountain Region (Region 4), comprising parts of Idaho, Wyoming, California, and the states of Utah and Nevada. Insect status is based largely on aerial detection surveys conducted over 25,500,000 acres of forested lands in 2000. Disease status is based largely on ground observations and surveys. General insect and disease information is summarized in the Summary of Conditions.

The Special Project Update summarizes on-going studies conducted by Forest Health Protection in cooperation with other Regions, Forest Service Research, and Universities.

Recent publications are listed to assist the reader in locating recent pest information of interest.

Summary of Conditions

Numbers of trees killed and acres defoliated in this summary include adjacent and intermixed state and private lands. For specific information on trees killed by bark beetles and acres defoliated for individual National Forests please refer to Tables 9 and 12, respectively.

Aerial detection surveys indicate that **spruce beetle** killed more trees than any other insect observed during 2000. Mortality increased with 81,700 dead trees reported in 2000 compared to 71,300 in 1999. The largest infestations were located in Utah on the Dixie and Manti-LaSal National Forests where 16,900 and 45,700 trees were killed respectively. Mortality was also observed on the Fishlake, Ashley, Uinta, and Wasatch-Cache National Forests. Significant mortality was observed on the Bridger-Teton National Forest in western Wyoming as spruce beetle caused mortality jumped from 100 trees killed in 1999 to 6,600 trees killed in 2000. Scattered spruce mortality was observed in southern Idaho on the Boise, Payette, Sawtooth, and Targhee National Forests.

Pine mortality attributed to **mountain pine beetle** increased slightly throughout the Region with 43,000 dead trees observed in 2000 compared to 34,000 trees in 1999. Over three-fourths of the mortality is in southern Idaho with building infestations located in both lodgepole and whitebark pines on the Challis, Sawtooth, and Payette National Forests. Over 10,000 of the relatively rare high elevation whitebark pines were recorded as tree mortality in aerial detection surveys in 2000.

The largest infestation in Region 4 is on the Sawtooth National Recreation Area. Because of the extent and homogeneity of size and age classes of the lodgepole pine stands in the area,

the current infestation has the potential to greatly increase in size in 2001. The beetle is causing scattered ponderosa pine mortality on the Dixie and Fishlake National Forests in southern Utah. Elsewhere in the Region, smaller mountain pine beetle outbreaks in lodgepole pine are located on the Bridger-Teton National Forest in western Wyoming and the Toiyabe National Forest in western Nevada.

Scattered ponderosa pine mortality caused by the **roundheaded pine beetle** was observed on the Dixie and Manti-LaSal National Forests in southern Utah. This mortality is sometimes part of a bark beetle complex in association with mountain pine beetle attacks.

Jeffrey pine beetle caused tree mortality again declined significantly on the Toiyabe National Forest and adjacent Federal, State and private lands in Tahoe Basin with only 100 dead trees attributed to this beetle in 2000.

Douglas-fir beetle-caused mortality decreased slightly Regionwide. In 1999, 68,400 trees were killed compared to 63,000 trees in 2000. In southern Idaho the largest outbreaks were located on the Boise and Payette National Forests. Elsewhere activity was observed on the Caribou, Sawtooth, Salmon-Challis, and Targhee National Forests. In Utah the largest outbreaks were located on the Manti-LaSal National Forest with other smaller outbreaks located on the Ashley, Fishlake, Wasatch-Cache, and Dixie National Forests. Douglas-fir mortality on the Bridger-Teton National Forest in western Wyoming decreased with 5,500 trees killed compared to 6,800 trees in 1999.

Only small isolated infestations of **western pine beetle** and **pine engraver beetle** were recorded in 2000 with most of the activity located on the Boise National Forest in southern Idaho.

Subalpine fir mortality thought to be caused by a complex of environmental factors and several weak pathogens and insects increased slightly throughout the Region in 2000 with 70,350 trees reported dead in 2000 compared to 65,200 trees in 1999. Most of the subalpine fir mortality was located on the Fishlake, Dixie, and Manti-LaSal National Forests in central and southern Utah, and the Bridger-Teton National Forest in western Wyoming.

Tree mortality caused by the **fir engraver beetle** decreased significantly from 26,600 trees killed in 1999 compared to 2,100 trees killed in 2000. The largest area of fir engraver beetle activity was observed on the Humboldt-Toiyabe National Forest.

Over 18,000 acres of defoliation from the **Douglas-fir tussock moth** was observed on state, private, and Bureau of Land Management lands in the Owyhee Mountains in southwest Idaho. Pheromone bait trap catches indicated increasing populations in the Weiser and Council Ranger Districts on the Payette National Forest in Idaho. In central Utah, 500 acres of defoliation were observed on the Fishlake National Forest.

Defoliation by the **western spruce budworm** increased on the Dixie National Forest in southern Utah from 900 acres in 1999 to 14,700 acres in 2000. In Idaho, approximately

3,300 acres of Douglas-fir were heavily defoliated by western spruce budworm in the northwestern area of the Targhee National Forest.

For the seventh consecutive year gamble oak (*Quercus gambellii*) was defoliated by the **fall cankerworm** in Utah. Overall acres of defoliation increased from 17,700 acres in 1999 to over 31,000 defoliated in 2000. The greatest increase in defoliation occurred in oak stands on state and private lands in southern Wasatch and Sanpete Counties in central Utah. Previously defoliated acreage decreased along the Wasatch Front in northern Utah in 2000.

Gypsy moth control efforts in 2000 were limited to mass-trapping around six positive catch sites recorded in 1999 along the Wasatch Front in Utah. No further moths were caught in the massed trap areas. This is further validation of the success of a cooperative project with the Utah Department of Agriculture to control a non-native introduced defoliator. A single male moth was caught in the delimitation grid in Emigration Canyon near Salt Lake City. This area will be mass-trapped in 2001. A pheromone trapping strategy is one component of an integrated pest management (IPM) program currently conducted to control gypsy moth populations in Utah. Other IPM components include: egg mass surveys; statewide detection trapping; public information and education efforts; and quarantine provisions as needed.

Foliage diseases were endemic in *Populus* species throughout the Region. Minor leaf damage was observed in central and eastern Idaho; northern Utah; and western Wyoming. In southern Idaho incidence of larch needle disease declined for the second straight year.

Status of Insects

Insects: Native

Defoliators

Douglas-fir tussock moth *Orgyia pseudotsugata*

Location: Idaho, Nevada, and Utah
Host: Douglas-fir, True firs

Total acreage defoliated in 2000 by Douglas-fir tussock moth in Region 4 increased slightly from 17,000-acres when the current outbreak began in 1999, to 19,000-acres. However, 9,600-acres were in the high defoliation category. Defoliation was severe on Bureau of Land Management, Idaho State, and private Douglas-fir forests in the Owyhee Mountains of southwest Idaho. Over 500-acres were defoliated on the Fishlake National Forest in central Utah, up from 100-acres in 1999. On the Humboldt-Toiyabe National Forest in northern Nevada, 50-acres of subalpine fir were defoliated in the Jarbidge Mountains, which coincidentally in 1927 was the first location in the United States that the insect was reported. Pheromone bait trap catches were in the high category in some locations of the Weiser and Council Ranger Districts of the Payette National Forest, and the Emmett and Mountain Home Ranger Districts of the Boise National Forest in south-central Idaho.

Western spruce budworm *Choristoneura occidentalis*

Location: Idaho, and Utah
Host: Douglas-fir, True firs

Defoliation caused by western spruce budworm populations increased from 4,800-acres in 1999 to 21,600-acres in 2000. The increase was most apparent on the Dixie National Forest in southern Utah where light to moderate defoliation caused by the foliage-chewing insect jumped from 900-acres recorded in 1999 to almost 15,000-acres in 2000. In Idaho, western spruce budworm defoliation was observed last year on the Dubois Ranger District of the Targhee National Forest. This was the first re-occurrence of the insect in Idaho since 1987 when the epidemic population crashed following a July late-frost. In 2000, almost 5,000-acres were defoliated on the Boise, Payette, Sawtooth, and Targhee National Forests, Idaho.

Bark beetles

Douglas-fir beetle *Dendroctonus pseudotsugae*

Location: Idaho, Nevada, Utah, and Wyoming
Host: Douglas-fir

Mortality caused by Douglas-fir beetle remained static with 63,000 trees killed on all forested ownership's in the Intermountain Region in 2000 compared to 68,400 trees in 1999. Outbreaks were located on the Sawtooth, Boise, Salmon-Challis, Caribou, Targhee and Payette National Forests in southern Idaho. In Utah 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 was similar to 1999 levels as 5,500 trees were killed on 2,300-acres.

Fir engraver beetle *Scolytus ventralis*

Location: California, Idaho, Nevada, and Utah
Host: Grand fir, Red fir, Subalpine fir, White fir

Only 2,100 dead trees were observed during aerial surveys in 2000, compared to 26,000 dead trees reported in 1999. Most of this mortality occurred on the Humboldt-Toiyabe National Forest in Nevada. Mortality was particularly heavy on the Ely Ranger District. Mortality remained low in Utah with only 500 trees killed on the Dixie, Fishlake, and Manti-LaSal National Forests. No significant mortality was observed in southern Idaho.

Jeffrey pine beetle *Dendroctonus jeffreyi*

Location: California, Nevada
Host: Jeffrey pine

Jeffrey pine beetle activity decreased again on the Humboldt-Toiyabe National Forest and Lake Tahoe Basin Management Area with only 100 trees killed in 2000 compared to 700 trees reported killed by the bark beetle in 1999.

Mountain pine beetle *Dendroctonus ponderosae*

Location: California, Colorado, Idaho, Nevada, Utah, and Wyoming
Host: Limber, Lodgepole, Jeffrey, Ponderosa, Western White, and Whitebark pines

Mountain pine beetle-caused mortality increased Regionwide, from 11,000 trees in 1998 to 23,700 trees in 1999 and, to 43,000 trees in 2000. The largest outbreaks in the Region were

located in lodgepole pine stands on the Sawtooth National Recreation Area and Salmon-Challis National Forests in central Idaho with a combined total of 21,000 trees killed. Abundant tree mortality significantly affected the recreation and fisheries resources. Trees along the Salmon River and Redfish Lake provide shade and scenic beauty for recreationists, and shade which moderates temperatures for spawning endangered salmon species. On the Humboldt-Toiyabe National Forest in western Nevada and eastern California, 2,700 trees were killed, mostly in overstocked, high-elevation whitebark or western white pine stands. In Utah, mountain pine beetle-caused mortality decreased in ponderosa pine on the Dixie National Forest but increased in lodgepole pine stands on the Wasatch-Cache and Ashley National Forests. Pockets of mountain pine beetle-caused mortality in ponderosa pine were observed on the south slope of the Uinta Mountains on the Ashley National Forest. On the Bridger-Teton National Forest in western Wyoming 1,300 lodgepole pines were killed.

Mortality of whitebark and limber pines attributed to mountain pine beetle attacks continued in 2000 with over 10,000 trees killed, down from 12,100 trees killed in 1999. Most of this mortality was in high elevation whitebark pine stands in southern Idaho where the rare pine stands are declining due to several causes: mountain pine beetle-caused mortality, white pine blister rust infections; interruption of normal fire cycles; overstocking, and overmature stands. These high elevation ecosystems are valued and important for watershed stability, recreation, and wildlife habitat. The heavy whitebark pine seeds are also an important food source for numerous birds and mammals.

Pine engraver beetle *Ips pini*

Location: Idaho, Nevada, and Utah
Host: Lodgepole, Ponderosa pine

Mortality due to pine engraver beetles remained low throughout the Region. Only 400-trees were killed by the beetles in 2000, mostly on or surrounding the Boise National Forest in southern Idaho. Activity is often associated with western pine beetle during prolonged droughts.

Roundheaded pine beetle *Dendroctonus adjunctus*

Location: Utah
Host: Ponderosa pine

Infrequent ponderosa pine mortality attributed to this beetle continues to occur in scattered areas of the Dixie and Manti-LaSal National Forests in southern Utah. Often this beetle occurs within a bark beetle complex on an affected tree. Roundheaded pine beetles are generally found in combination with western pine beetle and/or mountain pine beetle attacks on affected trees.

Spruce beetle *Dendroctonus rufipennis*

Location: Idaho, Nevada, Utah, and Wyoming
Host: Spruce

Spruce beetle was responsible for more tree mortality in 2000 in the Intermountain Region than any other insect. The number of trees killed on all ownership's was 81,700 compared to 66,200 in 1999. The largest infestations are still located in Utah where 46,000 trees were killed on the Manti-LaSal National Forest and nearly 17,000 were killed on the Dixie National Forest. The most recent outbreak on the Manti-LaSal National Forest was detected in the North Creek watershed in the Blue Mountains. This area is designated as a municipal watershed for the towns of Monticello and Blanding, Utah. The spruce forest is essential for maintenance and quality of the hydrologic functions of the watershed. Pheromone and trap tree treatments are currently being used to reduce beetle populations. Spruce beetle populations continue to rise on the Fishlake National Forest. Sanitation, salvage, and other treatments have been implemented on the Richfield Ranger District to suppress and contain outbreak populations in the vicinity of Monroe Mountain, Monument Peak, and Mount Terrell. Numerous mortality centers comprised of 10- to 100-trees have recently been detected near Circleville Mountain and the Elk Meadow Ski Resort on the Beaver Ranger District. Outbreaks in these areas pose a threat to recreation and scenic values on both public and private lands. Mortality was also observed on the Ashley, Uinta, and Wasatch-Cache National Forests. On the Bridger-Teton National Forest, in western Wyoming, tree mortality exploded from 100 trees killed in 1999 to 6,500 trees killed in 2000. No significant mortality was observed in southern Idaho national forests.

Western pine beetle *Dendroctonus brevicomis*

Location: Idaho, Utah
Host: Ponderosa pine

Tree mortality due to western pine beetle remained at endemic population levels. Approximately 400 trees were killed on the Boise National Forest in southern Idaho in 2000. Several infested trees were found in ground surveys near Ponderosa Campground on the Beaver Ranger District, Fishlake National Forest, Utah.

Others

Cooley spruce gall adelgid *Adelges cooleyi*

Location: Idaho, Utah, and Wyoming
Host: Spruce, Douglas-fir

This adelgid was found in forested stands and ornamental trees throughout the Region; impact is greatest on ornamental Colorado blue spruce trees in urban areas. On Douglas-fir,

the alternate host, infested needles often develop a yellow spot and twist at the point of attack.

Fall cankerworm *Alsophila pometaria*

Location: Utah
Host: Gamble oak

Approximately 31,000-acres of gamble oak were severely defoliated by fall cankerworm larvae in 2000, mostly in southern Wasatch and Sanpete Counties in central Utah. In 1999 there were 17,700-acres of defoliated gamble oak, down approximately 50 percent from the 34,200-acres defoliated in 1998. The outbreak is unusual because of its length, this is the seventh consecutive year of moderate to heavy defoliation on oaks. Outbreaks have appeared in widely separated areas of the state. In 1998 most of the defoliation occurred in northern Utah along the Wasatch Front, while in 1999 most of the defoliation occurred on the Dixie, Manti-LaSal, and Uinta National Forest in central and southern Utah.

Lodgepole pine terminal weevil *Pissodes terminalis*

Location: Utah
Host: Lodgepole pine

Moderate to heavy populations of lodgepole pine terminal weevil were observed in 10- to 25-foot tall lodgepole pine on the north slope of the Uinta Mountains. The infestations occurred on the Ashley and Wasatch-Cache National Forests in northern Utah.

Mountain Mahogany Looper *Anacamptodes clivinaria profanata*

Location: Nevada
Host: Mountain Mahogany

Nearly 3,000-acres of defoliated mountain mahogany were observed on the Ely and Elko Ranger Districts of the Humboldt-Toiyabe National Forests, and in Great Basin National Park in eastern Nevada.

Pine needle sheathminer *Zellaria haimbachi*

Location: California, Idaho, and Nevada
Host: Ponderosa and Jeffrey pines

Defoliation was severe on dry-site ponderosa pine saplings on the Boise and Payette National Forests in southern Idaho, and moderate-severe on Jeffrey and ponderosa pines in the foothills of the Sierra Mountains on the Humboldt-Toiyabe National Forest in eastern California and western Nevada.

Pine Sawflies *Neodiprion* sp.

Location: Idaho
Host: Lodgepole Pine

Heavy defoliation of lodgepole pine caused by a sawfly was again detected on 500-acres of private land near Lakefork, Idaho. The current outbreak began in 1998.

Needle Feeding Weevils *Scythropus sp.*

Location: Nevada
Hosts: Jeffrey and Ponderosa pines

Scythropus weevils caused light to moderate feeding injury on older needles of Jeffrey and ponderosa pine on the Humboldt-Toiyabe National Forest in western Nevada.

Sequoia pitch moth *Vespamima sequoiae*

Location: Nevada
Host: Jeffrey and ponderosa pines

Populations increased on host trees in the eastern Sierra's on the Humboldt-Toiyabe National Forest. Ornamental and Jeffrey/ponderosa pine plantations were affected near the Carson City and Reno areas in northwestern Nevada.

Spruce Engraver Beetle *Ips pilifrons*

Location: Utah
Host: Englemann spruce

Spruce *Ips* populations increased significantly in urban settings along the Wasatch Front in northern Utah. The population increases were due to a dry and warmer than normal spring and summer that stressed many off-site plantings of Englemann spruce.

Western pineshoot borer *Eucosma sonomana*

Location: Nevada and Utah

Host: Ponderosa and Jeffrey pines

Scattered infestations were noted on Jeffrey and ponderosa pine plantations on the Humboldt-Toiyabe National Forest in western Nevada, and on the Dixie National Forest in Utah.

Woodborers *Cerambycidae and Bupresditae*

Location: Idaho, Utah, and Wyoming
Hosts: Douglas-fir, Englemann spruce, lodgepole and ponderosa pines

Various cerambicid and buprestid woodboring beetle species are a normal part of the fauna associated with weak, dying, or dead trees. Population levels vary annually throughout affected landscape often with localized pockets of heavy activity in some locations. In the fall of 1999, field foresters, entomologists, and plant pathologists noticed that foliage in the tops of Douglas-fir and ponderosa pine trees in southwestern Idaho appeared thin and off-colored. Examinations were conducted, but no primary tree damaging agents were noted. During the spring of 2000, numerous reports were submitted to Boise National Forest officials concerning dead and dying, sapling and pole-sized Douglas-fir in southwestern Idaho. Field inspections showed most affected trees were in areas prone to drought—ridges, cutbanks, rock outcrops, and on shallow soils.

We believe weather conditions in southern Idaho in 1998 and localized site conditions worked together to weaken the Douglas-fir and allow insect colonization. The winter and spring of 1998 were far wetter than normal. The spring was one of the coolest on record. On June 29, 1998 temperatures climbed abruptly from a daily average of 55-degrees to 92-degrees. Consistent temperatures of 90-degrees and greater occurred for the next two months, with no rain until September. In short, the fast growing younger trees became too ~~"a~~accustomed" to growing in climate more like the Pacific Northwest and couldn't adjust to warmer, dryer conditions.

Insects: Non-native

European gypsy moth *Lymantria dispar*

Location: Idaho, Nevada, and Utah
Host: 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, two years of intensive pheromone trapping resulted in no moth captures, the and gypsy moth populations were considered eradicated. In 1997, 46 moths were captured in Salt Lake City and one moth on the adjacent Wasatch-Cache National Forest. These populations were believed to be new introductions as a result of moving infested material from the generally infested areas located in the eastern United States. In 1998 the Utah Department of Agriculture, in cooperation with the USDA Forest Service, treated 800-acres.

In 1999, 764-acres in the Knutson's Corner area of Salt Lake County were aerially treated using Bt. There were three applications made at 5-to 7-day intervals. Treatment was 95% effective with only one gypsy moth caught in the treatment block. Five additional single-moth catches occurred, but all were outside the treatment area. In 2000, a ten-acre mass-trapping grid was installed around each positive catch using nine pheromone traps per acre. Only one moth was caught. In 2001, a detection grid of pheromone traps will be resumed throughout Utah. A delimitation trap array will be employed around the one positive gypsy moth trap catch site in Emigration Canyon.

Status of Diseases

Diseases: Native

Stem and Branch Diseases

Dwarf mistletoes *Arceuthobium spp.*

Location: Idaho, Nevada, Utah, and Wyoming
Host: Douglas-fir, Pines, True Firs, Spruce, and Western Larch

These plant parasites remain 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.

True mistletoe on Juniper *Phoradendron juniperinum*

Location: Nevada, Utah
Host: Junipers

Occurring throughout the pinyon-juniper forest type in Utah and Nevada, this disease spreads and intensifies slowly and is therefore more common in older stands.

Root Diseases

Annosum root disease *Heterobasidion annosum*

Location: California, Idaho, Nevada, Utah, and Wyoming
Host: Bitterbrush, Chokecherry, Douglas-fir, Jeffrey pine, Lodgepole pine, Ponderosa pine, Spruce, True firs

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

Armillaria root disease *Armillaria* spp.

Location: Idaho, Nevada, Utah, and Wyoming
Host: Douglas-fir, Grand fir, Pines, Spruce, Subalpine fir

Evidence of Armillaria root disease can be found throughout the Region but 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 on cool sites at high elevation.

Black stain root disease *Ophiostoma wageneri*

Location: Idaho, Nevada, and Utah
Host: Pinyon pine

Aerial detection and follow-up ground surveys have discovered about two-dozen root disease centers in pinyon pine stands in the Intermountain Region. The perennial infections cause periodic mortality of individual pinyon pine over 50-acres of the Bureau of Land Management Burley District in southern Idaho. In Utah and Nevada, the host is more prevalent, the infected acreage totals 1,150-acres on the Humboldt and Toiyabe National Forests in Nevada, and 1,350-acres of the Dixie and Manti-LaSal National Forests in Utah.

Leaf and Needle Diseases

Aspen Defoliation *Marssonina populi*

Location: Central and northern Utah, southeastern Idaho, southwestern Wyoming
Host: Aspen

Moderate to heavy defoliation occurred in scattered aspen clones throughout the aspen component in high elevation sites.

Douglas-fir Needlecast *Rhabdocline pseudotsugae*

Location: Idaho and Utah

Host: Douglas-fir

Rhabdocline needlecast was observed causing light to heavy defoliation of two-year old needles and red-brown banding of last years needles in Ogden and Logan canyons on the Wasatch-Cache National Forest in northern Utah. This was the second year of heavy defoliation in some stands and it is forecast that up to one-third of these trees may die from the combined stress effects drought, defoliation, and likely attacks by Douglas-fir beetle beginning in 2002. In southeastern Idaho, the disease was noted on the Caribou-Targhee National Forests.

Diseases: Non-native

White pine blister rust *Cronartium ribicola*

Location: California, Idaho, Wyoming, Nevada
Host: Limber, Whitebark, Bristlecone, Western White, and Sugar pines

This introduced disease is common throughout its host ranges in southern Idaho and western Wyoming. It is present in the western portion of Region 4 in California and Nevada proximal to Lake Tahoe. No infection has been found or reported in Utah.
Five-needled pine trees and stands are of low occurrence and frequency in the Intermountain Region. Often relegated to high alpine areas, these pines grow slowly but provide important ecosystem functions such as providing shade and stabilization of snow retention for watershed integrity, recreation, aesthetics, and wildlife habitat and usage. The heavy whitebark pine seeds are also an important food source for numerous birds and mammals.

Declines/Complexes

Subalpine fir Mortality Complex
Dryocoetes confusus, Pityophthorus sp., Pityokeines sp., Crypturgus sp., Scolytus sp., Heterobasidion annosus, Armillaria sp., Cytospora abietis, Melampsporella caryophyllacearum

Location: Idaho, Nevada, Utah, and Wyoming
Host: Subalpine fir

Subalpine fir decline and mortality continues to occur throughout the host type in the Intermountain Region killing 64,000 trees on 18,000-acres. Tree mortality was heaviest on the Bridger-Teton National Forest in Wyoming with 15,000 trees killed, and on the Fishlake, Dixie, and Manti-LaSal National Forests in Utah with 14,000, 9,400, and 4,300 trees killed respectively. Tree mortality as also observed on the Humboldt-Toiyabe National Forest in Nevada where 3,000 trees died.

Ground examinations suggest a complex of factors are involved in this mortality. These factors include: overstocked stands and overmature trees, drought, frost damage, and a complex of secondary biotic agents. These include: twig beetles, woodborers, engraver beetles, secondary bark beetles, root diseases, cytospora canker, and fir broom rust. Fir mortality has continued almost unabated since beginning in the middle of a seven-year drought period in 1989. Since being described as a mortality complex in 1994, nearly 800,000 trees have died.

Nursery Diseases

Fusarium root disease (*Fusarium oxysporum*)
Location: Idaho, Utah
Hosts: Conifers

Fusarium root disease, caused primarily by *F. oxysporum*, causes important seedling losses at bareroot nurseries in southern Idaho and northern Utah. Although the pathogen is best controlled by pre-plant soil fumigation, substantial losses can still occur in fumigated seedbeds. Above-average disease losses occurred in 2000 on 1-0 bareroot Douglas-fir at the USDA Forest Service Lucky Peak Nursery near Boise, Idaho. The pathogen also caused more normal losses on first-year ponderosa and lodgepole pine seedlings. Several different conifer species were affected by *Fusarium oxysporum*-associated root disease at the Lone Peak Nursery in Utah; damage was generally sparse.

Gray mold (*Botytis cinerea*)
Location: Utah
Host: Giant sequoia

Gray mold caused by *Botrytis cinerea* was responsible for severe damage during 2000 on container-grown giant sequoia seedlings at the Lone Peak Nursery in Utah. Sequoia seedlings are very susceptible to this pathogen; disease control by fungicides may not always be effective, especially if the pathogen has developed resistance to commonly used chemicals. Growers plan to alternate several different chemicals to effectively control gray mold and help reduce chances for developing fungicide resistance.

Tip blight (*Sirococcus strobilinus*)
Location: Utah
Host: Engelmann spruce

Sirococcus strobilinus caused minor damage on container-grown Engelmann spruce seedlings at the Lone Peak Nursery in Utah during 2000. The pathogen was probably seedborne but damage was not sufficient to warrant direct control.

SPECIAL PROJECT UPDATE

Predicting Risk of Stand Deterioration Following Spruce Beetle Management Activities
The most important step of running the root disease model is initializing it with reasonable infection levels. Using the proportion of roots with symptoms based on pit-sampling probably yielded greater proportions of infested root system than the model was built to deal with. Using these levels required reducing the infested area of the stand by half to obtain reasonable results. Even then, it was necessary to reduce the probability of infection to 0.1 and annual spread to 0.05. These two keywords, combined with reducing the proportion of the stand infested, seemed to have the greatest impact on future mortality. With the stands available for this study, we were unable to correlate the incidence and severity of root disease with windthrow. Further research is required to assess the feasibility of this strategy. Contact: Steve Munson.

Spruce Beetle Management Strategies
Permanent plots were installed on the Fishlake National Forest to evaluate density management strategies that may mitigate spruce beetle impacts in stands of Englemann spruce. Plots were established in treated stands that are between 150-500 acres in size. All treated stands were within a larger contiguous landscape of spruce covering several thousand acres. Treatments occurred on mixed ownerships and will continue to be monitored until the cessation of the spruce beetle outbreak. Contact: Liz Hebertson.

Factors Influencing Spruce Beetle Population Dynamics and Silvicultural Implications for Spruce Beetle Management
Study sites were established on the Manti-LaSal National Forest to monitor seasonal availability of downed host material. The objective is to determine whether spruce beetle colonization, brood production, and larval survival differ with respect to the time of year downed host material is produced. Study pairs of Englemann spruce were selected and dropped, one in the fall of 1996 and the other in the spring of 1997 before beetle flight. All trees were visited in late July-August of 1997 to record attacks on each host. In the spring of 1999 trees were sampled to quantify the number of emerging adults. Data analysis is complete and a final report will be submitted for publication in 2001. Contact: Liz Hebertson.

Spruce Beetle Suppression Study

A spruce beetle suppression project was completed on the Logan Ranger District, Wasatch-Cache National Forest to evaluate the use of multiple treatment tactics. Three trap clusters of pheromone traps baited with the component attractant for spruce beetle, trap trees and sanitation treatments were used to suppress a localized population of spruce beetle on the T.W. Daniel Experimental Forest. The Experimental Forest is administered jointly by Utah State University and the Forest Service. A portion of the School Forest used pheromone traps and trap trees exclusively to suppress beetle populations. A research paper has been submitted and accepted for publication in the Western Journal of Applied Forestry. Participants in the study include RWU 4501 - Rocky Mountain Station and FHP, Ogden Field Office. Contact: Steve Munson.

Tools and Information for Predicting and Monitoring Spruce Beetle Populations
Plots monitoring phloem temperatures of infested Englemann spruce trees and associated insect development were initially installed on the Dixie and Wasatch-Cache National Forests in 1997. A variety of phloem temperature based parameters are being examined for strength of correlation (predictive power) with life cycle duration. Preliminary results indicate that average temperature for the larval growing season (July-Sept.) has a strong correlation with voltinism. Lab experiments to determine lifestage specific, temperature dependent development and threshholds were completed in 1999. Data from this study, in conjunction with the field data, will be used to develop a phenology model and classification rule for predicting one year versus two year populations. A final report has been completed and will be submitted to a refereed Journal for publication. Contact: Steve Munson.

Development of a Monitoring and Management Tool for the Central Rocky Mountain Populations of Mountain Pine Beetle
In 2000, mountain pine beetle rearing facilities were constructed in Ogden, UT; Gunnison, CO; and Rapid City, SD. Insects were shipped to the University of Minnesota where Steve Seybolds' lab prepared pheromone extracts using a variety of techniques. The samples were frozen for later chemical analysis by gas chromatography and gas chromatography-mass spectroscopy. Field tests will begin in 2001to test the response of three beetle populations to the beetle produced compounds in the commercially available pheromone in combination with one of a series of host monoterpenes. The field tests are based on the hypothesis of regionally specific host monoterpene synergists for the mountain pine beetle. Contact: Steve Munson.

Use of Non-Host Volatils to Inhibit Mountain Pine Beetle Attack
Cooperative tests will be conducted in 2001 in western Montana, northern and southern Idaho in both lodgepole pine and whitebark pine stands to test the effectiveness of compounds extracted from non-host plants to inhibit attack by mountain pine beetle. Cooperators in the investigation include Forest Health Protection entomologists in Regions 1 and 4, Rocky Mountain Research Station in Logan, and the Boise, Sawtooth, and Idaho Panhandle National Forests. Contact: Ralph Thier.

Mountain Pine Beetle Susceptibility/Risk Rating in Southwestern Ponderosa Pine

Two empirical methods for rating susceptibility of mountain pine beetle attack in ponderosa pine were evaluated using data collected from this collaborative effort among entomologists in Regions 2,3, and 4 and RWU 4501 of the Rocky Mountain Research Station in Fort Collins, CO. In the first method, data on bark beetle attacks from 45-sites throughout the Colorado Plateau were modeled using logistic regression to estimate the probability of attack on individual trees from tree and stand variables. The empirical method developed by Munson & Anhold, most closely correlated to the logistic regression results (Chojnacky et al. 2000). However, this empirical method lacks sensitivity because no site was classified lower than moderately susceptible to bark beetle attack. So in the second method, data will be analyzed from the same sites to quantify risk of an outbreak by integrating: 1) the effects of local weather on beetle population trends; 2) an index of beetle pressure; and 3) the stand susceptibility rating. A model will be developed in 2001 that will provide land managers with a landscape description of susceptibility and risk. Contact: Steve Munson.

Redfish Lake Verbenone Trial
Populations of mountain pine beetle (MPB) *Dendroctonus ponderosae* Hopkins have been building in the Sawtooth National Recreation Area (SNRA). A significant percent of the lodgepole pines are over 8-inches in dbh (diameter breast height) and are at extreme risk of being attacked and killed by MPB. In an attempt to deter beetle attacks, an experimental antiaggregative compound (verbenone) was placed in plots among lakeside trees. The verbenone treated plots had significantly fewer beetle-killed trees in 2000 than the untreated plots. Trials will be continued for the duration of the beetle outbreak to assess the efficacy of verbenone in protecting trees. Contact: Robert Progar.

Thinning Second Growth Ponderosa Pine as a Management Strategy for Western Pine Beetle
Evaluation of a permanent plot investigation on the Idaho City Ranger District, Boise National Forest, continues to determine if differences exist in tree mortality among stands of second-growth ponderosa pine thinned to two different densities and an unthinned check stand in the presence of western pine beetle infestation. Plots were last monitored in 2000, and an establishment report begun. Contact: Ralph Thier.

Douglas-fir Modeling
1997-1999 plots were established in Douglas-fir stands on the Wasatch-Cache and Manti-LaSal National Forests to develop a spatial model of Douglas-fir basal area as a predictor of Douglas-fir beetle caused mortality. The study sampled the spatial distribution of Douglas-fir beetle affected stands. Sampling protocols were developed that could be used to rate stand susceptibility to damage by sampling the spatial distribution of Douglas-fir basal area. A manuscript has been submitted and accepted by Environmental Entomology. The article should be published in late 2001 or early 2002. Contact: Steve Munson.

Pest Trend/Impact Plot System (PTIPS) Permanent Plot Project
This project was initiated with the goal of creating a large reliable database of shared data from various established permanent plot sources throughout the Western Regions. The plot system was initially started in 1990 with a primary focus of installing dwarf mistletoe growth

and yield plot data. Since then the database has been expanded to include various bark beetle plot data and western spruce budworm plot data. Contact: John Guyon.

Permanent Plots to Validate Forest Disease Models
This is an ongoing project to establish permanent plots to aid in the validation of disease models including the dwarf mistletoe model, the western root disease model, as well as models for comandra blister rust and limb rust. These plots were installed in forests containing ponderosa pine, lodgepole pine, and Douglas-fir dwarf mistletoes. Contact: John Guyon.

Biological Control for Noxious Weed Management
These projects involve coordination with federal agencies, multi-state agencies, counties, universities, and private individuals in collecting and exchanging biological agents to conduct operational and insectary releases for the management of noxious weeds. Information, new technologies, and educational materials are developed and shared in a collaborative stewardship approach to this growing problem. Contact: Tom Barbouletos.

Leafy Spurge Special Technology Development Project.
The field work for this project has been completed. Most of the infestation has been mapped, site characteristics have been delineated, agent populations have been monitored and a study to determine the impact of released agents has been completed. Analysis of the data continues and a report will be completed this spring. Contact: Tom Barbouletos.

Integrating Aggressive Biological into a Leafy Spurge Management Project
The purpose of this project, initiated in 1999, is to improve the effectiveness of a leafy spurge management program and to demonstrate that biological control can be an important tool when included in integrated management programs. Fieldwork and data analysis will continue on this project in 2001. A final report will be completed and issued in 2002. Contact: Rob Progar.

RECENT PUBLICATIONS

Bentz, B.J. and A.S. Munson. 2000. Spruce beetle population suppression in Northern Utah. Western Journal of Applied Forestry. 15(3): 122-128.

Chajnacky, D.C., B.J. Bentz, and J.A. Logan. 2000. Mountain pine beetle attack in ponderosa pine: Comparing methods for risk rating susceptibility. Res. Pap. RMRS-RP-26. USDA Forest Service, Rocky Mtn. Research Station, Ogden, UT. 10p.

Katovich, S.A., A.S. Munson, J. Ball, and D. McCullough. 2000. Bronze Birch Borer. USDA Forest Service, Forest Insect and Disease Leaflet #111. 6p.

Smith, J. P., J. Hoffman, K .Sullivan, E. Van Arsdel, and D. Vogler. 2000. First report of white pine blister rust in white pines of the Intermountain Region. Plant Disease Note: 84 (5) D-2000-0321-02N. p. 594.

Weatherby, J.C., R.A. Progar, and Phil Mocettini. 2001. Evaluation of tree survival on the Payette National Forest 1995-1999. FHP Rpt. 01-01. 29p.

Other Related Publications by Region 4 Professionals

Olson, D.H., S.S. Chan, G. Weaver, P. Cunningham, A. Moldenke, R. Progar, P.S. Muir, B. McCune, A. Rosso, E.B. Peterson. 2000. Characterizing stream, riparian, upslope habitats and species in Oregon managed headwater forests. p. 83-88. In: Wigington, P.J., Jr., and R.L. Beschta (eds.). Riparian Ecology and Management in Multi-Land Use Watersheds. International conference of the American Water Resources Association, August 30, 2000, Portland, OR. AWRA Publication TPS-00-2, Middleburg, VA. 616 p.

Olson, D.H., S.S. Chan, P. Cunningham, B. Hansen, A. Moldenke, R. Progar, P.S. Muir, B. McCune, A. Rosso, E.B. Peterson. 2000. Characterizing managed headwater forests – integration of stream, riparian, and upslope habitats and species in western Oregon: Companion projects to the BLM Density Management Studies. p. 539-540. In: Proceedings of the Society of American Foresters 1999 National Convention, September 11-15, 2000. Portland, OR. SAF Publication 00-1, Bethesda, MD; ISBN 0-939970-81-3.

Progar, R.A. and T.D. Schowalter, 2001. Canopy arthropod assemblages along a precipitation and latitudinal gradient among Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) forests in the Pacific Northwest of the United States. Ecography (in press).

Progar, R. A., T.D. Schowalter, and T. Work. 1999. Arboreal invertebrate responses to varying levels and patterns of green-tree retention in northwestern forests. Northwest Science 73: 77-86.

Progar, R.A., T.D. Schowalter, C.M. Freitag, and J.J. Morrell. 1999. Respiration from coarse woody debris as affected by moisture and saprotroph functional diversity in western Oregon. Oecologia 124: 426-131.

Schowalter, T.D. and R.A. Progar. 2001. Leaching from coarse woody debris as affected by moisture and saprotrophs in western Oregon. Oecologia (in review).

APPENDIX A

TABLE 1. Number of acres aerially surveyed by administrative area during 2000.

YEAR	OWNERSHIP	ACRES SURVEYED
	Federal Lands Administered by National Forests	
2000	Ashley National Forest, Utah	839,337
2000	Boise National Forest, Idaho	2,066,314
2000	Bridger-Teton National Forest, Wyoming	2,345,462
2000	Caribou-Targhee National Forest, Idaho	2,600,683
2000	Dixie National Forest,Utah	1,375,211
2000	Fishlake National Forest, Utah	1,336,486
2000	Humboldt-Toiyabe National Forest, Nevada	2,356,556
2000	Payette National Forest, Idaho	1,444,289
2000	Salmon-Challis National Forest,Idaho	1,636,580
2000	Sawtooth National Forest, Idaho	1,482,817
2000	Uinta National Forest, Utah	763,347
2000	Wasatch-Cache National Forest, Utah	932,233
	Other Federally Administered Lands	
2000	Bureau of Land Management, California	36,411
2000	Bureau of Land Management, Idaho	880,817
2000	Bureau of Land Management, Nevada	5,247
2000	Bureau of Land Management, Utah	149,731
2000	Bureau of Land Management, Wyoming	59,866
2000	Bureau of Reclamation, Idaho	50,047
2000	Bryce Canyon National Park, Utah	34,872
2000	Capital Reef National Park, Utah	2,867
2000	Cedar Breaks National Monument, Utah	6,036
2000	Glen Canyon National Recreation Area,Utah	34,239
2000	Grand Teton National Park, Wyoming	16,317
2000	Great Basin National Park, Nevada	76,628
2000	Yellowstone National Park, Idaho	34,776
2000	Zion National Park, Utah	3,717
	Tribal, State, and Private Lands	
2000	Private Forested Lands, Idaho	1,692,017
2000	State of Idaho Administered Lands	574,645
2000	Private Forested Lands, Nevada	4,424
2000	State of Nevada Administered Lands	16,143
2000	Private Forested Lands, Utah	1,947,813
2000	State of Utah Administered Lands	332,484
2000	Private Forested Lands, Wyoming	124,059
2000	State of Wyoming Administered Lands	17,623
2000	Shoshone-Bannock Tribal Lands, Idaho	53,167
2000	Uintah and Ouray Tribal Lands, Utah	198,207
Total	**Acres surveyed in Intermountain Region in 2000**	**25,531,468**

TABLE 2. Status of mountain pine beetle infestations by state during 2000.

State	Land Ownership Class	Outbreak Area (Acres)	Number of Trees
California	National Forest	300	1200
	Other Federal	0	0
	State and Private	100	100
California Total		**400**	**1,300**
Idaho	National Forest	13300	29300
	Other Federal	200	600
	State and Private	800	2400
Idaho Total		**14,300**	**32,300**
Nevada	National Forest	800	2300
	Other Federal	0	0
	State and Private	0	0
Nevada Total		**800**	**2,300**
Utah	National Forest	1900	5400
	Other Federal	100	100
	State and Private	200	400
Utah Total		**2,200**	**5,900**
Wyoming	National Forest	500	1200
	Other Federal	0	0
	State and Private	0	0
Wyoming Total		**500**	**1,200**
Grand Total		**18,200**	**43,000**

TABLE 3. Status of spruce beetle infestations by state during 2000.

State	Land Ownership Class	Outbreak Area (Acres)	Number of Trees
Idaho	National Forest	100	100
	Other Federal	0	0
	State and Private	0	0
Idaho Total		**100**	**100**
Nevada	National Forest	0	0
	Other Federal	0	0
	State and Private	0	0
Nevada Total		**0**	**0**
Utah	National Forest	34,500	69,000
	Other Federal	800	800
	State and Private	1,400	5,200
Utah Total		**36,700**	**75,000**
Wyoming	National Forest	3,200	6,600
	Other Federal	0	0
	State and Private	0	0
Wyoming Total		**3,200**	**6,600**
Grand Total		**40,000**	**81,700**

TABLE 4. Status of Douglas-fir beetle infestations by state during 2000.

State	Land Ownership Class	Outbreak Area (Acres)	Number of Trees
Idaho	National Forest	20,100	40,800
	Other Federal	1,200	1,800
	State and Private	1,800	1,200
Idaho Total		**23,100**	**43,800**
Nevada	National Forest	0	0
	Other Federal	0	0
	State and Private	0	0
Nevada Total		**0**	**0**
Utah	National Forest	3,000	9,100
	Other Federal	100	300
	State and Private	1,000	3,100
Utah Total		**4,100**	**12,500**
Wyoming	National Forest	2,500	6,100
	Other Federal	100	300
	State and Private	100	300
Wyoming Total		**2,700**	**6,700**

Grand Total		**29,900**	**63,000**

TABLE 5. Status of western pine beetle/Ips beetle infestations by state during 2000.

State	Land Ownership Class	Outbreak Area (Acres)	Number of Trees
Idaho	National Forest	400	70
	Other Federal	0	0
	State and Private	100	30
Idaho Total		**500**	**100**
Grand Total		**500**	**100**

TABLE 6. Status of Jeffrey pine beetle infestations by state during 2000.

State	Land Ownership Class	Outbreak Area (Acres)	Number of Trees
California	National Forest	50	100
Nevada	National Forest	50	100
Grand Total		**100**	**200**

TABLE 7. Status of subalpine fir mortality complex by state during 2000

State	Land Ownership Class	Outbreak Area (Acres)	Number of Trees
Idaho	National Forest	2,300	11,200
	Other Federal	300	400
	State and Private	1,200	1,300
Idaho Total		**3,800**	**12,900**
Nevada	National Forest	500	3,000
	Other Federal	0	0
	State and Private	0	0
Nevada Total		**500**	**3,000**
Utah	National Forest	9,600	33,300
	Other Federal	40	200
	State and Private	900	4,000
Utah Total		**10,540**	**37,500**
Wyoming	National Forest`	4,600	15,800
	Other Federal	300	1,100
	State and Private	30	50
Wyoming Total		**4,930**	**16,950**
Grand Total		**19,770**	**70,350**

TABLE 8. Status of fir engraver beetle infestations by state during 2000.

State	Land Ownership Class	Outbreak Area (Thousand Acres)	Number of Trees (Thousands)
Utah	National Forest	200	500
	Other Federal	0	0
	State and Private	0	0
Utah Total		**200**	**500**
Nevada	National Forest	500	1,400
	Other Federal	0	0
	State and Private	100	200
Nevada Total		**600**	**1,600**
Grand Total		**800**	**2,100**

TABLE 9. Number of trees killed and acres affected by bark beetles on National Forests of Region 4 during 2000 as determined by aerial detection surveys.

	Mountain Pine Beetle		**Douglas-fir Beetle**		**Western Pine Beetle/Ips**		**Spruce Beetle**		**Fir Engraver Beetle**		**Subalpine Fir Mortality Complex**		**Jeffrey Pine Beetle**		**Totals**	
Forest	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	**Trees**	**Acres**
Ashley	3,200	1,000	2,600	800	0	0	1,000	500	0	0	1,500	300	0	0	8,300	2,600
Boise	1,000	800	15,900	9,000	400	400	300	100	0	0	0	0	0	0	17,600	10,300
Bridger-Teton	1,300	500	5,500	2,300	0	0	6,500	3,200	0	0	15,400	4,300	0	0	28,700	10,300
Caribou	700	300	2,200	1,000	0	0	100	100	0	0	2,200	700	0	0	5,200	2,100
Challis	5,300	2,400	100	100	0	0	0	0	0	0	1,700	300	0	0	7,100	2,800
Dixie	800	400	500	200	0	0	16,900	12,200	200	100	9,400	5,300	0	0	27,800	18,200
Fishlake	500	100	1,100	400	0	0	5,100	2,500	100	100	14,000	2,500	0	0	20,800	5,600
Manti-LaSal	400	200	2,600	700	0	0	45,700	19,100	200	100	4,300	600	0	0	53,200	20,700
Payette	5,000	1,900	8,700	3,800	0	0	500	200	0	0	400	100	0	0	14,600	6,000
Salmon	100	100	1,600	400	0	0	0	0	0	0	1,900	500	0	0	3,600	1,000
Sawtooth	15,700	7,100	5,400	3,400	0	0	100	100	0	0	800	200	0	0	22,000	10,800
Targhee	1,500	800	7,700	2,600	0	0	700	200	0	0	5,000	900	0	0	14,900	4,500
Humboldt-Toiyabe	2,700	800	0	0	0	0	0	0	1,800	600	3,000	500	100	100	7,600	2,000
Uinta	0	0	1,300	500	0	0	300	200	0	0	900	300	0	0	2,500	1,000
Wasatch- Cache	500	200	1,000	400	0	0	100	100	0	0	3,600	700	0	0	5,200	1,400
TOTAL	**38,200**	**16,400**	**55,200**	**25,200**	**400**	**400**	**77,200**	**38,400**	**2,300**	**900**	**60,500**	**16,500**	**100**	**100**	**233,900**	**97,700**

TABLE 10. Status of Douglas-fir tussock moth by state in 2000.

State	Land Ownership Class	Defoliation Intensity (Acres)			Total acres
		Low	Moderate	High	
Idaho	National Forest	0	0	400	400
	Other Federal	2,400	3,000	5,300	10,700
	State and Private	2,200	1,800	3,300	7,300
Idaho Total		**4,600**	**4,800**	**9,000**	**18,400**
Nevada	National Forest	0	0	100	100
	Other Federal	0	0	0	0
	State and Private	0	0	0	0
Nevada Total		**0**	**0**	**100**	**100**
Utah	National Forest	0	0	500	500
	Other Federal	0	0	0	0
	State and Private	0	0	0	0
Utah Total		**0**	**0**	**500**	**500**
Wyoming	National Forest	0	0	0	0
	Other Federal	0	0	0	0
	State and Private	0	0	0	0
Wyoming Total		**0**	**0**	**0**	**0**
Grand Total		**4,600**	**4,800**	**9,600**	**19,000**

TABLE 11. Status of Western Spruce Budworm by state in 2000.

State	Land Ownership Class	Defoliation Intensity (Acres)			Total acres
		Low	Moderate	High	
Idaho	National Forest	900	0	4,300	5,200
	Other Federal	0	0	200	200
	State and Private	100	0	1,700	1,800
Idaho Total		**1,000**	**0**	**6,200**	**7,200**
Nevada	National Forest	0	0	0	0
	Other Federal	0	0	0	0
	State and Private	0	0	0	0
Nevada Total		**0**	**0**	**0**	**0**
Utah	National Forest	3,300	0	12,800	16,100
	Other Federal	0	0	0	0
	State and Private	300	0	300	600
Utah Total		**3,600**	**0**	**13,100**	**16,700**
Wyoming	National Forest	100	0	200	300
	Other Federal	0	0	0	0
	State and Private	0	0	0	0
Wyoming Total		**100**	**0**	**200**	**300**
Grand Total		**4,700**	**0**	**19,500**	**24,200**

TABLE 12. Number of acres defoliated by insects on National Forests of Region 4 during 2000 as determined by aerial detection surveys.

Forest	Douglas fir Tussock Moth	Western Spruce Budworm	Pine Butterfly	Gypsy Moth	Sugar Pine Tortrix	Pine Needle Sheathminer	Fall Cankerworm
Ashley	0	0	0	0	0	0	0
Boise	0	2,200	0	0	0	0	0
Bridger-Teton	0	0	0	0	0	0	0
Caribou	0	0	0	0	0	0	0
Challis	0	0	0	0	0	0	0
Dixie	0	14,700	0	0	0	0	0
Fishlake	500	1,400	0	0	0	0	500
Manti-LaSal	0	0	0	0	0	0	10,800
Payette	0	0	0	0	0	0	0
Salmon	0	0	0	0	0	0	0
Sawtooth	400	0	0	0	0	0	0
Targhee	0	3,300	0	0	0	0	0
Humboldt-Toiyabe	0	0	0	0	0	0	0
Uinta	0	0	0	0	0	0	1,500
Wasatch-Cache	0	0	0	0	0	0	400
Total	**900**	**21,600**	**0**	**0**	**0**	**0**	**13,200**

Figure 1

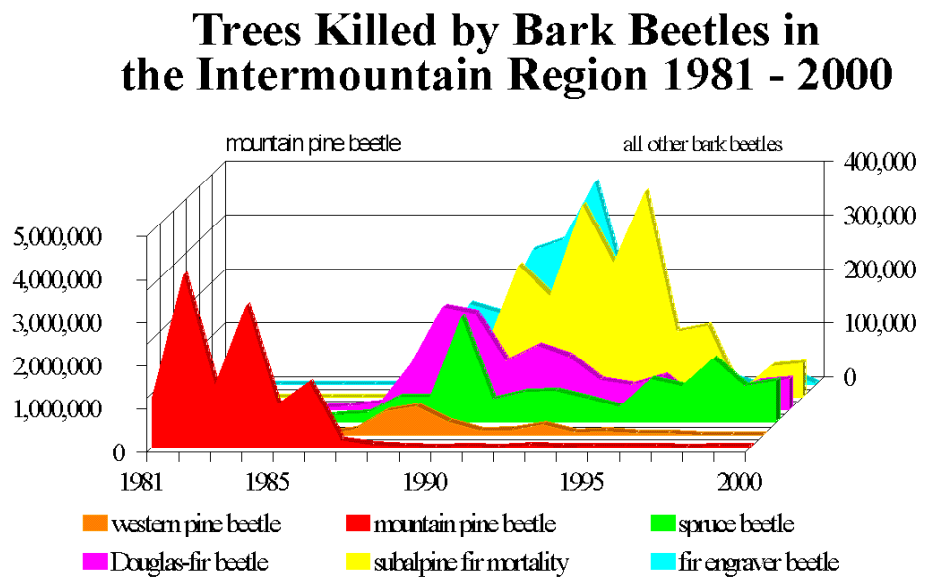

Figure 2

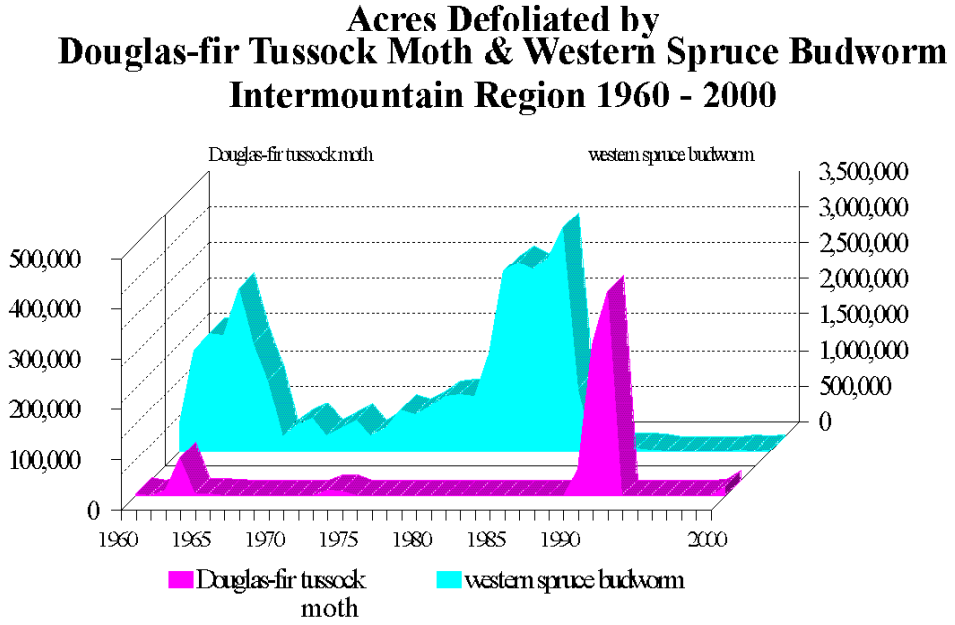

Figure 4. *Tree mortality associated with spruce beetle in Region 4 - 2000 aerial detection survey.*

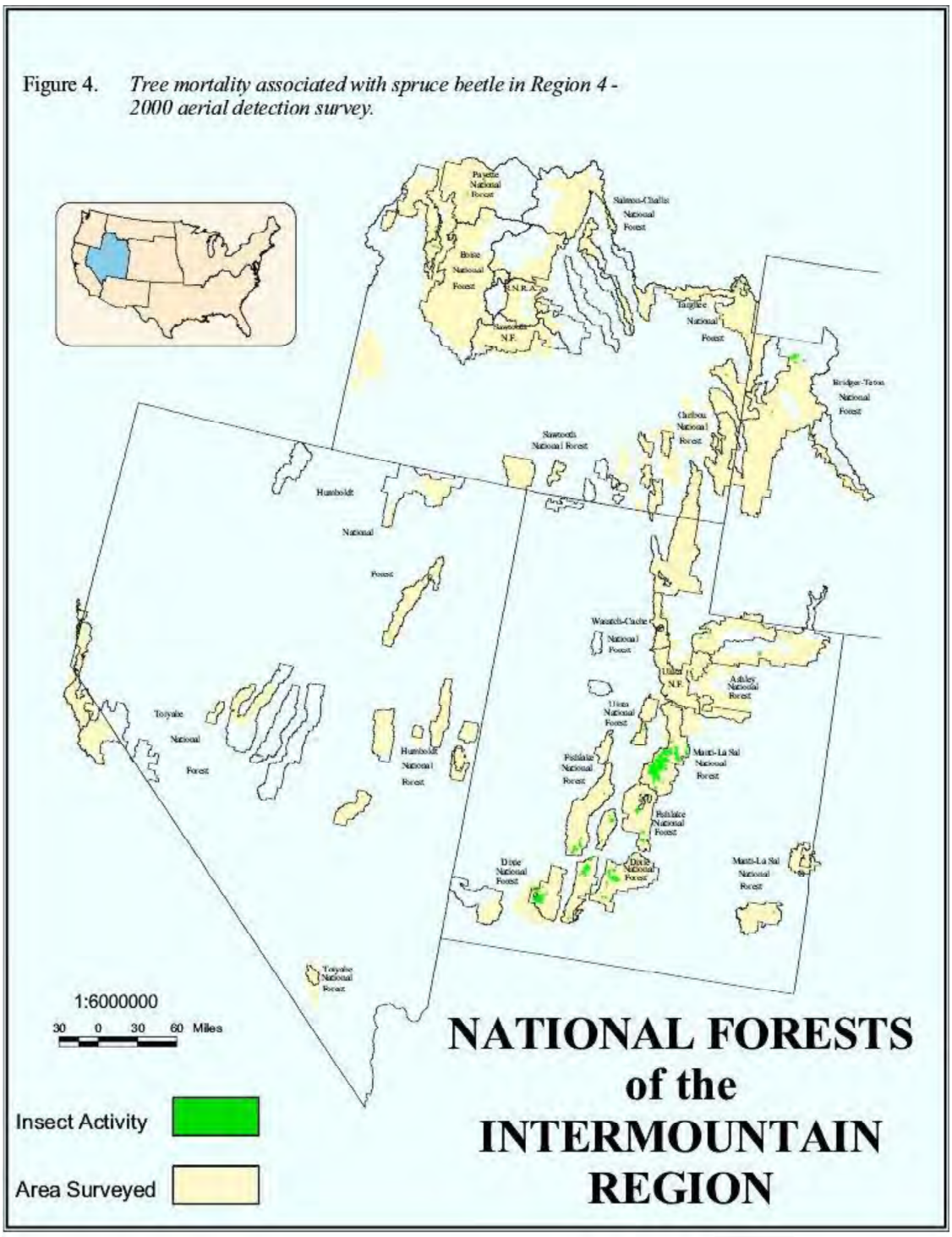

Figure 5. *Tree mortality associated with Douglas-fir beetle in Region 4 - 2000 aerial detection survey.*

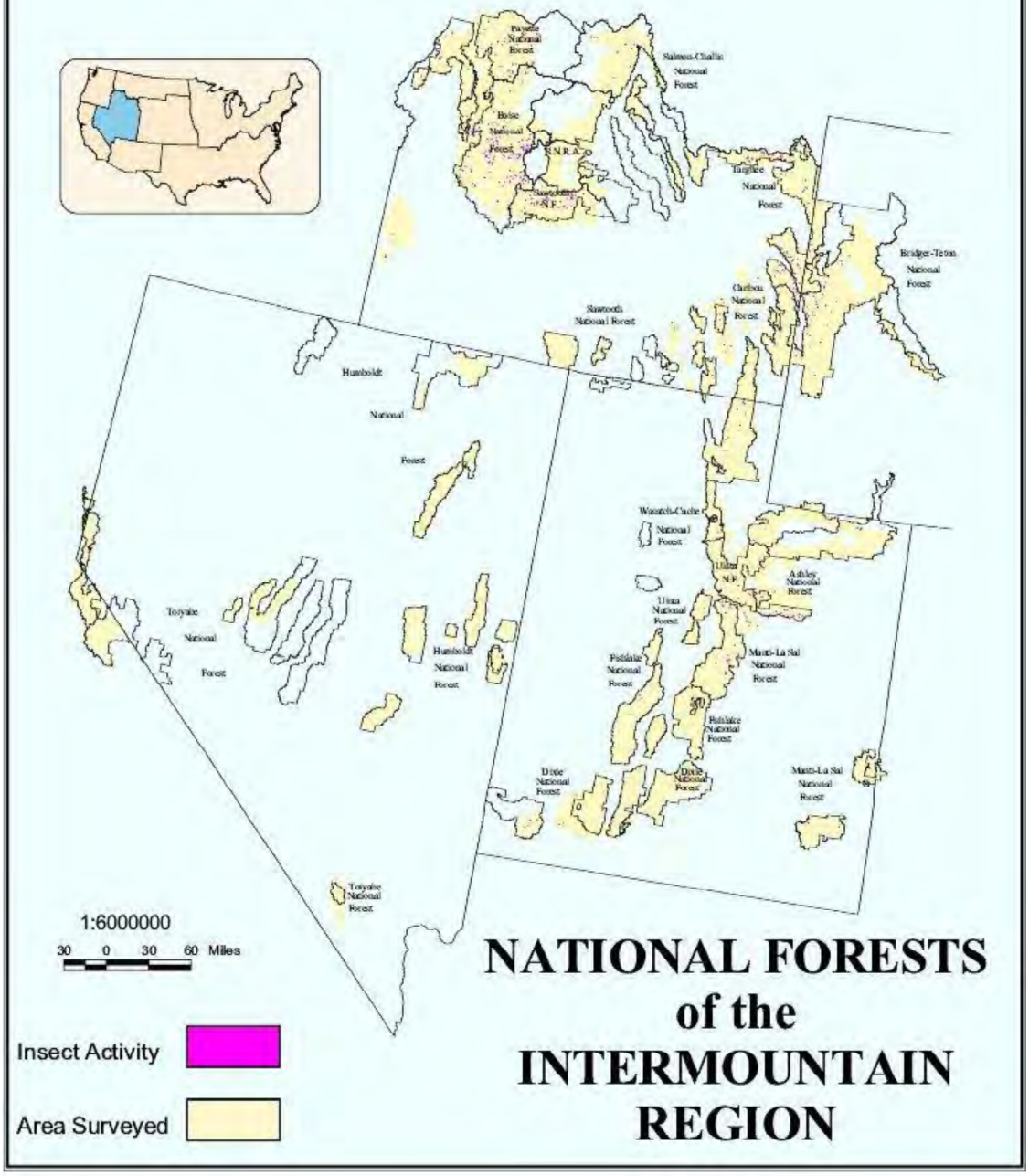

Figure 6. *Tree mortality associated with fir engraver beetle and subalpine fir mortality complex in Region 4 - 2000 aerial detection survey.*

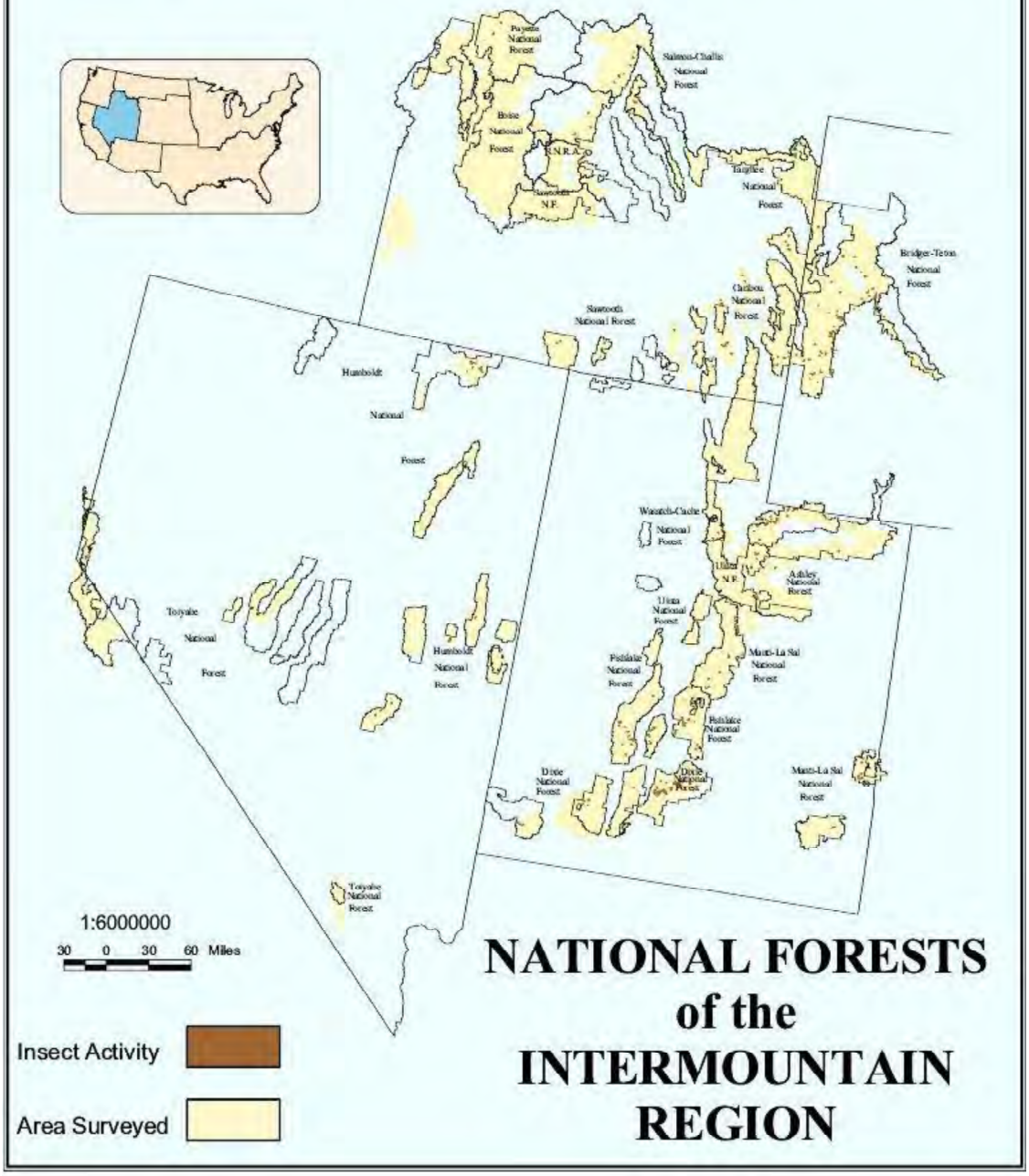

Figure 7. *Tree defoliation associated with western spruce budworm and Douglas-fir tussock moth in Region 4 - 2000 aerial detection survey.*