MONTANA

Forest Insect and Disease Conditions and Program Highlights - 2003

Report 04-1

2004

Compiled By:

Larry Meyer, USDA Forest Service, Northern Region, State and Private Forestry, Forest Health Protection

Contributors:

Beverly Bulaon, Gregg DeNitto, Ken Gibson, Marcus Jackson, Bob James, Sandy Kegley, Blakey Lockman, Larry Stipe, Nancy Sturdevant, USDA Forest Service, Northern Region, State and Private Forestry, Forest Health Protection; Steve Kohler, Brennan Ferguson, Montana Department of Natural Resources and Conservation, Forestry Division

Data Summary and Map Production:

Larry Stipe, USDA Forest Service, Northern Region, State and Private Forestry, Forest Health Protection

Cover Photo:

White pine blister rust in whitebark pine, courtesy of Marcus Jackson, USDA Forest Service.

Mountain pine beetle mass mortality in lodgepole pine, archives, USDA Forest Service.

Text Edits:

Linda Hastie, USDA Forest Service, Northern Region, Administrative Staff

TABLE OF CONTENTS

INTRODUCTION

This report summarizes the major forest insect and disease conditions in Montana during 2003 and was jointly prepared by the Montana Department of Natural Resources and Conservation, Forestry Division and USDA Forest Service (FS), Forest Health Protection (FHP), State and Private Forestry, Northern Region. Information for the report was derived from ground and aerial surveys within Reporting Areas across parts of Montana. A Reporting Area (RA) includes all federal, state, and private land ownerships within a particular geographic boundary (figure 1).

SUMMARY OF CONDITIONS

Bark Beetles

While part of the State received “nearly normal” amounts of precipitation during the calendar year 2003; officially, much of eastern Montana was still considered to be in an unprecedented long drought. Rain and snow during late winter and early spring brought some much-needed relief in a few areas; however, the period July-September saw a return to unusually hot and dry conditions. The resulting fire season in western Montana was exceeded in acres burned and committed resources only by the record-setting year of 2000. More than 350,000 acres in the State, many in southwestern Montana, were burned to some extent in 2003. All of those conditions contributed to an increase in infested area by most bark beetle species throughout the State. Unfortunately, fire and smoky conditions prevented aerial survey of all beetle-infested areas—only about 82% of forested stands in 24 reporting areas (statewide) were flown. But, for most of the State, both aerial- and ground-collected data showed still-increasing bark beetle infestations.

Mountain-pine-beetle-infested areas increased in many locations flown; however, in some locations, intensity of beetle-caused mortality declined due to host depletion. Decreases in infested area were recorded on the Lolo National Forest (NF); but much of that infested area was not flown. In total, more infested acres were recorded in 2003 than in 2002; however, it is likely total infested area was actually higher than recorded.

Douglas-fir beetle infested acres decreased in parts of northwestern Montana; but increased in southwestern and central Montana. Overall, infested acres increased in 2003; and beetle activity remained high in many areas, particularly ones near stands burned in 2000. Grand fir mortality attributable to fir engraver once again increased to all-time high levels; and western balsam bark beetle killed subalpine fir was mapped on fewer acres than last year’s record high—but again, only because some of the more heavily infested areas were not surveyed.

Now, as we begin 2004, we have yet to recover from the droughty conditions of the past several years. Without a significant change in weather, we anticipate most beetle infestations will continue to increase in both extent and intensity throughout the coming year.

Defoliators

In 2002 aerial surveyors mapped 54,444 acres of defoliation by western spruce budworm east of the Continental Divide in the Beaverhead, Deerlodge, Helena, and Gallatin Reporting Areas. In 2003, aerial surveyors mapped 124,142 acres of defoliation by budworm in Montana both east and west of the Continental Divide (figure 7). This figure could be greater because some areas with possible defoliation were not flown due to the Montana wild fires of 2003. A considerable number of moths were caught at several trapping sites. Ground checks at areas of high defoliation found significant mortality in the understory. Budworm activity was noted in other areas, but at endemic levels.

Defoliation by false hemlock looper (713 acres) was observed. False hemlock looper defoliated Douglas-fir on the Flathead Indian Reservation, east of Libby, north side of Flathead Lake, and along the Clark Fork River between Rock Creek and Beavertail Hill. Western false hemlock looper was detected on the Crow and Flathead Indian Reservations (60 and 226 acres, respectively), and the Flathead NF (427 acres). Defoliation of lodgepole pine (236 acres) by pine sawfly was reported on the Gallatin NF. Severe defoliation of Douglas-fir trees by Douglas-fir tussock moth in the National Bison Range and surrounding areas was easily visible by aerial detection. No gypsy moths were found in monitoring traps in the state of Montana, but a few moths have been caught for a third consecutive year in Yellowstone National Park.

Root Diseases

Mortality and growth losses from root disease continue to be high throughout the state. It is widespread and chronic; with root disease caused mortality being more common west of the Continental Divide, although large patches can be found east of the Divide. Annually, root diseases cause mortality on over 1 million acres in western Montana. The status of root disease remains fairly constant from year to year, so they are not normally monitored by aerial surveys. Although root disease, a native complex of several diseases, changes very little from one year to the next, it has greatly increased since the early 1900's due to changing forest conditions. Douglas-fir and true firs, which are the most susceptible tree species to the complex of root diseases, have greatly increased over the last 90 years, thus leading to higher levels of root disease. The effect of the fires of 2000 and 2003 on root diseases is one of opportunity. The tree species that are best adapted to low intensity, high frequency fires, are those species that are also root disease tolerant, such as western larch and ponderosa pine. In the root- diseased areas that burned, there is the opportunity to reduce the effects from root disease by planting these species or encouraging the natural regeneration of these species.

Dwarf Mistletoes

Douglas-fir, western larch and lodgepole pine are the tree species most severely affected by dwarf mistletoes. Fire greatly influences the distribution of dwarf mistletoes across the landscape. In general, any fire event that kills infected trees will reduce the population of dwarf mistletoe, at least in the short term. Large, complete burns will greatly reduce dwarf mistletoe populations across the landscape and may even eliminate small, localized populations. Small, patchy burns will temporarily reduce the amount of mistletoe, but infected residuals provide a ready source of dwarf mistletoe seeds for infection of the new regeneration.

White Pine Blister Rust

White pine blister rust continues to be present throughout the range of five-needle pines in the state. Rust severity is highest in the northwestern part of the state where the disease continues to cause extensive mortality in western white pine. The effects of blister rust on whitebark pine ecosystems took longer to appear than in western white pine forest type, but it is apparently proving to be equally devastating.

Limber Pine Decline

Limber pine mortality is continuing across scattered locations in central and eastern Montana. In recent years, Dothistroma needle disease and subsequent drought was associated with much of the mortality observed in permanent plots on the Lewis and Clark National Forest. White pine blister rust, winter injury, and competition-related stress have been implicated in decline and mortality in some locations.

ANNUAL AERIAL SURVEY

The annual aerial detection survey in Montana was conducted from June 30 until September 26, 2003. The survey covered approximately 20.6 million acres of mixed ownership forestlands, excluding most wilderness areas (figure 2). Yellowstone NP is included in this acreage. Five FHP sketch mappers, using three different airplanes, conducted the 2003 aerial survey.

The 2003 fire season started early in Montana with several large fires in most of the reporting areas. Temporary flight restrictions over these large fires along with ensuing smoke from fires in Idaho, Oregon, Washington, and Canada prevented aerial surveys on portions of the forested lands that are normally flown. As a result only about 80% of forested lands in 16 reporting areas in Montana were flown.

Much of the data summarized in this report is a product of the aerial survey, as well as ground surveys and biological evaluations. Along with the data summaries, aerial survey maps are available from the Missoula FHP Field Office, in both paper and digitized GIS format.

The annual aerial detection survey is an overview survey designed to cover large areas in relatively short periods. Aerially detected signatures include tree mortality, defoliation and windthrow. If forest disturbance activities are low, secondary disturbances such as diseases, needle casts, high water damage and previous fire damage are sketch mapped. The intent of the survey is to cover each area once a year during which time the observer sketch maps as many disturbances and damage as possible. The survey is conducted using single-engine, high-wing airplanes, flying at speeds of approximately 90 to 130 m.p.h, and at an average altitude of approximately 1,000 to 2,000 feet above ground level.

The aerial survey data are estimates made from airplanes and though not as many areas as we would like were ground checked, enough were checked to lend confidence to the areas for which we only have aerial survey data. Together, aerial and ground surveys provide information relative to bark beetle caused mortality, as well as other damage agents pertinent to land managers charged with the responsibility of maintaining forest health

INSECTS

Abbreviations

The following abbreviations are used for beetles and their hosts throughout the bark beetle section:

Beetles	DFB	=	Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopkins
	ESB	=	Spruce beetle, D. *rufipennis* (Kirby)
	IPS	=	Pine engraver, *Ips pini* (Say)
	MPB	=	Mountain pine beetle, *D. ponderosae* Hopkins
	WPB	=	Western pine beetle, *D. brevicomis* LeConte
	FE	=	Fir engraver, *Scolytus ventralis* LeConte
	WBBB	=	Western balsam bark beetle, *Dryocoetes confuses* Swaine
	RTB	=	Red turpentine beetle, *D. valens* LeConte
Hosts	LPP	=	Lodgepole pine
	PP	=	Ponderosa pine
	WWP	=	Western white pine
	WBP	=	Whitebark pine
	DF	=	Douglas-fir
	GF	=	Grand fir
	SAF	=	Subalpine fir
	ES	=	Engelmann spruce
Other	NF	=	National Forest
	RD	=	Ranger District
	IR	=	Indian Reservation
	BLM	=	Bureau of Land Management

Reporting area summaries follow. For each, bark beetle effects on their respective hosts are noted. To the extent possible, we have indicated areas affected, an estimate of impacts, and beetle population trends. Though reporting areas are typically designated by names of national forests, Indian reservations, or national parks; there may be within those reporting areas, lands of various ownerships—federal, state and private.

BARK BEETLE CONDITIONS BY REPORTING AREA IN BRIEF

Mountain Pine Beetle (MPB). The infested area mapped in 2003 increased in all areas flown, and would have been higher had all infested areas been surveyed (tables 4 and 5, and figure 3). The Lolo NF showed a decline in infested area, but only about one-third of the Lolo was flown. On the Deerlodge and Flathead NFs, where most infested areas were flown, infested area increased once again. Acres on which beetle-caused mortality was recorded—in all species and on all ownerships—increased to slightly more than 306,100 acres. Just over 261,300 acres had been recorded in 2002. This is the highest total infested area in the state since 1989. On those infested acres, nearly 1.2 million trees were killed in 2002—recorded as faders in 2003. Approximately 81% of those were lodgepole pine. Although beginning to decline in some stands, beetle populations are still expanding in many areas. As many as 94 new attacks per acre were found in one area surveyed.

Douglas-fir Beetle (DFB). Populations once again declined in parts of western Montana—infested stands on the Flathead and Kootenai

NFs showed still generally declining populations (table 3, figure 4). In many areas, beetle-killed trees were still noticeable; but in few we did find higher numbers of new attacks in 2003 than in 2002. Stands surveyed in and around areas affected by the 2000 fires on parts of the Bitterroot and Helena NFs showed still-high populations and increased new attacks in many areas in 2003. That was especially true on the Bitterroot NF, where infested area increased from 8,200 acres in 2002 to more than 34,500 acres in 2003. Stand conditions in some of those areas, however, suggest populations may soon begin to decline. Surveys conducted on the Flathead and Beaverhead NFs indicated populations were not as high in those areas. Many areas on the Lolo NF, where conditions were observed on the ground, showed still-high beetle populations. Because most of the Lolo was not flown, the area recorded as infested declined in 2003.

Statewide, the infested area mapped totaled 76,500 acres—considerably more than the 60,200 acres recorded in 2002. Almost 100,000 trees were killed. In some stands, particularly on the Lolo, Bitterroot, and Gallatin NFs populations continued to increase.

Fir Engraver (FE). Grand fir stands, in which FE-caused mortality was recorded, increased to another all-time high in 2003 (table 6, figure 5). Most stands in which grand fir was a significant component, in western Montana, showed high levels of infestation. Total infested area exceeded 20,600 acres in 2003. Nearly 21,300 grand firs were killed. A previous high of 8,900 acres had been recorded in 2002. We believe the dramatic increases in FE-caused mortality were drought related; and without a return to more normal precipitation, beetle-caused mortality will likely continue at unusually high levels for the next couple of years.

Western Balsam Bark Beetle (WBBB). The number of acres on which subalpine fir mortality, attributed to WBBB, were recorded decreased in 2003; however, many portions of the Gallatin and Beaverhead NFs, where beetle populations have been high, were not flown. In the areas surveyed, more than 76,000 infested acres were recorded—and an estimated 104,600 subalpine fir were killed (table 6, figure 6). That compared to more than 112,000 acres recorded in 2002. We believe in many areas, populations are still increasing.

Others. Pine engraver beetle (IPS) populations, and associated tree mortality increased substantially in ponderosa pine stands in some parts of eastern Montana. While not recorded at extreme conditions in most places, engraver beetle affected acres increased to just over 4,730 acres—compared to only about 500 acres in 2002. Spruce beetle (ESB) populations remained at endemic levels in Montana, despite small increases on the Gallatin NF. The outbreak recorded east of Yellowstone Lake in Yellowstone NP, however, increased to more than 8,700 acres in 2003. Just over 6,000 acres had been recorded there last year. Western pine beetle (WPB)-caused mortality, still relatively low for our dry conditions, remained at about the same level recorded in 2002. Beetle-killed trees were recorded on approximately 850 acres in second-growth ponderosa pine stands. About 900 acres had been killed last year. Beetle populations continued to respond to increased host susceptibility caused by unusually dry conditions (table 6).

The following tables and area summaries included throughout this report, show estimates of infested areas and amounts of associated mortality; as gathered through annual aerial detection surveys. Some have been augmented by ground surveys; but time, access, and available personnel limit those. These combined survey methods, then, provide information on extent and intensity of bark beetle infestations.

BARK BEETLE CONDITIONS BY REPORTING AREA

Beaverhead Reporting Area

Dillon RD. Much of the district was not flown in 2003; however, most bark beetle-caused mortality recorded in 2002 was observed in SAF stands, where WBBB appeared to be one of the more prevalent of the mortality-causing agents in those stands. Groups of faders, ranging from 5 to 300 trees each, were mapped throughout the Beaverhead Mountain Range, from Gold Stone Pass on the north to Tex Creek on the south. Largest concentrations were mapped near Lake Canyon and Dad Creek Lakes. Total infested area on the district in 2002 was about 2,400 acres; on which an estimated 4,300 SAF were killed.

In other parts of the district, widely scattered small groups of DFB-killed DF—totaling less than 250 acres were observed in the Blacktail and East Pioneer Mountains. Widely scattered groups of MPB-killed WBP, comprising just over 120 acres, were noted. They were of considerably less impact than the outbreak of WBBB.

Wise River RD. WBBB remained the single most important agent of mortality in SAF stands on the district again in 2003. Many 20- to 100-tree groups of faders were recorded in the Pioneer Mountain Range, from the Big Hole River south to Elkhorn Springs. Also throughout that area, generally in the Wise River drainage at lower elevations, many groups of DFB-killed DF were mapped. Infested areas totaled an estimated 1,400 acres on which 2,200 trees were killed.

WBBB-killed SAF were found scattered in very small groups throughout the Pioneers, some of the more notable ones being in the upper Wise River drainage. The area infested by WBBB was estimated at 740 acres, on which about 1,500 trees were killed.

Wisdom RD. Most of the western half of the district was not flown in 2003, but as in other parts of the Forest, WBBB remained the most significant mortality-causing agent. SAF stands throughout the Beaverhead Mountain Range, along the Montana/Idaho border are infested to greater or lesser extents. Notable concentrations were mapped in the Ruby Creek drainage, west of Wisdom; and in the Beaver Creek and Thompson Creek drainages in the Anaconda Range to the north. As recorded on the district in 2003, 840 dead SAF were killed on 560 acres.

Other small and widely scattered DFB-caused mortality was of less significance in 2002, and likely remained the same this year. Still, mortality attributed to DFB totaled 2,200 trees on 1,300 acres.

Madison RD. SAF mortality, attributed to WBBB, reached extremely high levels throughout the district in 2002 and again in 2003. While some stands were more heavily infested than others, it appeared there were few SAF stands on the district not affected to some extent. Relatively small groups—up to 100 trees each—were reported in the Tobacco Root Mountains to the north. To the south, throughout the Gravelly Range, extremely large groups of faders—covering as much several thousand acres each, and averaging an estimated 3-5 trees per acre—were mapped.

Largest concentrations of WBBB-killed trees were noted southwest of Ennis near Summit, Baldy Mountain, Monument Ridge, and elsewhere throughout the Snowcrest and Gravelly Ranges. Lesser, but significant amounts of WBBB-caused mortality were recorded in the Ruby Range and the Blacktail Mountains. Total affected area on the district was estimated at 4,100 acres on which 9,200 trees were killed. Large groups of WBP killed by MPB—much increased from 2002—were recorded in the southern portion of the Gravelly Range, especially from Perkins Creek eastward to West Fork Madison River.

Elsewhere, there were lesser amounts of DFB-killed DF, and MPB-killed WBP scattered throughout the reporting area. DFB-caused mortality was especially noticeable in the West Fork Madison River drainage, and totaled about 5,900 trees on 2, 070 acres. MPB-killed WBP were significant in the southern portion of the Gravelly Range, from Perkins Creek eastward to West Fork Madison River. An estimated 48,600 WBP were killed on 10,075 acres. Smaller amounts of LPP (on 80 acres) and PP (on 1,235 acres), killed by MPB, were also noted on the district.

To the south, in the Centennial Range, on lands administered mostly by BLM, large amounts of SAF, killed by WBBB, were found. In that same general area, significant amounts of WBP and LPP have also been infested by MPB. Largest groups of SAF faders were noted near Nemesis Mountain and totaled almost 5,600 trees on 1,740 acres; while most MPB-caused mortality was to the west of there, from Odell Creek west to West Fork Corral Creek. A total of 38,800 WBP and 500 LPP were killed on a combined 13,300 acres. Small amounts of DFB activity were observed at a few lower elevation sites.

Aerial survey estimated totals for the Beaverhead Reporting Area, on lands of all ownerships, showed nearly 6,400 acres infested by DFB; 41,400 acres infested by MPB (all hosts); and almost 14,500 acres infested by WBBB. Approximately 196,900 trees were killed by bark beetles throughout the area in 2002—and recorded as faders in 2003. Again, only about 60% of the reporting area was flown in 2003.

Bitterroot Reporting Area

Stevensville RD. Widely scattered and small groups of DFB-killed DF were noted in the Bitterroot Mountains, west of Stevensville. In lower elevation stands, along the eastern slopes of the Bitterroots, small and very scattered groups of PP, killed by MPB and/or WPB were also observed. Several groups of LPP, killed by MPB, were mapped in several drainages, west of Stevensville.

In the Sapphire Mountains, to the east of the Bitterroot Valley, many small groups of beetle-killed trees were generally scattered throughout the reporting area. Most numerous were groups of DFB-killed DF—especially prevalent from about Burnt Fork Creek on the north to Skalkaho Creek on the south. There were also quite numerous groups of SAF, killed by WBBB, most noticeable near Skalkaho Mountain. A few small groups of PP, killed by MPB, were mapped throughout the reporting area.

District totals showed more than 1,300 acres of DFB-infested DF; nearly 200 acres infested by MPB—most in WBP stands; and more than 230 acres affected by WBBB. Except for increased DFB activity, similar levels were found in 2002.

Darby RD. A few widely scattered groups of PP, killed by MPB and WPB, were observed in low-elevation stands on the east slopes of the Bitterroot Mountains. Beetle-killed groups were noticeable south of Lake Como. In that same general area, widely scattered and small groups of LPP, killed by MPB were mapped. Also in that area, and particularly in the Lost Horse Creek drainage, many DF have been affected by fire, DFB, or both. In the Sapphire Mountains, especially south of Skalkaho Creek, many large groups of DFB-killed DF were mapped. Districtwide, DFB-infested acres increased markedly in 2003.

In summary, almost 5,760 acres exhibited some level of DFB-caused mortality (compared to 350 in 2002); and 265 acres of MPB-killed trees—most of which were recorded in PP and stands. Other bark beetle-caused damage was noticeable, but less important.

Sula RD. Many groups of DF, killed by DFB and varying in size from a few to as many as 150 trees each, were noted throughout several tributaries of East Fork Bitterroot River, from Sula east to the Forest boundary. Some of the larger groups were recorded near French Basin and towards Lost Trail Pass. East of the Bitterroot River, stands along Tolan Ridge and above Springer Creek contained some of the largest groups of faders. Total area infested by DFB increased to almost 10,200 acres in 2003. Only about 900 acres had been recorded in 2002. About 9,000 DF were killed on those infested acres.

Also on the district several groups of PP, killed by MPB and totaling 560 acres, were recorded. At higher elevations, SAF stands generally contained small groups of WBBB-killed trees; totaling about 60 acres.

West Fork RD. Extreme amounts of DFB-killed—and fire-affected—DF were mapped throughout the reporting area. Largest groups were noted in the upper portions of West Fork Bitterroot River drainage. There, virtually every tributary of the West Fork, which contained DF stands, had large groups of beetle-killed trees. Numerous large groups were also observed west of Nez Perce Pass, in the Frank Church-River of No Return Wilderness; however, much of that wilderness area was not flown. Groups of beetle-killed trees are generally larger and more widely distributed than in 2002. District totals showed nearly 16,900 acres still infested. In addition, a few hundred acres were observed on which MPB had killed LPP or PP; and about 400 acres showed comparatively small amounts of WBBB-killed SAF.

Throughout the Bitterroot NF, in areas affected by fires of 2000, it was still difficult for the aerial observer to distinguish between DF affected by fire and those infested by DFB in some areas. However, a significant increase in beetle-infested stands not affected by fire was noted. Ground surveys conducted in the past 2 years indicated many fire-damaged trees were infested in 2001, but many non-damaged trees had been attacked in 2002 and 2003. Surveys conducted in fire-affected and adjacent stands in 2002, on more than 50 variable-radius plots, showed an average of 27 new attacks per acre in 2002, compared to 6 in 2001. Walk-through surveys in 2003 confirmed still-building populations in many areas. In some areas, host depletion suggests beetle populations may soon begin to decline.

Bitterroot Reporting Area totals for 2003 showed more than 34,500 acres infested by DFB, on which about 32,000 DF were killed. Slightly less than 100 acres of LPP, and more than 1,050 acres of PP, contained MPB-caused mortality. Much of the latter was recorded on the Sula State Forest. Just over 870 acres of SAF stands were infested by WBBB. Morality attributed to other bark beetles was less noticeable.

Custer Reporting Area

Beartooth RD. Large groups of WBBB-killed SAF were recorded in the Pryor Mountains near Tony Island Spring, near East Pryor Mountain, and on Big Pryor Mountain. Smaller groups were recorded throughout the reporting area.

Elsewhere, MPB-caused mortality was noted in PP stands at several widely scattered locations. The most significant amounts of MPB-caused mortality, however, were mapped in LP stands in the Lost Water Creek drainage, in Burnt Timber Canyon, and above Big Coulee. Infested stands were also noted on lands administered by BLM, to the southeast of lands under FS jurisdiction. Total infested area was about 1,000 acres on FS land and another 970 on BLM.

South of Red Lodge, several large groups of WBP, killed by MPB, were mapped along Line Creek Plateau and near Maurice Mountain. East of Picket Pin and Iron Mountains, large groups of WBBB-killed SAF were observed. More than 2,900 acres were infested to some extent, districtwide. An estimated 3,200 SAF were killed.

Sioux RD. MPB- and IPS-infested PP stands were observed in Chalk Buttes, Ekalaka Hills, and the Long Pines. Additional beetle-caused mortality was observed in the east and west Short Pine Hills, north and south Cave Hills, and Slim Buttes. These populations, first recorded in 2001, have increased significantly. The area was not flown in 2002. A total of 2,600 acres, averaging mortality of about 1 tree per acre, was recorded in 2003.

Ashland RD. Many small and widely scattered groups of PP, killed by combinations of MPB and IPS were recorded in many of the tributaries of Otter Creek, Beaver Creek, and the Tongue River, east of Ashland. Mortality appeared to be concentrated near Liscom Butte, Elk Ridge, Home Creek Butte, Camps Pass, Yager Butte, and Chimney Rock. Much of that bark beetle activity appeared to be associated with stand damage directly attributable to the Stag Fire of 2000. Throughout the district, beetles killed about 1,100 PP on a combined 617 acres.

Custer Reporting Area-wide, bark beetle-caused mortality totaled 50 DF on 30 acres; 1,200 limber pine on 2,000 acres; 575 PP on 635 acres and 650 WBP on 530 acres, killed by MPB; an estimated 2,900 PP killed by IPS on 3,000 acres; and 3,500 WBBB-killed SAF on 3,300 acres.

Deerlodge Reporting Area

Butte RD. Very large groups of LPP, killed by MPB, were once again mapped to the north, south, east, and west of Butte in 2003. The largest groups, with the most intense amounts of beetle-caused mortality, were recorded to the southeast of Butte, in the Basin Creek and Thompson Park areas. There, fader groups extended to several thousand acres each, and ranged from estimated 15-50 beetle-killed trees per acre. Ground surveys conducted there showed the infestation in that area is still increasing. One set of data-collection plots, in the Thompson Park area, averaged 94 new attacks per acre.

To the east, along East Ridge, the very noticeable outbreak continued, as did ones near Delmoe Lake, north of Homestake Pass. To the north of Butte, in Hail Columbia Gulch, Sheep Gulch, Browns Gulch, and Telegraph Gulch, outbreaks continued to build. In all areas surveyed in 2003, MPB-infested areas were more expansive than in 2002.

To the west and southwest, near Fleecer Mountain, and along east-facing slopes of Fleecer Ridge increasing amounts of MPB-killed LPP were mapped. Districtwide, more than 140,800 LPP were killed on nearly 18,500 acres. That represented a significant increase in infested area over 2002.

DFB-killed DF was noted in small and widely scattered amounts throughout the DF type and totaled about 30 acres, with approximately 100 DF killed.

Jefferson RD. MPB-infested LPP stands were mapped east of Delmoe Lake, and extending east of Whitetail Reservoir into the upper portions of Whitetail Creek. Infestations there were not as extensive as those to the west, but increased in 2003. Infested area on the district doubled in 2003, to more than 6,700 acres. More than 15,000 LPP were killed.

South of Boulder, minor amounts of DFB-killed DF were noted; however, most beetle-caused mortality there was also MPB-killed LPP, found in tributaries of Boulder and Little Boulder Rivers. In the northern portion of the Tobacco Root Mountains, several groups of SAF, killed by WBBB and totaling 215 acres, were mapped in the South Boulder River and Curly Creek drainages. In that same general area, but north of Windy Pass, MPB-killed LPP and were mapped at higher elevations and northward on lower sites, MPB had killed small and scattered groups of PP.

North of Boulder, on lands administered by both BLM and FS, MPB had killed numerous groups of PP and a few groups of LPP. Populations there also appeared to be increasing.

Deer Lodge RD. MPB-caused mortality in LPP stands increased east of Deer Lodge, in the Baggs Creek and Cottonwood Creek drainages. Small and, as yet, widely scattered groups of MPB-killed LPP were observed in many LPP stands throughout the reporting area. Those outbreaks, totaling about 1,200 acres, were recorded at about the same level as observed in 2002.

Large groups of MPB-killed LPP were also noted near Jones Mountain and in the Racetrack Creek drainage, west of Deer Lodge. Elsewhere in the reporting area, many small and scattered groups of DFB-killed DF were found north and east of Deer Lodge Mountain. Districtwide, more than 7,400 LPP were killed on 1,230 acres; and 900 DF were killed on 370 acres.

Pintler RD. Large and rapidly expanding groups of LPP, killed by MPB, were mapped in Boulder Creek and Smart Creek drainages, north of Philipsburg. Building MPB populations were found in many mature LPP stands on the district, but especially noticeable were concentrations found in Upper Willow Creek drainage. Other groups were mapped near the confluence of Stony Creek and Rock Creek. District totals were down from 2002 levels: 1,650 acres of MPB-caused mortality in LPP stands, 97 in PP stands, and another 28 in WBP stands. A total of about 1,800 trees were killed by MPB in 2002.

In upper Stony Creek drainage, and northward into Harvey Creek drainage, many widely scattered groups of DFB-killed DF were observed. Those infestations increased in

2003 to more than 9,900 trees on 5,100 acres. In several high-elevation SAF stands, notably upper Stony Creek, Rock Creek, and Lutz Creek, WBBB-caused mortality was prominent. Mortality in those stands totaled slightly more than 5,100 trees on 4,225 acres. In a few lower elevation PP stands, north towards the Clark Fork River, MPB had killed several groups of trees. There, stands on predominantly State and private land, the infested area totaled more than 650 acres.

For the Deerlodge Reporting Area, MPB-infested stands were found on more than 31,000 acres—most in LPP stands on FS-administered lands. DFB infested another 6,600 acres and WBBB about 4,600 acres.

Flathead Reporting Area

Swan Lake RD. Historically high amounts of GF, killed by FE, were once again mapped throughout mixed-conifer stands on the district in 2003. While FE was the direct cause of mortality, beetles were no doubt taking advantage of large numbers of drought-weakened trees that have become increasingly prevalent over the last few years. Several large polygons, each covering hundreds of acres, and averaging about one FE-killed GF per acre, were mapped east of Echo Lake. Throughout the reporting area, there were other concentrations of FE-killed trees as well.

Southward through the Swan Valley most stands that contained GF were affected to a greater or lesser extent by FE activity. DF stands in that same general area were also impacted by DFB, but to a much lesser extent. Infested groups were typically not large, but were generally scattered throughout the DF type. The largest concentration of DFB-killed trees was mapped in Hall Creek and Groom Creek drainages, east of Swan Lake. Other large groups were noted south of there, in the North Fork and South Fork Lost Creek drainages. DFB killed 2,500 trees on 1,800 acres.

Significant amounts of MPB-killed LPP were also widely scattered throughout LPP stands, both east and west of Swan Valley. There were also important amounts of WBP mortality, attributed to MPB, in some locations—the most notable being a large fader group mapped south of Swan Lake, near the head of Fatty Creek. Many high-elevation SAF stands in that area also contained trees killed by WBBB—generally scattered throughout the type. A particularly large group was seen near the headwaters of North Fork Porcupine Creek.

On the "Island Unit," west of Flathead Lake, MPB-killed LPP and FE-infested GF increased again in 2003. Several large groups of beetle-killed LPP, on the east slopes of Blacktail Mountain, contained several hundred trees each. In that same area, thousands of GF were killed by FE. Many small groups of LPP, killed by MPB, DF killed by DFB, and SAF killed by WBBB were mapped throughout the eastern part of the unit. Lower elevation PP stands were adversely affected by MPB throughout the unit as well.

Districtwide, more than 4,650 acres showed some level of FE-caused mortality on both FS and private land. An additional 1,800 acres were impacted by DFB, and MPB killed various of its host on 8,400 acres on lands of all ownerships.

Spotted Bear RD. MPB-caused mortality continued to expand in LPP stands along the South Fork Flathead River, south and east of Spotted Bear in 2003. One polygon between Addition Creek and Jungle Creek—about 2500 acres, contained an estimated 50,000 beetle-killed trees last year and decreased only slightly in intensity in 2003. Other groups nearby totaled thousands of dead trees each. Most LPP stands along tributaries of the South Fork, south of the ranger station, have been affected to some extent. Ground-collected data in that area showed an average of nearly 35 trees per acre killed in 2002. That was a general increase over the level of the previous year. In total, almost 11,000 acres showed MPB infestations, compared with about 14,000 acres in 2002.

Other areas of increasing MPB activity were mapped along Spotted Bear River—especially in the vicinity of Big Bill Mountain. In DF stands in the Spotted Bear River drainage, DFB-killed trees were common, but in mostly small and widely scattered groups, and decreased somewhat from levels recorded in 2002. DFB activity was especially noticeable in the vicinity of Beacon Mountain and Crossover Mountain. Elsewhere on the district, MPB- and DFB-caused mortality was scattered. Several groups of WBBB-killed SAF were noted in high-elevation sites throughout the district. Total DFB-affected stands on the district covered slightly more than 350 acres.

Hungry Horse/Glacier View RD. Recorded MPB and DFB activity decreased slightly throughout the district in 2003, although not all the northern portion of the district was flown. MPB-caused mortality was common in both LPP and WWP stands on both sides of Hungry Horse Reservoir, from Hungry Horse and Martin City, south to the district boundary. Building populations of MPB mapped in the upper portions of Middle Fork Flathead River, especially along and near Patrol Ridge, were not mapped in 2003; but are likely expanding. Numerous other groups of MPB-caused faders were mapped along the Middle Fork from Nimrod, north to Tunnel Creek in 2002. That area was not flown this year. MPB killed a reported 200 LPP, about 50 WWP, and less than 20 WBP on a combined 250 acres.

DFB-caused mortality was observed in higher concentrations on the Coram Experimental Forest, other sites just south and east of Hungry Horse and Martin City, and along the reservoir, south to Dudley Creek. Nearly 1,000 acres were affected. At higher elevations, considerable amounts of WBBB-caused mortality were noted in SAF stands—of particular note near Three Eagles Lakes and along Pioneer Ridge. In those areas, more than 970 acres were infested.

On Glacier View RD, in high-elevation SAF stands throughout the reporting area, groups of WBBB-killed trees increased substantially. Numerous groups, of several hundred acres in size, contained 2-3 beetle-killed trees per acre. More than 4,200 acres were impacted. To the south, in tributaries of North Fork Flathead River, DFB-, MPB-, and FE-caused mortality was widely scattered. A major portion of the district was not flown due to wildfires in the area. In those areas—from Coal Creek south to Big Creek, DFB populations have previously been recorded at outbreak levels in some stands. MPB affected stands on about 70 acres and DFB on approximately 50 more.

Tally Lake RD. Many large groups of FE-killed GF and WBBB-killed SAF were observed on Stillwater SF, north of Whitefish Lake, within this reporting area. Throughout mixed conifer stands on the district itself, many groups of beetle-killed trees, of several species, were observed. Around Tally Lake, numerous groups of DFB-killed DF and GF killed by FE were once again recorded. Some groups contained several hundred trees each. In that same general area, MPB populations were found in LPP stands, but at a somewhat decreased level from 2002. From there, south to Highway 2 west of Kalispell, LPP stands infested by MPB, DFB-killed DF, and especially GF killed by FE, were common.

Throughout the Logan Creek drainage, many lower elevation DF stands have been seriously impacted by DFB; while upper elevation ones showed significant amounts of WBBB-caused mortality. Mortality attributed to WBBB was especially noticeable in stands near Sheppard Mountain, Elk Mountain, and in upper portions of Alder and Robertson Creek drainages. FE-caused mortality was also noted in many stands dominated by GF. In general, bark beetle-caused mortality recorded during aerial surveys (trees killed by beetles in 2002) increased throughout the reporting area.

On district and adjacent lands, nearly 1,300 acres showed some level of DFB-caused mortality, about 200 acres showed MPB-killed trees, about 1,900 acres of FE-related activity, and more than 4,400 acres of WBBB-infested SAF.

Throughout the Flathead Reporting Area, on lands of all ownerships, more than 24,500 acres have been infested by MPB (compared to 21,600 acres in 2002); 16,100 acres by FE (8,100 acres in 2002; 5,600 acres by DFB

(7,100 acres last year); and 13,800 acres by WBBB (more than twice the 5,400 acres reported in 2002). In all, slightly less than 105,000 bark beetle killed trees were recorded in 2003.

Gallatin Reporting Area

Big Timber RD. DFB-caused mortality in the lower Boulder River drainage, south of Big Timber increased once again in 2002. Beetle-killed groups from Falls Creek, south to Ruby Creek, ranged in size from about 5 to 30 trees each. From there southward to East Fork Boulder River, groups were much larger. One group, near Hicks Park Campground, and another near Box Canyon were estimated to contain 600 and 450 beetle-killed DF, respectively. On private and FS lands, approximately 1,850 acres were reported as infested—more than twice the 850 acres recorded in 2002.

In the upper part of the drainage, from about Fourmile Creek south to Boulder Pass, numerous groups of WBBB-killed SAF were mapped. Several groups contained a few hundred beetle-killed trees each. From Elk Creek south to Sheepherded Peak, several large groups of MPB-killed WBP were recorded. In that area, about 3,700 acres of SAF stands have been affected, and an estimated 3,900 SAF have been killed. A few small groups DFB- and WBBB-caused mortality were noted on the east slopes of the Crazy Mountains. Most of the rest of the district was not flown.

Livingston RD. Scattered, small groups of DFB-killed DF were once again mapped in the Mill Creek drainage. Although lessening, DFB populations have existed in that area of the district for more than 10 years. Similar small groups were recorded in North Fork Sixmile Creek. Those infestations covered less than 450 acres, total.

On the western side of the Yellowstone Valley, in high-elevation stands above Rock Creek and Big Creek, significant amounts of beetle-killed SAF and WBP were noted. Most were small and widely scattered groups; however, a few covered several hundred acres each.

The northern portion of the district was not flown in 2003; but in 2002 widely scattered groups of MPB-killed LPP (one of 200 trees was noted near Ibex Mountain), DFB-infested DF, and SAF affected by WBBB were mapped on the west side of the Crazy Mountains. In the areas flown, more than 3,300 SAF were killed on almost 5,500 acres.

Gardiner RD. A few groups of DFB-killed DF, most containing from 5 to 60 trees each, were mapped in the Bear Creek drainage, northeast of Gardiner. In that same area, high-elevation stands of SAF and WBP had been infested by WBBB and MPB, respectively.

A small outbreak of DFB was also noted in Cedar Creek, east of the Yellowstone River, north of Gardiner. White pine blister rust was reported as the damaging agent in WBP stands at several locations on the district; however, MPB and secondary bark beetles may also be affecting those trees. One group of faded WBP near High Mountain was assumed to have been killed by MPB. Other SAF and WBP mortality was observed in the upper stretches of Tom Miner Creek.

Throughout the district, about 644 acres of DFB-infested stands were noted. Another 2,480 acres were found to contain noticeable amounts of WBBB-caused mortality. In total about 3,800 trees were killed by bark beetles.

Bozeman RD. The only portion of the district flown in 2003 was the Bridger Mountain Range, north of Bozeman. There, widely scattered and mostly small groups of beetle-killed SAF and DF were noted. Highest concentrations of faded trees were found in Jackson Creek and Stone Creek drainages. Other groups were more scattered. In that area, western spruce budworm defoliation in DF stands increased markedly in 2003. Significant and prolonged defoliation, coupled with a continuing drought, could lead to increasing DFB activity throughout the Bridger Range.

Elsewhere, in 2002, the most prevalent bark beetle conditions noted on the district were widely scattered, but occasionally there were large groups of WBBB-killed SAF totaling about 620 acres. The largest groups in the Gallatin Range were mapped in the Rock Creek drainage; however, fader groups were noted throughout. Most of the Madison and Gallatin ranges, where thousands of acres of WBBB-infested SAF stands have been recorded in past years, were not flown in 2003. Also of note throughout the district were widely scattered, small groups of DF, killed by DFB that totaled approximately 145 acres. That activity likely continued in 2003.

Hebgen Lake RD. DFB-killed DF were still very noticeable both north and south of Hebgen Lake. There appeared to be a lessening of infested area in 2002; however, it increased once again in 2003. In addition, ground surveys revealed very active DFB populations. Numerous fader groups exceeded 100 trees each. Total infested area was about 700 acres.

Little of the district north of Hebgen Lake was flown in 2003. In the portion that was flown, several groups of DFB-killed DF were recorded in the Beaver Creek drainage; and a few groups of MPB-killed WBP were mapped above Lightning Lake and near Moose Butte.

In 2002, SAF stands throughout the Madison Range were once again heavily infested by WBBB. Very large groups were mapped within the Snowslide Creek, Sage Creek, Little Sage Creek, and Wapiti Creek drainages. Elsewhere, though widely scattered throughout the SAF type, groups were generally smaller. Although not all SAF stands were flown in 2002, nearly 12,000 acres were observed with some degree of beetle-infested stands. Even fewer acres were flown in that area in 2003, but a WBBB activity was recorded on almost 2,500 acres. ESB-killed trees were noted on more than 700 acres.

For the portion of the Gallatin Reporting Area flown, nearly 5,650 acres of DFB-infested stands were observed, compared to 2,400 in 2002. Another 475 acres of MPB-infested LPP, 9,000 acres of MPB-killed WBP, and almost 87,000 acres on which WBBB-killed SAF was found were mapped. Only 15,000 acres of WBBB-caused mortality had been recorded in 2002.

Helena Reporting Area

Townsend RD. Extensive stands of white bark and limber pines, affected by blister rust, were recorded in the Big Belt Mountains, east of Canyon Ferry Lake. MPB and secondary bark beetles have also infested many of those stands. We visited WBP stands south of Mount Edith and confirmed the presence of both blister rust and MPB. Most recent tree mortality there was MPB-caused. Elsewhere on the district, small but very widely distributed groups of DFB-, WBBB-, and MPB-killed trees were mapped throughout host types. Many more such groups of trees were recorded in 2003 than had been in 2002. Some of the larger groups of MPB-killed LPP were recorded in the Grassy Mountain area, east of Townsend. A large group of WBBB-killed SAF was mapped north of Duck Creek Pass. WBP and LP have also been killed by MPB in that area. Districtwide, DFB-infested trees were observed on about 60 acres; MPB killed LPP on 2,600 acres, PP on 1,070 acres, LP on 600 acres, and WBP on 130 acres; and WBBB-caused mortality was recorded on about 750 acres.

Helena RD. Significant and increasing amounts of MPB-killed PP were mapped south and east of Helena. The most numerous and largest groups were recorded in the Crow Creek drainage, west of Eagle Creek Ranger Station, and in the McClellan Creek drainage near Strawberry Butte; south and east of Helena. Other notable groups were noted in the Sixmile Creek drainage, west of Helena. Lightly scattered, small groups of MPB-killed LPP and DF killed by DFB were noted to the northwest of Helena, toward Mullan Pass.

Numerous, mostly small 5- to 20-tree groups of PP, killed by MPB, were observed northeast of Helena, near Hogback Mountain and northward toward Mount Rowe, near the boundary between Helena and Lewis & Clark

NFs. Smaller, more widely scattered groups of PP, killed by MPB, were noted throughout the PP type. Throughout the district, beetle-killed PP were noted on 1,300 acres. Several groups of DF, killed by DFB, some as large as 30 trees were observed in the vicinity of stands affected by wildfires in 2000. Total DFB-infested area was about 140 acres. WBBB killed SAF on another 1,050 acres.

Lincoln RD. DFB-caused mortality in DF stands generally declined throughout the district, but in some areas beetle populations remained high and quite active. DFB-killed trees were observed in a few scattered locations, particularly in the Nevada-Ogden area, southwest of Lincoln. Several groups of DF, killed by DFB, were once again recorded in the Arastra Creek drainage, northwest of Lincoln. Elsewhere, groups were small and widely scattered throughout the district. Total affected area was approximately 1,300 acres.

MPB-caused mortality in some low-elevation PP stands was also observed. Most were small groups, well scattered throughout the type; however, larger groups were recorded on private land, just to the east of the Forest boundary in South Fork Dearborn River, Wolf Creek, and several nearby drainages. Those outbreaks covered several hundred acres. WBBB-killed SAF and LPP, killed by MPB, increased significantly in the upper Arastra Creek drainage, and east from there, nearly to Copper Creek. Those populations and resultant mortality appeared to be increasing rapidly. MPB activity was recorded on more than 3,500 acres and WBBB-infested trees were noted on 4,300 acres.

Throughout the Helena Reporting Area, and especially northwest of Helena, western spruce budworm populations are increasing significantly. Defoliation, coupled with prolonged drought, may result in increased amounts of DFB activity within the next few years. Area-wide survey estimates for bark beetle-caused mortality totaled: DFB 1,800 acres; MPB 12,800 acres; and WBBB about 6,350 acres.

Kootenai Reporting Area

Rexford RD. Small groups of DFB-killed DF were found in a widely scattered pattern on both the east and west sides of Lake Koocanusa. Notable concentrations to the west were found in the Big Creek and South Fork Big Creek drainages; while to the east, most were found in the Pinkham Creek drainage, especially near Virginia Hill. Total affected area was about 1,650 acres.

Also noticeable were groups of SAF, killed by WBBB, near Robinson Mountain, Red Mountain and Boulder Mountain. That mortality totaled nearly 650 acres. Other beetle-caused mortality was more widely scattered and small groups.

Fortine RD. DFB-caused mortality, in DF stands, increased somewhat over that noted in 2002. The most severely affected stands were located in the Galton Range, south of the US/Canada border; and along Gibraltar Ridge, south to Dickey Lake. South of there, larger groups were mapped near Louis Lake and above Stewart Creek. Many other, but typically smaller groups, were mapped from White Creek south to Shepherd Mountain. Others were found scattered generally throughout Sunday Creek and its tributaries. DFB-caused mortality totaled nearly 2,500 acres on FS and private land.

SAF mortality, caused by WBBB, was also prevalent at many locations on the district, but was observed less often than in 2002. One of the largest groups on the district was mapped east of Skillet Mountain, but it was much reduced from last year. Total for the district was more than 3,000 acres in 2002; but reduced to 1,100 acres in 2003.

Three Rivers RD. DFB continued to be the most significant mortality-causing agent throughout DF stands on the district. Most DF and other mixed-conifer stands were very generally infested by DFB from Bull Lake, northward to Idamont Creek, south of the Kootenai River. North of the River, small groups of DFB-killed trees were widely scattered in the southern portion of the Yaak River drainage. The most heavily infested areas were mapped in the Callahan Creek and Pine Creek drainages; however, it appeared that many DF stands were affected to a greater or lesser extent. Total affected area was about 2,500 acres; down from about 5,000 acres in 2002.

In the northern part of the Yaak drainage, combinations of MPB and blister rust continued to seriously affect WWP stands. Large-diameter and older trees are more impacted by MPB, whereas blister rust has affected stands of all ages. MPB-killed WWP was especially noticeable from Pine Creek on the south to Pete Creek on the north, where about 700 trees were killed on 650 acres. A few groups of MPB-killed LPP were noted throughout the Yaak drainage, with the largest groups still found in the vicinity of Newton Mountain. Those outbreaks accounted for about 6,500 dead trees on 2,550 acres. DFB-caused mortality was very widely scattered throughout the upper Yaak. Most fader groups were small, but total infested area was almost 2,500 acres.

Libby RD. As a result of continued unusually dry conditions, widespread and significant amounts of DFB-, MPB-, and FE-caused mortality was observed in mixed-conifer stands throughout the district. Beetle-killed groups were especially noticeable south of Libby in Libby Creek, Swamp Creek, and Fisher River drainages. While groups of beetle-killed trees were well distributed throughout their respective forest types, DFB-caused mortality was more prevalent from West Fisher Creek north to the Kootenai River, west of Libby Creek; and from the Fisher River drainage north to the Kootenai River east and north of Highway 2, as far east as Pleasant Valley. In that same area, significant amounts of GF, killed by FE, were recorded in 2003. Those groups were particularly noticeable near Reinhart Gulch, Tepee Lake, and south of Fisher River Siding.

Several additional groups of DF, killed by DFB, were mapped in the Cody Creek and Dunn Creek drainages, and near Richards Mountain and Warland Peak. Significant numbers of DFB-killed trees were also observed throughout the Wolf Creek drainage. DFB-infested stands on the district declined in 2003 to about 1,600 acres—down from nearly 9,300 acres in 2002.

While a few MPB-killed groups of LPP were noted from about Tepee Creek, north along Fisher River, they were much more noticeable south of Fisher River, towards the district boundary in 2002. Those populations declined somewhat in 2003. Other groups of MPB-killed LPP were mapped in the Bobtail Creek and Quartz Creek drainages, north of Libby. Totals for the district were more than 2,000 trees killed on about 900 acres.

North and east of Libby, still numerous groups of DFB-killed DF were noted throughout host type in the Purcell Mountains. Although prevalent, they were less than recorded in 2002. Other groups of beetle-killed trees, attributable to MPB (in LPP, PP, and WWP), DFB, WPB, and FE were widely distributed in fairly small, but numerous groups throughout the reporting area. FE infested about 700 acres.

Cabinet RD. Numerous, but relatively small groups of MPB-killed LPP and WWP, and DFB-killed DF, were mapped at various locations throughout the Vermillion River drainage. MPB-caused damage was more prevalent in the lower portion of the drainage, while DFB was more common in the upper. Several small groups LPP, killed by MPB, were found in the Swamp Creek drainage; DFB-caused mortality was more common from there, westward to the Bull River. In some mixed-species stands, MPB-killed WWP has increased from 2002 levels. In total, MPB killed host trees on about 800 acres of LPP type and another 40 acres of WWP.

DFB-infested DF stands were still common south of the Clark Fork River, from Little Beaver Creek, northwestward to Elk Creek; but at much lower levels than in the last several years. Most beetle-killed groups are now small and widely scattered. Districtwide about 1,300 acres were infested. Widely scattered small groups of MPB-killed LPP, PP, and WWP; plus noticeable amounts of SAF, killed by WBBB, and FE-killed GF also were found at several locations in that portion of the district south of the Clark Fork.

Total mortality attributed to bark beetles in the Kootenai Reporting Area was 14,300 DF killed by DFB on 11,000 acres; 2,270 GF killed by FE on 3,000 acres; 12,400 trees killed by MPB on 6,200 acres; and 3,200 SAF killed by WBBB on 2,600 acres.

Lewis & Clark Reporting Area

Rocky Mountain RD. District was not flown in 2002 and 2003.

Judith RD. Small and widely scattered groups of beetle-killed trees were mapped in the Highwood Mountains in 2003. Most were DFB-killed DF; however, isolated groups of LPP and PP, killed by MPB, were also noted. No significant concentrations were recorded, rather a generally light infestation throughout the reporting area, often associated with noticeable root disease centers. Total beetle-killed trees were 160 DF on 260 acres and 1,460 PP on 800 acres.

In the Judith RD portion of the Big Snowy Mountains, MPB-killed PP was found in a widely scattered pattern of small groups. Highest concentrations of fader groups were mapped in North Fork and South Fork of Flatwillow Creek. One of the larger groups was seen west of Lyons Butte.

On lands administered by BLM north of Lewistown, in the Judith, North Mocassin, and South Mocassin Mountains, many small groups of PP, killed by MPB, were mapped throughout forested stands. There appeared to be a significant increase in infested stands on lands of mixed ownership in 2003. Total infested area was almost 12,000 acres.

Musselshell RD. Very widely scattered and small groups of MPB-killed PP were mapped throughout the Big and Little Snowy Mountains. Largest groups were recorded near North Horsethief and Horsethief Canyons; and in the Willow Creek drainage, north and east of Posey Spring. Elsewhere, groups were very widely distributed. Most was on non-FS land and totaled about 270 acres. Noticeable pockets of root disease were recorded near Green Pole Canyon. Bark beetle activity is a likely associate in those stands. On the district, about 2,400 PP were killed on about 1,900 acres.

In the Crazy Mountains, numerous large groups of WBP, killed by MPB; and SAF, killed by WBBB, were mapped in high-elevation stands. Some of the largest groups were recorded near Mount Elmo, Virginia Peak, and above Box Canyon.

Kings Hill RD. Numerous large groups of MPB-infested PP were mapped throughout the Little Belt Mountains, at a significantly higher concentration than recorded in 2002. The largest groups were noted near Indian Gulch, above Tenderfoot Creek; in the Pilgrim Creek drainage, west of Monarch; Logging Creek drainage; and in the Tillinghast Creek drainage, east of Big Mountain. While other groups were not as large, there was a noticeable increase in the extent of beetle-infested stands throughout the reporting area, up to about 5,500 acres in 2003.

Also widely scattered throughout the Little Belt Mountains, DFB-killed DF was found in some stands. A few concentrated groups were mapped in the Tenderfoot Creek drainage, near Taylor Hills. In an area south of Kings Hill and west of Lost Fork Ridge, there were large groups of MPB-killed LP and WBP, as well as WBBB-killed SAF. Totals for the district were about 9,900 SAF killed on slightly fewer than 3,000 acres. Small and widely scattered groups DFB-killed DF also mapped throughout the district.

Area-wide mortality attributed to bark beetles in the Lewis & Clark Reporting Area totaled almost 1,600 DF on 1,300 acres; 29,500 pines on 21,300 acres; and 14,400 SAF on 6,700 acres. All those figures are up significantly from 2002.

Lolo Reporting Area

Missoula RD. Because of the fires of 2003 in western Montana, the Missoula RD was not flown in 2003. Bark beetle conditions noted in 2002 only increased in scope and intensity throughout the reporting area. Although not infested to the extent other stands on the Forest have been, LPP stands throughout the western portion of the District were generally found to contain smaller and more widely scattered groups of MPB-killed trees. Many DF stands, particularly in the Lolo Creek drainage, showed continuing DFB-caused mortality. Few groups were larger than about 30 trees, but they were fairly generally scattered throughout DF types. Stands in the Rattlesnake Creek drainage were similarly affected.

DF stands in Rock Creek drainage, on the other hand, showed still high amounts of DFB-caused mortality in 2002, and increased in 2003. Many large groups of faders, some up to 500 trees, were mapped from about Cinnamon Bear Point to the confluence of Rock Creek and Clark Fork River. The most significant amount of DFB-caused mortality was recorded in the Rock Creek drainage and totaled about 12,000 trees on 5,600 acres last year. In upper Rock Creek drainage—from about Pawnee Gulch to Squaw Rock—MPB-caused mortality in LPP stands became more noticeable. Bark beetle-killed trees elsewhere on the district were generally light and scattered. Ground surveys conducted in portions of Rock Creek drainage in 2003 showed still-high levels of DFB activity in many areas—notably the upper part of the drainage.

District totals in 2002 included 1,200 acres of MPB-killed trees in addition to the more than 5,600 acres of DFB-infested stands.

Ninemile RD. Also not flown in 2003. For the most part, MPB activity continued with only a slight lessening of intensity. While some of the LPP stands in the immediate vicinity of Siegel Pass showed decreasing amounts of MPB-caused mortality in 2002, many other stands throughout the district had markedly increased amounts of faded trees. Very large groups of beetle-killed trees were mapped from Stark Mountain, northwestward along the Ninemile Divide to Ninemile Peak. Large groups of dead LPP were also recorded near Josephine Peak, and in the Mill Creek drainage, to the east.

Elsewhere, large amounts of MPB-killed LPP and PP were recorded throughout the district. LPP and DF stands in the Fish Creek and Petty Creek drainages showed significant amounts of beetle-caused mortality; however, in those areas, it was generally smaller groups and more widely scattered. It appeared that most LPP stands, with any significant component of susceptible-size trees, anywhere on the district, were being affected by MPB. Total infested LPP stands on the district in 2002 covered nearly 24,000 acres on lands of all ownerships. DFB-caused mortality was found on but 365 acres.

Plains/Thompson Falls RD. Notable increases in the amount of MPB-killed LPP were recorded in many stands throughout this reporting area and the adjacent Superior RD again in 2003. These were trees that were killed in 2002; however, ground surveys showed populations are still increasing in many areas. In a few stands, there has been a decrease in beetle intensity, due to host depletion. But beetle populations continued to move into previously uninfested stands.

The largest polygons along the divide between the two districts were recorded near Brooks Mountain, Knox Pass, and Mount Bushnell. Those areas were still heavily infested, but there has been a slight decrease in outbreak intensity. Southeast of Thompson Falls in LPP stands the within Cherry Creek drainage, very large groups of MPB-killed LPP were mapped near Eddy Mountain and Sacajawea Peak. Those infested stands, too, have experienced decreasing intensity because many susceptible trees have been killed. More generally, LPP stands throughout the Coeur d'Alene Mountains from the confluence of the Flathead and Clark Fork Rivers, westward to the Montana/Idaho border were affected to some extent.

North of the Clark Fork River, within Thompson River drainage, LPP stands were also heavily impacted by MPB. The largest groups in that area were recorded near Cube Iron Mountain, Big Hole Peak, in the West Fork Fishtrap Creek drainage, and along Corona Divide.

Still other LPP stands west of Siegel Pass towards Keystone Peak and north to Siegel

Mountain, exhibited large groups of beetle-killed trees. More than 100,000 beetle-killed LPP have been recorded in that area alone.

Near Marmot Peak, and in other parts of upper Fish Trap Creek, stands of WWP have been seriously affected by a combination of blister rust and MPB. Infestations there have intensified. Elsewhere, MPB populations have killed significant amounts of LPP and PP in Thompson Creek and Little Thompson Creek drainages.

Widely scattered, in mostly small groups—but still important total amounts, DFB-caused mortality was observed throughout DF stands on the district. In noticeable, but considerably lesser amounts, MPB has killed WBP in some stands, and WBBB has contributed to the death of SAF.

Totals for the district and adjacent state and private lands showed MPB-killed trees on almost 50,400 acres; about 600 acres infested by DFB; 900 acres with WBBB-caused mortality; and about 50 acres infested by WPB.

Seeley Lake RD. Not flown in 2003, but MPB-caused mortality was still noticeable in LPP stands south of Seeley Lake, in the vicinity of Clearwater Lake, near Florence Lake. MPB-killed WBP, as well as damage caused by blister rust, was noted in several stands near Morrell Mountain. Those infestations intensified in 2003. Total for the district was about 250 acres of LPP-infested stands and another 720 acres of WBP with significant amounts of MPB-killed trees.

Elsewhere on the district, DFB-killed trees were much more noticeable in 2003. Stands in the Cottonwood Creek drainage and towards Morrell Peak were particularly heavily infested. Throughout the DF type on the district, DFB-caused mortality appeared to be increasing. About 430 acres, total, were reported in 2002. That figure probably increased significantly in 2003. WBBB-caused mortality was observed on about 50 acres in a few high-elevation SAF stands. Minor amounts of MPB-killed PP were also noted on the district, but a few larger groups were seen near Woodward.

Superior RD. Most of the district was flown in 2003. Large groups of LPP, killed by MPB, were mapped in Sunrise Creek and Quartz Creek drainages, southeast of Superior. Elsewhere, very large groups of MPB-killed LPP—some totaling hundreds of thousands of trees—were mapped near Van Ness Point, Mount Baldy, and Blacktail Mountain southeast of St. Regis; near Moon Peak and Up Up Mountain, west of St. Regis; and very generally scattered throughout the Twelvemile Creek drainage. The largest polygons in that general area were recorded near Brooks Mountain, Knox Pass, and Mount Bushnell—on the divide between Superior and Plains/Thompson Falls RDs. Very large groups were also mapped near Greenwood Hill and Camels Hump Lookout. Districtwide, more than 47,200 acres were infested. As noted previously, these outbreaks continued to expand in 2003, but in some of the areas that have been infested for several years, there was a general decrease in intensity.

Significant amounts of MPB-caused mortality were recorded in PP stands east of Superior, from Eddy Creek northwest to Sloway Gulch. Acres with noticeable amounts of PP mortality declined somewhat in 2003, but still totaled about 400 acres. At least some of that mortality is thought to be drought related. Ground surveys showed still-increasing populations in many areas. In some, host depletion has resulted in population declines; however, in a few areas surveyed, 2003 attacks averaged more than 120 per acre.

Throughout the Lolo Reporting Area—the most heavily impacted in the State (of which only about 35% was flown)—MPB-killed LPP was reported as totaling 555,300 trees on 94,100 acres; 3,7700 PP killed on 5,300 acres; 4,850 WBP on 2,800 acres; and 18 WWP on less than 10 acres. Although much less significant, DFB reportedly killed about 2,600 DF on 1,150 acres; WPB killed 620 PP on 530 acres; and WBBB accounted for 2,800 dead SAF on 1,300 acres. Because so little of the Reporting Area was flown, we are confident all those estimates are low.

Garnet Mountains (BLM)

Because of fire activity in western Montana, only the northern and eastern portions of the reporting area were flown. Some infested areas, noted in 2002, were not flown in 2003, but likely still exist.

Mostly small and widely scattered groups of bark beetle-killed trees were mapped throughout the Area. No significant outbreaks were recorded; however, the total number of groups of dead trees was notable. A few miles east of Bonner, MPB-killed groups of LPP were noted—some as large as 40 trees each. Along the Blackfoot corridor, to the east, MPB- and WPB-killed PP were numerous. Near Lost Horse Mountain, a developing MPB outbreak in LPP continued. In the upper portion of Elk Creek, several small groups of DFB-killed DF were recorded. Further to the east, in McElwain Creek drainage, MPB-infested LPP stands were noticeable. In a few higher elevation SAF stands, WBBB damage was apparent. To the east, especially near White Rocks, Gravely, and Luke Mountains, MPB-killed PP was prevalent.

In total, about 1,640 DF were killed on 920 acres; MPB killed approximately 850 LPP and 1,000 PP on a combined 800 acres; 20 WPB-killed PP were recorded on 30 acres; and 370 dead SAF on 240 acres were attributed to WBBB.

INDIAN RESERVATIONS

Blackfeet IR. The Blackfeet IR was not flown in 2001, 2002, or 2003.

Crow IR. Widely scattered, but mostly small groups of MPB-caused mortality, were recorded in PP stands in drainages the on eastern slopes of the Wolf Mountains, east of Lodge Grass. Heaviest concentrations were mapped in Kid Creek and Pass Creek drainages, south of Sioux Pass, with smaller groups mapped south to the WY border. To the north, MPB- and IPS-killed PP were mapped in Cache Creek, Corral Creek, and Thompson Creek drainages. Total infested area on the Reservation (including the Pryor Mountains) was 750 acres, on which an estimated 1,100 PP were killed.

Widely scattered, generally small groups of PP, killed by MPB, were found in the Pryor Mountains. Some groups of LP killed by MPB, and PP killed by IPS were also reported. Those totaled about 70 each. The largest concentrations of beetle-killed PP were found in Pryor Creek and East Pryor Creek drainages, as well as near West Pryor Mountain. At some higher elevations, WBBB had killed about 200 SAF on approximately 100 acres.

Flathead IR. Only the southern portion of the reservation was flown in 2003; however, that is where most of the MPB activity is taking place. Significant increases in the amount of LPP, killed by MPB, were noted there in 2002 and again in 2003. Most of larger groups of MPB-infested stands were mapped in the southwestern portion of the reservation—in an area roughly delineated by Highway 93, Highway 200, and the Flathead River. The largest groups of beetle-killed trees were recorded along the reservation/Lolo NF divide, from approximately Burgess Lake, southeastward to Saddle Mountain. Most of the mortality recorded was attributed to MPB, and most was in LPP stands. There were stands of PP also affected, and some trees were killed by IPS and WPB. Large groups of faders were observed in Magpie Creek, Revais Creek, and Hewolf Creek drainages. In 2002, beetle-caused mortality was reported to the east in Dry Creek and Pistol Creek drainages, and near McDonald Lake. While not flown in 2003, beetle activity is no doubt still present in those areas.

The remainder of the Reservation was not flown in 2003; however, bark beetles were unquestionably still active in the following areas—reported in 2002. In the northeast, MPB-caused mortality increased markedly from Hellroaring Creek, north to the Reservation boundary. Elsewhere, MPB activity in both LPP and PP stands was very generally scattered throughout the respective host types. Larger groups of LPP faders were noted south of Rainbow Lake, and significant amounts of PP mortality were observed in the

Revais Creek drainage and near Saddle Mountain.

In the interior of the Reservation, important amounts of MPB-caused mortality were found in PP stands near Sonyok Mountain, and northward into the Salish Mountains, west of Loon Lake; on Wild Horse Island; and near Black Lake.

Scattered throughout mixed conifer stands were noticeable amounts of mortality attributed to DFB, FE, and WPB. Some SAF stands in the upper Jocko River drainage experienced mortality caused by WBBB.

Total beetle-infested areas on the portion of the reservation flown included 50 DF killed on 15 acres; 30 PP killed by WPB on 15 acres; another 18,800 PP killed by MPB on 4,450 acres; and about 3,700 PP killed by IPS on 1,800 acres. WBBB-caused mortality accounted for 50 dead SAF on 10 acres. The most significant damage recorded was the 185,500 LPP killed by MPB on nearly 28,300 acres. Again, those estimates do not reflect damage that likely occurred in portions of the Reservation not flown.

Fort Belknap IR. Conditions were little changed from those observed in 2002. Very widely scattered and generally small groups of MPB-killed PP were mapped across the Reservation. Groups ranged in size from 1-90 trees, with concentrations noted near Thornhill Butte, Landusky, in the Little Rocky Mountains, and within Beaver Creek and Lodgepole Creek drainages. A few small and isolated groups of LPP, killed by MPB, were also observed near Mission Ridge. About 325 PP were killed on just under 200 acres. Another 100 LPP were killed on about 50 acres.

Northern Cheyenne IR. Not flown in 2003. The very widely scattered and small groups of PP, killed by IPS and MPB, noted throughout the forested areas of the reservation in 2002 continued. Heaviest concentrations of MPB-killed trees were mapped in Trail Creek and Skunk Creek drainages, south of Busby; but there were noticeable groups of IPS-killed trees there, as well.

In the eastern part of the reservation, south and east of Lame Deer; larger and less widely scattered groups of IPS-killed PP were noted. Area affected by IPS totaled 445 acres in 2002, on which about 1,060 trees were killed. MPB killed another 1,300 PP on 720 acres.

Rocky Boys IR. A few widely scattered, mostly small groups of PP, killed by MPB, were mapped throughout the forested area of the reservation flown in 2003. Largest groups were observed in the Eagle Creek, Sandy Creek, and Beaver Creek drainages; however, they were much less significant than LPP stands infested by MPB. In recent years, much less MPB-killed LPP has been recorded; but in 2003 numerous groups, some of up to 500 trees each, were recorded in the southwestern portion of the reservation. Largest groups were mapped near Centennial Mountain, Black Mountain, and east of Salt Coulee. Other small groups were mapped within the Eagle Creek drainage. Active management efforts have been implemented to reduce beetle-caused mortality.

Nearly 2,050 beetle-killed LPP were mapped on about 1,100 acres; and another 130 PP on 70 acres. There may have been more beetle activity in PP stands than reflected in this year's estimates. DFB killed about 40 trees on 30 acres.

NATIONAL PARKS

Glacier NP. The park was not flown again in 2003 due to several fires that burned for much of the summer. In 2002, along the southern boundary, almost 100 acres of LPP stands were noted to contain MPB-killed trees. In that same area about 50 DF, on 15 acres, were killed by DFB. Those outbreaks likely continued.

Yellowstone NP. An area east of Yellowstone Lake was not flown because of wild fires. Large groups of WBBB-caused mortality were mapped in SAF stands throughout the Gallatin Range, in northwest portion of the park. Largest groups were noted near Little Quadrant Mountain, Quadrant Mountain, Electric Peak, and Antler

Peak. In that same general area, several large groups of WBP, killed by MPB, were also recorded. In the north central part of park, from the Gardiner River east to Coyote Creek, numerous but small groups of DFB-killed DF were observed. Elsewhere in the northern portion of the park, numerous small groups of WBP and LPP, killed by MPB, were widely scattered. A few larger groups of the former were noted near Mount Washburn, Frederick Peak, Mount Hornaday, and Amethyst Mountain. The most expansive and intense of those outbreaks is south and east of Mount Washburn.

The most significant groups of beetle-killed trees in the Park were the large groups of ES, killed by ESB, in Columbine, Beaverdam, and Rocky Creek drainages, east of Yellowstone Lake. That outbreak expanded from the area infested in 2002. In the southeastern portion of the park, large groups of WBP, killed by MPB; and SAF, killed by WBBB were observed. The largest groups of the former were on the Two Ocean Plateau. Those conditions also worsened in 2003.

Throughout the rest of the park, widely scattered and mostly small groups of SAF, LPP and WBP faders were mapped. More significant amounts of SAF mortality, attributed to WBBB, were noted along Big Game Ridge and in the upper Snake River drainage, east of the park's south entrance.

Beetle-killed totals for the park included 3,300 DF—attributed to DFB on 1, 130 acres; 18,060 ES on 8,750 acres killed by ESB; 1,010 LPP on 700 acres killed by MPB; 27,900 WBP killed by MPB on 15,100 acres; and finally, 10,500 SAF were killed by WBBB on 6,390 acres. The biggest increases were noted in ESB and MPB activity.

DEFOLIATORS

Western Spruce Budworm

Western Spruce Budworm (*Choristoneura occidentalis* Freeman) was responsible for a large percentage of the widespread and heaviest defoliation. Other defoliating insects were more localized and affected less acreage, but none appeared not to have declined or subsided to an undetected level. Overall, native and non-native defoliator populations in Montana have been increasing in recent years. This trend has been expected due to abnormally dry conditions for the past few years that are typically conducive to insect population growth. Drought conditions cause tree stress and shift tree resources increasing their susceptibility to defoliator attack. Trees experiencing continual annual defoliation may be unable to recover from repeated attacks and become further stressed, potentially dying.

Population levels for this native insect have been increasing since 1999 and are currently regarded in outbreak status in some areas. Aerial detection surveys show a total of 124,142 acres were defoliated by budworm alone in 2003. This figure could be much greater because some areas of possible defoliation were not flown due to the fires of 2003 in Montana. Previously damaged stands from last year have grown in size into large landscape masses as seen from aerial survey. In Bridger Range, on Gallatin National Forest, defoliation has expanded from 15,000 acres in 2002 to 56,004 acres in 2003 – the highest concentrations in the state. Moderate to heavy defoliation was noted in the overstory, with heavy to complete defoliation on understory hosts. Nearly 30,000 acres in the Helena National Forest were defoliated, mostly concentrated at Fleicher Pass and Stemple pass in the western half of the forest. In the Beaverhead-Deerlodge National Forest there was very high defoliation that continued from last year. When defoliation can be seen by aerial survey, conditions on the ground are most often more severe. Ground surveys and monitoring trap catches on Fleicher Pass confirmed that budworm populations are very high due to heavy defoliation noted on understory trees. Ground surveys in various locations across the state observed budworm activity where little to none had been detected in previous years. Aerial and ground surveys suggest that where defoliation is moderate to high, additional damage will continue and even increase by 2004.
Detailed examinations of spruce budworm monitoring plots across western Montana,

showed combined defoliation over Montana was not severe, despite extreme defoliation in some areas. Monitoring collection traps hung in all plots caught little to no moths per trap except for the Beaverhead-Deerlodge and the Helena National Forests (1,729 and 584 moths, respectively). Large tree mortality observed on plots was attributed to fire, Douglas-fir bark beetle (*Dendroctonus pseudotsugae* Hopkins), or root disease. A large percentage of understory host trees less than 5” diameter-at-breast height, were dead in permanent plots. However, mortality due to defoliation was not the cause. Permanent plots will be thoroughly re-evaluated in 2004 due to higher than normal population levels. If weather conditions continue as in recent years, budworm populations will significantly rise and cause more widespread defoliation.

Douglas-fir Tussock Moth

Some additional defoliation of Douglas-fir by Douglas-fir tussock moth occurred in 2003 on approximately 200 acres of private land in the vicinity of Loon Lake, Northwest of Polson, which was heavily defoliated in 2002. The population appears to have declined substantially in that area. Several blue spruce in a wind break on private land northwest of Polson were heavily defoliated in 2003. This location was not far from the Loon Lake infestation.

.

Several groups of mature Douglas-fir on the National Bison Range displayed not only severe defoliation from a distance, but completely bare tops upon closer inspection.

Monitoring Douglas-fir tussock moth population levels by means of pheromone-baited sticky traps to catch adult males has been done in western Montana since 1979. Traps have been placed at 33 permanent plots. The nearest plot to the 2002 defoliated area was near Jette Lake, a few miles to the southwest. In 2002, trap catches at this plot averaged 72.6 moths per trap, a substantial increase from 2001 levels of 50.0 moths per trap. Catches at this plot in 2003 declined to 15.6 moths per trap. Trap catches at most of the other plot locations also decreased in 2003 over the 2002 levels. Because of fire closures and ongoing forest fires, traps could not be placed as early in the flight period as desired on some of the plots, and this may have been a factor that affected the numbers of moths caught on these plots.

Plot locations where the most moths were caught and numbers of moths were: Jette Lake (15.6); Pistol Creek (11.4); Pattee Canyon (6.6) and Big Arm (5.0)

Table 1. Douglas-fir tussock moth trap catches western Montana 1995-2003

Average number of male moths per trap.

Plot	Location	1995	1996	1997	1998	1999	2000	2001	2002	2003
Albert Creek	14N, 21W, S16	0.0	0.0	0.0	0.0	0.4	1.2	3.2	2.6	0.0
Arlee	16N, 20W, S1	0.0	0.0	0.0	0.0	1.6	0.8	4.6	7.0	0.0
Big Arm	24N, 21W, S36	0.0	0.2	0.0	0.0	0.0	0.8	13.0	30.0	5.0
Big Fork	27N, 19W, S36	0.0	0.0	0.0	0.0	0.0	2.2	0.4	0.0	0.0
Blue Mountain	13N, 20W, S34	0.0	0.0	0.0	0.6	1.2	0.4	10.8	18.0	0.0
Butler Creek	16N, 23W, S24	0.0	0.2	0.0	0.0	0.4	2.8	8.4	9.6	0.0
Clear Creek	19N, 24W, S26	0.0	0.0	0.0	0.0	0.4	*	0.6	1.2	0.0
Corral Creek	15N, 22W, S36	0.0	0.0	0.4	0.0	0.6	0.8	1.0	2.4	0.0
Ferndale	27N, 19W, S32	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.0
Fish Creek	14N, 24W, S6	0.0	0.0	0.0	0.0	0.0	1.0	0.4	0.0	0.0
Foys Lake	28N, 22W, S36	0.0	0.0	0.0	0.0	0.0	0.0	3.4	0.6	0.2
Frenchtown F	14N, 21W, S10	0.0	0.0	0.0	0.0	0.4	0.4	0.8	0.4	0.0
Frenchtown J	14N, 21W, S22	0.0	0.0	0.0	0.0	0.2	1.6	2.4	6.8	0.2
Frenchtown T	14N, 21W, S23	0.0	0.0	0.0	0.4	0.0	1.4	4.8	12.8	0.0
Jette Lake	23N, 21W, S2	0.0	0.8	0.0	0.4	2.0	6.0	50.0	72.6	15.6
Kerr Dam	22N, 21W, S13	0.0	0.0	0.0	0.2	0.4	8.6	22.8	27.4	0.0
Lake Mary Ronan	25N, 22W, S23	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Lakeside	26N, 20W, S6	0.0	0.0	0.0	0.2	0.0	2.2	0.6	0.0	0.0
Lolo Creek	11N, 20W, S6	0.0	0.0	0.2	0.0	0.0	1.0	2.6	0.2	0.0
Pattee Canyon	12N, 19W, S12	0.0	0.0	0.0	0.2	0.0	1.2	8.6	20.6	6.6
Petty Creek	14N, 22W, S19	0.0	0.0	0.2	0.0	0.8	9.8	7.6	4.6	0.0
Pistol Creek	18N, 20W, S35	0.0	0.4	0.4	1.2	63.6	13.8	55.8	62.2	11.4
Polson-Big Creek	22N, 19W, S21	0.0	0.0	0.0	0.0	0.6	0.2	3.4	5.2	0.2
Polson-Hell Roaring	22N, 19W, S33	0.0	0.0	0.0	0.0	0.0	2.0	0.8	0.4	0.0
Polson-Lost Lake	22N, 19W, S17	0.0	0.0	0.0	0.2	0.2	3.4	4.6	3.4	0.0
Revais Creek	17N, 22W, S4	0.0	0.0	0.0	0.0	0.8	1.6	1.6	2.2	0.0
Rocky Point	23N, 20W, S4	0.0	0.0	0.2	0.0	0.6	1.4	21.6	30.0	0.6
St. Mary Lake	18N, 19W, S35	0.0	0.0	0.2	0.0	0.0	1.0	4.4	0.8	0.0
Skidoo Bay	23N, 19W, S2	0.0	0.0	0.0	0.0	0.0	0.2	0.6	6.0	0.2
Smith Camp	25N, 20W, S8	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.2	0.4
Somers # 1	27N, 21W, S27	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.2
Somers # 2	27N, 20W, S26	0.0	0.0	0.0	0.0	0.0	1.4	1.6	1.0	0.0
Worden Creek	12N, 20W, S21	0.0	0.0	0.0	0.0	0.0	0.2	0.0	1.2	0.0

Gypsy Moth

Cooperative detection monitoring for the European gypsy moth in Montana with the Animal and Plant Health Inspection Service (APHIS), Montana Department of Agriculture, and Montana Department of Natural Resources and Conservation (DNRC) continued in 2003. Detection surveys consist of pheromone-baited traps that are placed strategically throughout the state, mostly in high traveled areas. Monitoring will continue in 2004.

Other Defoliators

Besides western spruce budworm and Douglas-fir tussock moth, only two other defoliators caused noticeable damage. Western False Hemlock looper (*Nepytia freemani* Munroe) was detected on 703 acres in the Flathead National Forest, Flathead Indian Reservation, and Crow Indian Reservation. This looper caused a significant amount of heavy defoliation in this same area on the Flathead National Forest last year, but ground surveys were not conducted to look for possible mortality. However, overall damage has decreased since last year. Pine Sawfly

(*Neodiprion nanulus contortae* Ross) was only detected in the Gallatin National Forest damaging 236 acres in Ponderosa pine dominated forests.

DISEASES

Root Diseases

Root diseases are the most significant disease agents of mortality and growth loss in Montana, mostly west of the Continental Divide. Because root diseases are diseases of the site, we see very little changes occurring from one year to the next. The most significant root diseases in Montana are Armillaria root disease (*Armillaria ostoyae* (Romagn.) Herink), laminated root disease (*Phellinus weirii* (Murr.) Gilb.), annosum root disease (*Heterobasidion annosum (*Fr.) Bref.), and brown cubical root and butt decay (*Phaeolus schweintizii* (Fr.) Pat.). The most susceptible tree species in Montana is DF, with GF and SAF taking a close second. The most tolerant species are WL, pines and western red cedar, with the remaining species falling somewhere along the gradient between susceptible and tolerant. Although root diseases cause significant amounts of mortality and growth loss, they are also a major agent influencing both structure and species composition across landscapes. Root diseases have greatly influenced succession of vegetation in our forests. This is especially evident in the absence of natural fire cycles. On sites where there is a mixed species component with root disease tolerant serals, root diseases tend to prolong the seral stage on those sites. Root diseases slowly thin out the more root disease-susceptible species (Douglas-fir and true firs), and favor the root disease-tolerant serals.

On GF/SAF climax habitats, with a DF forest type, low levels of root disease will actually push the stand towards climax faster than in the absence of root disease. This is due to the greater susceptibility of DF to root diseases. Although grand fir and subalpine fir are fairly susceptible to root diseases, they are measurably more tolerant than DF. Root disease on western red cedar/western hemlock climax sites will also push stands towards climax by weeding out the more root disease susceptible seral species on these sites (DF and GF).

On sites with a root disease susceptible forest type and climax habitat, very high levels of root disease will maintain early stand development. Root disease patches experience wave after wave of mortality as trees become large enough for their root systems to contact the inoculum on the site. Trees are unable to grow to a very large size before being killed by root disease.

Mortality from Douglas-fir bark beetle (DFB) continues to be high in various spots in Montana, which has raised some issues regarding management for DFB beetle in root diseased areas. DF infected with root disease often harbors endemic levels of DFB which likely aids in the rise of the DFB populations during an outbreak.

Annosum root disease of PP is less evident than the above root diseases, but very important in local areas. It has been found causing mortality in ponderosa pine plantations in various locations on the Darby RD, Bitterroot National Forest, private lands west of Kalispell, and continues to be a significant agent on the Flathead Indian Reservation.

Black stain root disease (*Leptographium wageneri* (Kendrick) M.J. Wingfield) was found at two different sites outside of Bozeman in 2003. At these two sites, it was associated with declining Douglas-fir. The fungus was isolated and sent to Dr. T.C. Harrington at Iowa State University and positively identified as *Leptographium wageneri* var. *pseudotsugae* T.C. Harrington & F.W. Cobb. Although black stain root disease can be a significant disease in other parts of the country, we have never considered it a significant agent in Montana. We have no plans to formally monitor these two sites, but we will increase our search efforts for this disease.

White Pine Blister Rust

White pine blister rust is an introduced pathogen of western white pine that has been present in western North America since the 1920's. Blister rust spread quickly throughout the natural range of western white pine in the northwest United States with devastating impact. By the mid-1960's initial control efforts, such as Ribes removal and chemical control, had been abandoned. Harvest of white pine was accelerated because managers thought that little would survive.

A tree breeding program, in place since the early 1950's, has utilized low levels of naturally occurring rust-resistance in western white pine to produce rust-resistant planting stock. This stock has been used operationally for approximately the last 15 years, and is the basis for restoration of western white pine. Rust-resistant white pine is utilized, among many places, on the Kootenai, Lolo, and Flathead National Forests, and the Stillwater and Swan State Forests in western Montana. Initial predictions for performance of the rust-resistant white pine were that 65% or more of the trees would remain canker-free. However, monitoring studies in operational plantations in Idaho are showing that infection levels of the rust-resistant stock are highly variable by site, ranging from zero to 95%+. The relation of current infection level to future mortality in rust-resistant white pine is not known; continued monitoring of operational plantations will be required in order to answer this and other key management questions.

In order to address this and other issues involving the performance and management of rust-resistant white pine, a three-day conference of geneticists, pathologists, silviculturists, and ecologists was held in October, 2002, in Coeur d'Alene, ID. As a follow-up to that conference, two-day workshops were then offered in order to update forest managers on the latest information regarding performance and management of rust-resistant western white pine in the Inland Empire. Approximately 55 foresters from private industry and federal and state agencies attended the two workshops that were offered in 2003; two more workshops will be offered in the summer of 2004. A one-day workshop titled "Pruning for White Pine Blister Rust" is also offered each summer through University of Idaho Forestry Extension.

In addition to western white pine, blister rust infects other native species of five-needle pines such as whitebark and limber pine. The effects of blister rust on whitebark pine ecosystems took longer to appear than in the western white pine forest type, but apparently have the ability to be equally devastating. The combined effects of blister rust and mountain pine beetle have caused extensive areas of whitebark pine mortality, raising concerns about the long-term viability of whitebark ecosystems and the resultant effects on whitebark-dependent species such as grizzly bear and Clark's nutcracker. There is currently an effort underway to compile the various surveys on the status of whitebark pine and blister rust that have been done in the western United States. A training workshop, sponsored by the Whitebark Pine Ecosystem Foundation, will take place in June of 2004. The purpose of this workshop is to teach identification of blister rust on whitebark pine, as well as standardized monitoring techniques for future surveys.

Dwarf Mistletoes

Dwarf mistletoes (*Arceuthobium* spp.) are parasitic plants that extract water and nutrients from living conifer trees. The dwarf mistletoes are native components of western coniferous forests, having co-evolved with their hosts for millions of years. The different dwarf mistletoes are generally host specific. In Montana, lodgepole pine and larch dwarf mistletoes occur throughout the range of their respective hosts while Douglas-fir dwarf mistletoe occurs only in the range of its host west of the Continental Divide.

Because dwarf mistletoes are obligate parasites, ecological forces that have patterned the development of the host tree species have also played roles in influencing the distribution of dwarf mistletoes across the landscape. Fire is one of those influential ecological forces. In general, any fire event that kills host trees will reduce the population of dwarf mistletoes, at least in the short term. The larger and more continuous the fire disturbance, the greater the reduction in dwarf mistletoe populations at the landscape level. Large, complete burns will greatly reduce dwarf mistletoe populations across the landscape and may even eliminate small, localized populations. Small, “patchy” burns will temporarily reduce portions of dwarf mistletoe populations, but infected residuals provide a ready source of dwarf mistletoe seeds for the infection of the newly developing regeneration.

Human influences, including fire suppression and logging, have also had effects on dwarf mistletoe population dynamics. Partial cutting, which created multi-storied stands, and fire suppression may have served to increase the severity of dwarf mistletoes relative to the “pre-settlement” condition. Conversely, dwarf mistletoes may have been reduced in certain age classes, habitat types, elevation zones or topographic positions that have been intensively managed. Fire suppression and cutting practices that have encouraged shifts in species compositions could have either increased or decreased the disease severity depending on what species of trees and dwarf mistletoes occurred on any given site.

The parasitic activity of dwarf mistletoes causes reduced tree diameter and height growth, decreased cone and seed production, direct tree mortality, or predisposition to other pathogens and insects. Western larch and Douglas-fir dwarf mistletoes have been estimated to cause average growth losses of 20 ft^3/acre/year in areas where they occur in Montana. Lodgepole pine dwarf mistletoe has been estimated to cause an average growth loss of 9 ft^3/acre/year in eastern Montana and 12 $ft.^3$/acre/year in western Montana. On the other hand, witches’ brooms and tree mortality may result in greater structural diversity and increased animal habitat. Dwarf mistletoe flowers, shoots, and fruit are food for insects, birds, and mammals. Witches’ brooms may be used for hiding, thermal cover, and nesting sites by birds and mammals. In the long term, heavily infested stands of the host trees can begin to decline, resulting in a successional shift toward other tree species.

In 2003, dwarf mistletoe suppression activities were proposed on 750 National Forest acres in Montana. Treatments were accomplished on more than 950 acres associated with these suppression proposals.

Heartwood Stem Decays

The main function of heartwood in live trees is to give individual trees vertical stability. The decay of heartwood weakens this vertical stability, making trees more susceptible to stem breakage. Stem breakage can lead to mortality and subsequent formation of small-scale canopy gaps. The main successional functions of heartwood stem decays are to move stands from a mature closed canopy to a more open canopy and to perpetuate an open canopy.

Stem decays are important in the creation of wildlife habitat in living trees. Although primary cavity nesters are capable of excavating in sound wood, they selectively excavate in trees and snags with heartwood decay. Most primary cavity nesters do not reuse their holes from one year to the next. Their previous year’s holes are then used by a multitude of secondary cavity nesters, which are very dependent on already-created holes for successful reproduction. Thus, cavity-nesting habitat (i.e., heartwood decay) is necessary for the successful reproduction of a number of animal species.

Heartwood decay fungi are also necessary for the formation of hollow trees, which are also important habitat for a number of animal species. Hollow trees are created when decay fungi invade the heartwood of a living tree. The decay may progress to the point that the cylinder of decayed heartwood eventually detaches from and slumps down, leaving a hollow chamber. The only way to obtain a hollow dead tree or log is to start with a living tree hollowed out by decay.

Foliage Diseases

Most fungi causing foliage diseases are confined to the needles and leaves, a few attack buds, and some invade young twigs. Foliage diseases are generally more severe in the lower canopy on seedlings, saplings, and small poles than on larger trees. Most of the fungi affect either foliage of the current season or older foliage, but rarely both; it is unusual for all the foliage in either category to be involved. The fungi vary in pathogenicity from year to year according to climatic conditions; heavy infection over a period of years is exceptional. Some trees in a stand are severely infected, but others escape with little or no infection, apparently because of individual resistance. Foliage diseases rarely cause mortality, but they do cause a reduction in growth.

Larch needle disease was identified on 33,143 acres of western larch in the Kootenai and Flathead reporting areas during the aerial detection survey of 2003. Larch needle blight was confirmed during several site visits to the Kootenai National Forest. Affected trees had reflushed by late summer, but needles on spur shoots were shortened and chlorotic. Epidemics of larch needle diseases (larch needle blight and/or larch needle cast) have been reported in the Northern Region about every ten years since 1913. Two years of complete infection can kill spur shoots. Several years of heavy damage (>70%) may lead to tree mortality, but this is uncommon. Growth loss is probably the greatest effect of this disease.

Elytroderma needle blight

Elytroderma needle blight (*Elytroderma deformans* (Weir) Darker) is the most damaging foliage disease on ponderosa pine in Montana. The fungus infects and kills needles, but also invades twigs and causes localized brooms. Spores of the fungus mature in late summer and fall and are dispersed when the needles are wet.

The fungus can live from year to year in invaded bark, so the disease can be perpetuated without conditions favorable for either spore production or infection of new needles.

Localized areas of heavy infection from Elytroderma needle blight were again seen across western Montana in 2003. Elytroderma has been heavy in several locations in Montana for a number of years: Jette Lake area north of Polson, Bitterroot Valley south of Missoula, and the Belt Creek Canyon east of Great Falls.

Sphaeropsis (Diplodia) shoot blight and canker

Sphaeropsis shoot blight and canker (also known as Diplodia shoot blight) is caused by the fungus *Sphaeropsis sapinea* (Fr:Fr) Dyko & Sutton in Sutton. The disease is seen mainly on ponderosa pine in Montana, but other species can be affected. Damage occurs on current year's growth in the spring as evidenced by needle stunting, discoloration, and shoot dieback. Needles turn a straw-like color, then red as the shoot dies and dries out. Resin droplets often exude from the base of infected needles. Cones are infected by the fungus and act as a source of inoculum each spring as spores are spread to new growth by rain-splash. Severity of infections on ponderosa pine varies. In the most susceptible trees, nearly all current-year shoots can be infected, and chronic infections can result in non-vigorous crowns and occasional top-kill. In less susceptible trees only scattered shoots are affected, while some ponderosa pine appear to be resistant and without visible infections. Patterns of infection within a tree's crown vary as well; there may be numerous dead shoots on one side of a tree and few if any on the other. Observations suggest that ponderosa pine along river bottoms and major drainages may have heavier levels of *Sphaeropsis sapinea* infection, perhaps due to airflow patterns or other environmental conditions.

Western gall rust and Sphaeropsis shoot blight

Casually attributing shoot dieback on ponderosa pine to Sphaeropsis shoot blight may lead to an incomplete or incorrect diagnosis. Informal surveys show that western gall rust infections are commonly present towards the ends of branches with shoot dieback, although there is no reason that western gall rust and Sphaeropsis shoot blight cannot be present on the same branch. In fact, even small amounts of water stress increase damage caused by *Sphaeropsis sapinea*, and western gall rust infections may be causing stress in portions of the branch distal to even small rust galls. Combined damage from Sphaeropsis shoot blight and western gall rust continues to cause noticeable dieback of ponderosa pine shoots. Low levels of damage can currently be seen throughout western Montana. Moderate to severe damage occurs in certain locations.

DECLINES

Limber Pine Decline and Mortality

Data collected recently from permanent plots in the Lewis and Clark National Forest showed that much of the mortality there was associated with high levels of defoliation caused by the foliar pathogen *Dothistroma septospora* followed by several years of drought. White pine blister rust increased in these plots from 1995 to 2002. Some mortality in the plots was also attributed to competition-related stress. The previously mentioned problems, in addition to winter injury, were observed in limber pine at scattered locations across central and eastern Montana.

Subalpine Fir Mortality

Subalpine fir mortality across western Montana remained high in 2003. Much of the mortality occurred from varying combinations of root diseases, bark beetles, and possibly other factors. The most significant factor, however, is thought to be mortality directly or indirectly caused by western balsam bark beetle. Over 200,000 trees were killed by WBBB on nearly 150,000 acres in 2003. The pathogenic fungus carried by western balsam bark beetle, *Ophiostoma dryocoetidis*, appears to cause mortality even when trees are only lightly attacked by the beetles.

Aspen Mortality

Current aspen numbers in Montana are estimated at only one-third of historical numbers. In 2003, mortality was reported on 1,435 acres in the Crow IR, Gallatin, Lewis and Clark, and Rocky Boys IR reporting areas. Aspen does not compete well in low-light environments and requires canopy-opening disturbances, such as fire, to regenerate. Without regeneration, stands of this short-lived tree species are expected to become decadent and deteriorate. Reductions of Montana aspen forests are believed to be largely due to fire suppression activities over the past 100 years; however, this supposition needs further investigation.

ABIOTIC

Herbicide

Mature ponderosa pines have shown substantial needle discoloration and loss in campgrounds where herbicides containing picloram have been applied to control certain noxious weeds. Additional symptoms included curling of small branches and needles, swollen terminal growth, and tree mortality. Trees and broadleaved shrubs with growth regulator-like injury symptoms were in or adjacent to areas where the herbicide had been applied. Tissue analysis has not been done to show presence of picloram or other herbicide ingredients in the affected trees, but it should be noted that labels for some herbicide formulations containing picloram claim control of pine, Douglas-fir and spruce.

Drought

Montana has been experiencing a drought for the past four years. Foliage discoloration, reduced growth, top dieback, branch dieback, and overall decline were seen on various tree species across the state.

Hazard Tree Management in Recreation Sites

FHP has increased its efforts to provide technical assistance to land managers in hazard tree management in recreational areas. A form is available to help managers evaluate trees and properly document on-going hazard tree management programs. FHP provides training in using the form and other aspects of hazard tree management, including comprehensive vegetation management.

A national database has been developed to identify the most common factors associated with tree failures. FHP will be taking on a greater role in 2004 to facilitate the use of this database in Montana. If this database is adequately supported and successful in the information gained, educational materials will be developed to help resource managers in decision-making related to hazard trees.

Anyone requesting training or other assistance with hazard tree management should contact Marcus Jackson (406-329-3282) or Blakey Lockman (406-329-3189).

Nursery Diseases

During 2003 the most severe problems on forest tree seedlings at nurseries in Montana were root and stem diseases incited by several species of Fusarium. Fusarium species can cause important diseases on both bareroot and container-grown seedlings. The most important diseases include damping-off of young germinants and root diseases of older seedlings. Stem disease caused by Fusarium on container-grown ponderosa pine seedlings at one Montana nursery was less severe than during 2002. Nursery managers were proactive with timely applications of fungicides and an ambitious sanitation program.

Other important root pathogens include *Cylindrocarpon* spp. and *Pythium* spp. *Cylindrocarpon* spp. are primarily pathogens of container-grown western white pine seedlings whereas Pythium usually damage many different conifer and hardwood hosts in bareroot nurseries.

Botrytis cinerea is an important foliar pathogen which is especially damaging in container nurseries. Western larch and Engelmann spruce are especially susceptible and some level of damage occurs annually. This pathogen is also important in causing molding of seedlings during cold storage. Other important pathogens of conifer seedlings include *Sphaeropsis sapinea*, *Sirococcus conigenus* and *Phoma eupyrena*, all causing tip dieback diseases on *Pinus* spp. Most tip dieback diseases occur at endemic levels each year; occasionally disease outbreaks occur because of prolonged cool, wet conditions during the spring and early summer.

Tests to develop alternatives to pre-plant soil fumigation with methyl bromide/chloropicrin for production of bareroot seedlings were initiated in the early 1990s. Several tests have been conducted in bareroot nurseries in the inland Pacific Northwest. Production of high-quality seedlings without pre-plant soil fumigation has occurred in several nurseries for many years. Alternatives include crop rotation and fallowing supplemented by application of selected organic amendments. Incorporating green manure crops (particularly *Brassica* spp.) to maintain soil organic matter, improve soil tilth and reduce disease severity have not been successful in forest nurseries during several trials. Adding a biological control agent (*Trichoderma harzianum*) may help improve efficacy of fumigation-alternative treatments. A large trial involving several container nurseries was initiated during 2003 to determine if this biocontrol agent (commercially available as T-22 Root Shield®) is effective against root pathogenic fungi under greenhouse conditions.

Tests were concluded in conjunction with the Missoula Technology & Development Center to evaluate several treatments designed to reduce levels of pathogenic fungi within reused styroblock containers. Dry heat and radio frequency waves were promising as alternatives to submersion in hot water and chemical sterilization treatments.

A study to genetically characterize populations of *Fusarium oxysporum* from forest nurseries was initiated in cooperation with the Rocky Mountain Research Station, Moscow, ID. This work will include evaluating the genetic diversity of fungal populations and develop molecular markers that might be used to differentiate pathogenic from non-pathogenic isolates of this important potential pathogen.

Tree Improvement Plantation Diseases

Tree improvement plantations in Montana were damaged by foliage diseases at various levels during 2003. The most damaging diseases were caused by *Lophodermella concolor* on lodgepole pine, *Meria laricis* on western larch and *Rhabdocline pseudotsugae* and *Phaeocryptopus gaumannii* on Douglas-fir. These diseases mostly impacted tree growth. Direct disease control with pesticides was implemented to ameliorate disease effects because of the importance of growth in selecting individual trees for tree improvement. Other diseases of roots and/or stems were generally less important. One exception was extremely high levels of western gall rust (*Endocronartium harknessii*) on lodgepole pine at the Big Creek Tree Improvement site (Lolo National Forest). This site also had extensive western white pine mortality due to below freezing temperatures during the growing season

SPECIAL PROJECTS

1. Changes in Fire-Killed Western Larch

Research concerning the deterioration of fire-killed western larch is limited. This ten-year study, with multiple size classes, will provide more information about losses in lumber and fuelwood values than previous studies. Wildlife biologists have shown interest in learning more about how changes in fire-killed larch relate to wildlife use. Others may find this study useful in projecting down woody fuel loads on burned larch sites.

The study includes four size classes (8” to 11.9” d.b.h., 12” to 15.9” d.b.h., 16” to 19.9” d.b.h., and 20+” d.b.h.) spread over five locations within the boundaries of the 2001 Moose Fire. Ten trees in each size class will be randomly selected and dissected 1, 2, 3, 5, 7, and 10 years after the fire. Checks, woodborers, wood stain, decay and other factors will be measured after the trees are cut down. Twenty trees will be left uncut for each size class as “longevity snags” to continue monitoring for conk development and snag longevity.

Second year data were collected in October 2003. Data are currently being analyzed. Checks, wood borer-caused damage, and sapwood decay all increased substantially between one and two years after the fire. A report of first and second year findings will be available Spring 2004

2. Larch Dwarf Mistletoe Remeasurements

Larch dwarf mistletoe plots established in 1991 and re-measured in 1996 on the Flathead Indian Reservation were remeasured in 2003. The objectives of this study are:

1. Quantify the spread and intensification of dwarf mistletoe in western larch with and without overstory removal and precommercial thinning.

2. Quantify the growth effects due to dwarf mistletoe in infected western larch with and without overstory removal and precommercial thinning.

3. Provide visual demonstration of the treatment effects on stand growth and development.

4. Provide data for the validation of dwarf mistletoe models for stand conditions similar to those found in this study.

Data will be analyzed this winter with results of the remeasurement expected in 2004.

3. Assessing the Effectiveness of Management Activities on DFB Populations

A multi-year study, begun in 2002, will help determine effectiveness of management activities on DFB populations, and particularly ones existing in fire-affected areas. Beetle-infested stands on the Bitterroot, Helena, and Beaverhead NFs; as well as BLM-administered land near Boulder, were assessed for beetle presence and status prior to implementation of management efforts. Those efforts included salvage of infested and threatened trees, use of trap trees or baited funnel traps, and the use of the DFB anti-aggregant, MCH. Management activities were implemented in 2002 and 2003. Data were collected following implementation of management and subsequent beetle flights in both years.

Although not all proposed and scheduled activities have been carried out, in areas where salvage logging was conducted, and in most areas where funnel traps were used, beetle-caused mortality was markedly reduced in both 2002 and 2003. In areas where MCH was used to protect threatened trees or stands, treatments were deemed successful. In almost none of the treated areas was new beetle-caused mortality observed.

In a few of the treated stands, pheromone-baited funnel traps and MCH will once again be used in 2004 to reduce anticipated DFB-caused mortality. In other areas, we have determined DFB populations are sufficiently low that additional treatments are not warranted. Following evaluations in fall 2004, overall affects of three post-fire year treatments will be reported. For additional information, contact Nancy Sturdevant, Missoula Field Office (MFO).

4. Testing Efficacy of Verbenone Pouch in Reducing MPB-Caused Mortality in PP

A project was conducted in PP stands on the Helena RD to help determine the efficacy of the standard, 5-gram verbenone pouch compared to a new "slow-release" pouch in protecting trees from MPB attack. In a randomly assigned treatment (by block) test, we treated three 1-acre plots in each of 6 blocks. Treatments consisted of 0, 20 standard, or 40 new (slow-release) pouches per acre. Pouches were stapled to individual trees in a grid pattern (approximately ½-chain apart at 40/acre; about ¾-chain apart at 20/acre). Stands were treated in late June and evaluated in late September. The standard pouches were replaced at the end of July. Treatment results were not as we had hoped because of beetle populations too low to make valid comparisons between treatments. Results are shown in tables below. For additional information, contact Ken Gibson, MFO.

0 Pouches (Control)

Plot	PP/ Acre (≥5"dbh)	Trtmnt (Verb/ Acre)	Mass Attacks	% Mass Attacks
1	194	0	2	1.0
4	142	0	1	0.7
8	94	0	2	2.1
10	138	0	4	2.9
12	114	0	5	4.4
18	110	0	0	0
Avg.	*132*	-	*2.3*	*1.7*

New Pouches

3	159	New	0	0
6	111	New	4	3.6
9	163	New	3	1.8
11	111	New	5	4.5
14	102	New	0	0
17	97	New	4	4.1
Avg.	*124*	-	*2.7*	*2.1*

Standard Pouches

2	164	Std	1	0.6
5	172	Std	1	0.5
7	68	Std	0	0
13	89	Std	0	0
15	59	Std	0	0
16	110	Std	0	0
Avg.	*110*	-	*0.3*	*0.3*

5. West-Wide Evaluation of Bifenthron as a Protectant against Bark Beetle Attacks

As part of a multi-Region study, we conducted a preventive spray treatment in MPB-susceptible LPP stands on Jefferson RD. We selected 210 live LPP, at least 8 inches d.b.h., in early June. Selected trees were randomly assigned to one of six groups, each of which would receive a different "treatment." Six treatments were: 0.03% bifenthren (Biflex), 0.06% Biflex, 0.12% Biflex, 2% carbaryl, 2003 control (no spray) and 2004 control (no spray, reserved for second year of study).

Trees were treated in mid-June. Mixtures were water-based sprays, applied with hydraulic sprayers. Tree boles were treated to a point of runoff, to a height of about 25 feet. Following treatment, a standard MPB tree bait was attached to each tree (except trees reserved for 2004). Treatment effects were evaluated in late-September. In summary, weaker concentrations of Biflex provided poor protection from MPB attack; highest concentration (0.12%) was moderately successful. Carbaryl provided excellent protection. Results are shown in table below. Trees still alive will be re-baited in 2004 to assess 2-year protection. For additional information, contact Ken Gibson, MFO.

	Control	0.03% Biflex	0.06% Biflex	0.12% Biflex	2% Carbaryl
Attacked	31	29	22	6	1
Not Att'd	2	6	10	25	34
% Alive	6	17	31	81	97

6. Testing Efficacy of Verbenone Pouch in Reducing MPB-Caused Mortality in WBP

An individual-tree test was conducted in WBP stands in Swan Mountain Range, Seeley Lake RD; testing efficacy of standard 5-gram verbenone pouch and a "new" (slow-release) pouch in reducing MPB-caused mortality in high-value trees. Trees were selected and treated in late May. Test was comprised of three treatments: 2 standard pouches per tree, 2 "new" pouches per tree, and none (controls). Fifty trees were selected for each treatment. Standard pouches were replaced in late-July; project results being determined in September. Treatments, not statistically different from each other, successfully protected trees from beetle attack when compared to untreated controls. Following table illustrates those results:

Treatment	Avg. d.b.h.	Not attacked[1]	Strip attack[2]	Mass attack[3]	% Attacked
Control	14.0 in.	27	1	20	42
Standard	14.9 in.	43	2	3	6
New	14.6 in.	40	5	4	8

[1] Unsuccessful attacks ("pitch outs" included)
[2] "Strip attacks" were partial attacks and were not killed
[3] Only "mass attacks"—trees actually killed—contributed to "% attacked"

For additional information, contact Sandy Kegley, Coeur d'Alene Field Office (CFO).

7. Annosum Survey

Region 1 Forest Health Protection routinely recommends treating ponderosa pine stumps to prevent the introduction of *Heterobasidion annosum* (Fr.)Bref., causal agent of annosum root disease. Spores of the agent need to be present in order for new infections to become established. Knowing the incidence of the fungus will give us a better handle on the risks involved with not treating stumps. A project was initiated in 2002 to determine the incidence of p-type *Heterobasidion annosum* in Region 1. A survey was completed for the Lolo NF in 2002, the Bitterroot NF in 2003, and a survey is planned for the Flathead NF in 2004. The stands selected for surveying are ponderosa pine forest type, with large stumps old enough for fruiting bodies to have had a chance to form, and regeneration old enough to have made contact with infected stump roots. A query was developed to incorporate all these criteria.

TSMRS (timber stand maintenance record system) stand data from the Lolo, Flathead, and Bitterroot NFs were queried for stands that met the following criteria: ponderosa pine forest type, mature harvesting 30+ years ago OR mature harvesting 20-30 years ago, and 30+ acres in size.

Stand selection came from two stratum; 30+ year-old mature harvesting activity, and 20- to 30-year-old mature harvesting activity. Ten percent of each stratum was randomly selected for surveying. The survey involves systematically searching the old stumps for *H. annosum* fruiting bodies (conks). When conks are found, data is taken on the stump, including the diameter and GPS coordinate.

Data is also taken on any symptomatic and/or dead trees in close proximity to the stump.

In 2003 on the Lolo NF, we surveyed six more stands (to complete the original 10 percent survey level) and revisited seven stands that were previously recorded as not having *H. annosum*. These seven stands were revisited because the field notes indicated the crews were finding the right decay, but could not find fruiting bodies. We found positive *H. annosum* in three of these stands, and thus changed the Lolo NF numbers from 2002. Combining 2002 and 2003, we searched 46 stands on the Lolo NF and found positive *H. annosum* in 12 stands. These infected stands appear to be well distributed throughout the search area.

We completed the survey on the Bitterroot NF in 2003. We searched 46 stands on the Bitterroot NF and found positive *H. annosum* in 30 stands. Very few stands from the Flathead NF meet the query criteria; 10 percent of each stratum equals only five stands. We were unable to survey these five stands on the Flathead NF in 2003, but plan to survey them in 2004. An FHP report is forthcoming and will include the location of the positive *H. annosum*, the location of all the searched stands, and potential management implications and recommendations.

COMMON AND SCIENTIFIC NAMES

Pathogens

Annosum root disease	*Heterobasidion annosum* (Fr.:Fr.) Bref.	Primary hosts: DF, GF, PP, SAF
Armillaria root disease	*Armillaria ostoyae* (Romagn.) Herink	DF, GF, SAF, sapling pines
Black stain root disease	*Leptographium wageneri* (Kendrick) M.J. Wingfield	DF, PP
Brown cubical butt rot	*Phaeolus schweinitzii* (Fr.:Fr.) Pat.	DF
Dothistroma needle cast	*Dothistroma septospora* (Doroguine) Morelet	LP, PP, WWP, LPP, WBP
Dwarf mistletoes	*Arceuthobium* spp.	LPP, LP, DF, WL
Brown Stringy rot	*Echinodontium tinctorium* (Ell. & Ev.) Ell. & Ev.	GF, WH
Elytroderma needle cast	*Elytroderma deformans* (Weir) Darker	PP
Fusarium root rot	*Fusarium oxysporum* Schlechtend.:Fr.	DF (Nursery)
Grey mold	*Botrytis cinerea* Pers. ex Fr.	WL (Nursery)
Laminated root rot	*Phellinus weirii* (Murrill) R.L. Gilbertson*.*	DF, GF, WH, SAF
Sirococcus tip blight	*Sirococcus conigenus* (DC.) P. Cannon & Minter	WWP (Nursery)
Sphaeropsis shoot blight	*Sphaeropsis sapinea* (Fr.:Fr.) Dyko & Sutton in Sutton	PP
Western gall rust	*Endocronartium harknessii* (J.P. Moore) Y. Hiratsuka	LPP, PP
White pine blister rust	*Cronartium ribicola* J.C. Fisch.	WWP, WBP, LP

Insects

Douglas-fir beetle	*Dendroctonus pseudotusugae* Hopkins	DF
Douglas-fir tussock moth	*Orygia pseudotsugata (*McDunnough*)*	DF, TF, ES
Gypsy moth	*Lymantria dispar (*Linaeus*)*	Most hardwoods
Mountain pine beetle	*Dendroctonus ponderosa* Hopkins	All pines
Pine engraver beetle	*Ips pini* (Say)	PP, LPP
Spruce beetle	*Dendroctonus rufipennis* Swaine	ES
Western balsam bark beetle	*Dryocoetes confuses* Swaine	SAF
Western spruce budworm	*Choristoneura occidentalis* Freeman	DF, TF, ES, WI
Western pine beetle	*Dendroctonus brevicomis* LeConte	PP
Fir engraver beetle	*Scolytis ventralis* LeConte	GF, SAF
Hemlock looper	*Lambdina fiscellaria lugubrosa* (Hulst)	DF
False hemlock looper	*Nepytia canosaria* (Walker)	DF

DF = Douglas-fir; GF = Grand fir; TF = True fir; SAF = Subalpine fir; PP = Ponderosa pine; LP = Limber pine: LPP = Lodgepole pine; WWP = Western white pine; ES = Engelmann spruce; WH = Western hemlock; WL = Western larch; WBP = Whitebark pine

PUBLICATIONS 2003

Bennett, D.; Gibson, K. 2003. Douglas-fir beetle and western spruce budworm in Centennial Analysis Area, Ashton-Island Park Ranger District, Caribou-Targhee National Forest. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-20. August 26, 2003. 10p.

Bentz, B.; Gibson, K.; Kegley, S.; Livingston, L.; Schaupp, B. 2003. Guidelines and tips for hosting WFIWC. Western Forest Insect Work Conference Website, http://www.fsl.orst.edu/wfiwc/meetingguidelines 7 p.

Bulaon, B.M. 2003. Douglas-fir beetle surveys of the fires of 2000 in the Northern Region. Missoula, MT: USDA Forest Service, State and Private Forestry. Report 03-2. 10p.

Ferguson, B.A. 2002. Armillaria root disease - a hidden force in the forest. Western Forester 47(6): 14-15.

Ferguson, B.A.; Dreisbach, T.A.; Parks, C.G.; Filip, G.M.; Schmitt, C.L. 2003. Coarse-scale population structure of pathogenic Armillaria species in a mixed-conifer forest in the Blue Mountains of northeast Oregon. Canadian Journal of Forest Research 33: 612-623.

Gibson, K. 2003. Marking guides for Blodgett Stewardship Project, Bitterroot National Forest. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-03. July 2, 2003. 3p.

Gibson, K.; Sturdevant, N. 2003. Mountain pine beetle threats to surviving ponderosa pine, Boulder Complex Fire, BLM, Butte Field Office. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-5. April 2, 2003. 2p.

Gibson, K. 2003. Douglas-fir beetle in the Boulder River Corridor, Gallatin National Forest. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-10. July 2, 2003. 2p.

Gibson, K. 2003. Douglas-fir beetle in Upper Rock Creek, Pintler Ranger District. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-11. June 30, 2003. 6p.

Gibson, K. 2003. Douglas-fir beetle in the North Fork Salmon River Drainage, Salmon-Challis NF. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-16. July 24, 2003. 7p.

Gibson, K. 2003. Douglas-fir beetle in the Middle East Fork EAWS. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-18. August 5, 2003. 3p.

Gibson, K. 2003. Mountain pine beetle in second-growth ponderosa pine, Superior Ranger District, Lolo National Forest. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-19. August 6, 2003. 2p.

Gibson, K. 2003. Western spruce budworm in Bridger Canyon, Bozeman RD, Gallatin National Forest. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-21. August 21, 2003. 4p.

Gibson, K. 2003. Douglas-fir beetle on Hebgen Lake Ranger District. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-23. August 28, 2003. 3p.

Gibson, K. 2003. Follow up: Bark beetle evaluation in Moose Fire Area. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-24. September 9, 2003. 2p.

Gibson, K. 2003. Bark beetle potential on Flathead Fires of 2003. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-25. October 28, 2003. 4p.

Gibson, K. 2003. Leave-tree mortality in thinned and underburned stands, Philipsburg Ranger District. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-28. November 4, 2003. 2p.

Gibson, K. 2003. Bark beetle-caused mortality in second-growth ponderosa pine, Northern Cheyenne Indian Reservation. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-29. November 24, 2003. 4p.

Gibson, K.; Jackson, M. 2003. Insect and disease considerations, South Island Analysis Area, Swan Lake RD, Flathead NF. Missoula, MT: USDA Forest Service, State and Private Forestry, FHP Unpublished office report. August 2003. 24p.

Hagle, S.K.; Gibson, K.E.; Tunnock, S. 2003. Field guide to diseases and insect pests of northern and central Rocky Mountain conifers. Missoula, MT: USDA Forest Service, State and Private Forestry, Northern and Intermountain Regions. Report number R1-03-08. 197p.

Jackson, M.; Lockman, B. 2003. Update on limber pine decline and mortality on the Lewis and Clark National Forest, Montana. Missoula, MT: USDA Forest Service, State and Private Forestry. Report 03-4. 8p.

James, R. 2003. Hawaii Agriculture Research Center Nurseries, Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR03-2, February 11, 2003. 3p.

James, R. 2003. Evaluation of insects and plant pathogens in the Bigfork Tree Improvement Area, Flathead National Forest. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report. TR-03-13. June 18, 2003. 2p.

James, R. Insect and diseases at tree improvement areas, Plains Ranger District, Lolo National Forest. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-14. June 18, 2003. 2p.

James, R.L. 2003. Comparing three methods of assaying soil Fusarium and Trichoderma populations for integrated pest management in forest nurseries. Missoula, MT: USDA Forest Service, State and Private Forestry. Report 03-3. 13p.

Kegley, S. 2003. Pine slash, Coeur d'Alene Indian Reservations. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-7. April 17, 2003. 3p.

Kegley, S. 2003. Pine engraver beetles on the Longshot Timber Sale, Sandpoint Ranger District, Idaho Panhandle National Forests. Missoula. MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-15. July 24, 2003. 4p.

Kegley, S. 2003 .Pine engraver beetles at Dufort North and Granite Plantations, Idaho Panhandle National Forests. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-17. July 24, 2003. 2p.

Kegley, S. 2003. Fly Flat, Line Creek, Spruce Tree, and Heller Creek Campgrounds, St. Joe Ranger District, Idaho Panhandle National Forests. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-22. August 21, 2003. 4p.

Kegley, S.; Gibson, K. 2003. Protecting whitebark pine from beetle attacks. In *Nutcracker Notes* Issue 5 (Fall/Winter 2003). Whitepine Ecosystem Foundation, Missoula, MT. p12-14.

Kegley, S.; Gibson, K.; Schwandt, J.; Marsden, M. 2003. A test of verbenone to protect individual whitebark pine from mountain pine beetle attack. Missoula, MT: USDA Forest Service, State and Private Forestry. Report 03-9. 6p.

Kegley, S.; Sturdevant, N. 2003. Establishment report for Douglas-fir tussock moth permanent plots on the Clearwater National Forest. Missoula, MT: USDA Forest Service, State and Private Forestry. Report 03-6. 4p.

Kegley, S.; Wulff, D. 2003. 2002 North Idaho Douglas-fir tussock moth trapping system report. Missoula, MT: USDA Forest Service, State and Private Forestry. Report 03-5. 7p.

Kohler, S.; Gibson, K. 2003. Highland Park, City of Missoula. Missoula, MT: Montana Department of Natural Resources and Conservation. January 15, 2003. 8p.

Lockman, B.; Gibson, K. 2003. Vegetation management, Lake Como Campground, Bitterroot NF. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-4. March 6, 2003. 3p.

Lockman, B.; Gibson, K.; Becker, R. 2003. Forest management considerations for the Flathead Indian Reservation with emphasis on reducing insect and disease-caused tree mortality. Missoula, MT: USDA Forest Service, State and Private Forestry, FHP Unpublished office report. February 2003. 23p.

Lockman, B.; Jackson, M.; DeNitto, G. 2003. Western larch hazard trees in Seeley Lake CG-Follow up visit. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-4a. April 2, 2003. 2p.

Lockman, B.; Jackson, M.. 2003. Elytroderma needle blight in ponderosa pine in the Elk Bed Analysis Area, Bitterroot National Forest. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-08. May 20, 2003. 4p.

Lockman, B.; Gibson, K. 2003. Insect and disease considerations, Callahan Creek Analysis Area, Three Rivers Ranger District. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-9. June 4, 2003. 2p.

Lockman, B. 2003. Pathogens and insects In a CEEM certification stand, Elk Bed Analysis Area. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-12, June 30, 2003. 3p.

Lockman, B.; Jackson, M. 2003. Western larch needle blight on the Kootenai NF – Three Rivers RD. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-27. October 31, 2003. 3p.

Meyer, L., compiler. 2003. Montana Forest Insect and Disease Conditions and Program Highlights-2002. Missoula, MT: USDA Forest Service, State and Private Forestry and Montana Department of Natural Resources and Conservation, Forestry Division. Report 03-1. 60p.

Randall, C. 2003. CDA golf course forest health, landscape tree concerns. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-01. January 24, 2003. 3p.

Schwandt, J.; Kegley, S.; Kearns, H. 2003. Forest health concerns in the Two-Mile Fuels Reduction Project, Coeur d'Alene River District. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-26. October 14, 2003. 6p.

Sturdevant, N.; Gibson, K. 2003. Bark beetle potential in fire hazard reduction treatment areas, Lewis and Clark County. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-06. May 6, 2003. 9p.

Sturdevant, N. 2003. An evaluation of mountain pine beetle in limber and whitebark pine. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-30. October 31, 2003. 3p.

Sturdevant, N. 2003. An evaluation of western spruce budworm and Douglas-fir beetle on the Cherry Creek Ranch. Missoula, MT: USDA Forest Service, State and Private Forestry, File 3420. FHP Trip Report TR-03-31. November 25, 2003. 4p.

Sturdevant, N.; Kegley, S.; Dewey, J. 2003. Evaluating release sites of *Cyphocleonus achates* as potential insectaries in Montana and Idaho. Missoula, MT: USDA Forest Service, State and Private Forestry. Report 03-7. 7p.

DIRECTORY OF PERSONNEL

Montana Department of Natural Resources and Conservation — Phone: (406) 542-4300

Bob Harrington	State Forester	bharrington@state.mt.us	4301
Rob Ethridge	Chief, Service Forestry Bureau	rethridge@state.mt.us	4303
Steve Kohler-Retired	Forest Pest Management Specialist	skohler@state.mt.us	4238
Brennan Ferguson	Contract Forest Pathologist	bferguson@state.mt.us	4288

Montana Department of Natural Resources and Conservation, Forestry Division
2705 Spurgin Road, Missoula, Montana 59804

◆

USDA Forest Service Regional Office — Phone: (406) 329-3308

Bill Boettcher	Director	wboettcher@fs.fed.us	3280
Ralph Thier[1]	Forest Health Monitoring Coordinator	rthier@fs.fed.us	801-625-5820
Janet Valle[1]	Pesticide Use Coordinator	jvalle@fs.fed.us	801-625-5258

USDA Forest Service, Northern Region, Federal Building,
200 East Broadway, P.O. Box 7669, Missoula, Montana 59807

[1] USDA Forest Service, 324 25th Street, Ogden, UT 84401

◆

USDA Forest Service Missoula Field Office — *Phone:* (406) 329-3308

Gregg DeNitto	Group Leader	gdenitto@fs.fed.us	3637
Beverly Bulaon	Entomologist	bbulaon@fs.fed.us	3298
Bill Cramer	Bio. Science Technician	wcramer@fs.fed.us	3130
Ken Gibson	Entomologist	kgibson@fs.fed.us	3278
Marcus Jackson	Plant Pathologist	mbjackson@fs.fed.us	3282
Blakey Lockman	Plant Pathologist	blockman@fs.fed.us	3180
Kjerstin Skov	Entomology, SCEP	kskov@fs.fed.us	3329
Larry Stipe	Entomologist, GIS Coordinator	lstipe@fs.fed.us	3280
Nancy Sturdevant	Entomologist	nsturdevant@fs.fed.us	3281
Larry Meyer	Bio. Science Technician, Aerial Survey	lmeyer@fs.fed.us	3136

USDA Forest Service, Northern Region, Federal Building,
200 East Broadway, P.O. Box 7669, Missoula, Montana 59807

DIRECTORY OF PERSONNEL, continued

USDA Forest Service Coeur d'Alene Field Office *Phone:* (208) 765-7223

Jill Wilson	Group Leader	jwilson@fs.fed.us	7342
Sue Hagle[1]	Plant Pathologist	shagle@fs.fed.us	(208) 926-4356
Terri Johnson[2]	Computer Clerk	tljohnson01@fs.fed.us	(208) 373-4268
Bob James	Plant Pathologist	rjames@fs.fed.us	7421
Sandy Kegley	Entomologist	skegley@fs.fed.us	7355
Carol Bell Randall	Entomologist	crandall@fs.fed.us	7343
John Schwandt	Plant Pathologist	jschwandt@fs.fed.us	7415
Doug Wulff	Bio. Science Technician	dwulff@fs.fed.us	7344
Holly Kearns	Pathology, SCEP	hkerns@fs.fed.us	7340

USDA Forest Service, Northern Region, Idaho Panhandle National Forests,
3815 Schreiber Way, Coeur d'Alene, Idaho 83814-8363

◆

[1]USDA Forest Service, Lochsa Ranger District, Route 1, Box 398, Kooskia, ID 83539

[2]USDA Forest Service, Forest Health Protection, 1249 South Vinnell Way, Suite 200, Boise, ID 83709

Table 2. Acres of host type infested by bark beetles, 1998-2003

	1998	1999	2000[1]	2001	2002[3]	2003[3,4]
DFB[2]	8,310	38,259	34,401	82,273	60,203	76,035
ESB	1,995	830	213	637	6,232	9,539
IPS	698	214	11	17	498	4,784
WPB	1,318	1,324	368	670	739	834
FE	523	134	159	1,047	8,929	20,647
WBBB	59,248	43,472	28,010	27,622	112,024	76,035
MPB	39,198	77,347	40,758	111,626	261,348	305,911
Total	111,290	161,580	103,920	223,892	450,134	493,785

[1]Not all areas were flown in 2000 due to fires.

[2]DFB=Douglas-fir beetle; ESB= Spruce beetle; IPS=Pine engraver;
WPB=Western pine beetle; FE=Fir engraver; WBBB=Western balsam bark beetle;
MPB=Mountain pine beetle

[3]Includes Yellowstone NP in both MT and WY.

[4]Not all areas were flown in 2003 due to fires.

Table 3. Douglas-fir beetle-infested acres and new dead trees in Montana, all ownerships, from 2000 through 2003

	2000		2001		2002		2003	
Reporting Area	**Acres**	**Trees**	**Acres**	**Trees**	**Acres**	**Trees**	**Acres**	**Trees**
Beaverhead	772	1,716	★	★	3,463	6,073	6,403	13,840
Bitterroot	★	★	11,414	21,649	11,755	24,676	34,442	31,989
Custer	★	★	14	50	0*	0*	27*	45*
Deerlodge	★	★	217	530	2,405	3,563	6,610	13,249
Flathead	6,329	14,199	14,909	22,813	7,164	16,924	5,580	8,552
Gallatin	1,244*	3,600*	2,231	3,214	2,374	4,293	5,649*	7,450*
Helena	273*	740*	1,521	2,262	1,204	2,103	1,817	3,560
Kootenai	15,352	42,677	32,051	61,132	17,589	24,411	10,924	14,134
Lewis & Clark	★	★	377	761	457*	576	1,293*	1,585*
Lolo	9,660	28,296	9,660	28,296	9,659	21,484	1,143*	2,627*
Garnets	★	★	415	1,166	111	541	917*	1,637*
Flathead IR	771	2,258	1,427	2,960	1,691	2,598	14*	44*
Crow IR	★	★	4	18	0	0	0	0
Glacier NP	★	★	★	★	15*	49*	★	★
Yellowstone NP	★	★	★	★	2,315	3,523	1,135*	3,296*
Other	★	★	433	2,139	0	0	28	42
TOTAL	34,401	93,486	82,274	155,820	60,202	118,441	75,982	102,050

★ = Not surveyed (Yellowstone includes both MT and WY)
*Only partially surveyed

Table 4. Acres of mountain-pine-beetle-caused mortality on State and private lands in Montana from 2000 through 2003

	2000				2001				2002				2003			
Reporting Area	LPP[1]	PP	WBP	WWP	LPP	PP	WBP	WWP	LPP	PP	WBP	WWP	LPP	PP	WBP	WWP
Beaverhead	35	6	12	0	★	★	★	★	1,149	135	1,131	0	171*	95*	2,265*	0*
Bitterroot	★	★	★	★	837	0	0	0	45	519	0	0	0	532	0	0
Custer	★	★	★	★	0	108	0	0	2*	8*	0*	0*	0*	20*	0*	0*
Deerlodge	★	★	★	★	347	0	0	0	4,380	563	32	0	4,951	659	89	0
Flathead	81	46	0	107	362	80	13	41	2,062	185	39	76	3,735	1,266	236	12
Gallatin	0*	0*	4*	0*	15	2	0	0	19	0	0	0	336*	27*	561*	0*
Helena	2*	94*	20*	0*	28	1,526	0	0	103	2,394	0	0	1,465	1,522	0	0
Kootenai	14	25	0	14	28	58	0	79	2,315	81	0	74	860	79	0	71
Lewis & Clark	★	★	★	★	47	2,238	2	0	6*	592*	0*	0*	651*	4,202*	309*	0*
Lolo	992	172	0	2	4,170	459	8	0	7,333	1,131	44	27	5,305*	1,124*	478*	0*
Garnets	★	★	★	★	22	204	0	0	134	296	0	0	196*	377*	2*	0*
Crow IR	★	★	★	★	68	390	0	0	0	557	0	0	0	231	0	0
Fort Belknap IR	★	★	★	★	0	138	0	0	0	82	0	0	0	27	0	0
No. Cheyenne IR	★	★	★	★	0	4	0	0	0	16	0	0	★	★	★	★
Rocky Boys IR	★	★	★	★	0	24	0	0	0	399	0	0	465	51	0	0
Flathead IR	135	624	28	0	481	466	0	0	915	839	0	0	2,023*	923*	0*	0*
Other	0	0	0	2	0	28	0	0	0	0	0	0	0	0	0	0
Total	1,259	967	64	125	6,405	5,725	23	120	18,416	7,797	1,246	177	20,158	11,135	3,940	83

[1]LPP = Lodgepole pine; PP = ponderosa pine; WBP = whitebark pine; WWP = western white pine
★= Not surveyed
* = Partially surveyed

Table 5. Acres of mountain-pine-beetle-caused mortality on all Federal ownership in Montana, from 2000 through 2003

	2000				2001				2002				2003			
Reporting Area	LPP	PP	WBP	WWP	LPP	PP	WBP	WWP	LPP	PP	WBP	WWP	LPP	PP	WBP	WWP
Beaverhead	641	46	169	0	★	★	★	★	11,150	2,736	29,132	0	287*	1,933*	36,626*	0*
Bitterroot	★	★	★	★	146	555	2	0	1,028	836	6	0	74	524	78	0
Custer	★	★	★	★	0	1,158	0	0	36*	1,017*	0*	0*	0*	554*	533*	0*
Deerlodge	★	★	★	★	976	2	2	0	21,212	246	388	36	24,976	1,207	336	0
Flathead	4,639	100	42	447	13,052	92	767	130	17,986	435	429	412	17,583	66	1,574	73
Gallatin	6*	0*	14*	0*	12*	0*	0*	0*	128	0	0	0	138*	8,452*	0*	0*
Helena	8*	8*	2*	0*	88	590	0	0	271	1,499	0	0	6,231	2,639	345	0
Kootenai	190	98	0	199	978	95	4	727	2,965	603	2	898	4,000	187	0	903
Lewis & Clark	★	★	★	★	509	4,126	0	0	10*	1,483*	0*	0*	605*	7,603*	4,389*	19*
Lolo	27,217	1,436	10	56	64,745	1,371	210	41	100,475	3,068	718	149	88,755*	4,155*	2,332*	6*
Crow IR	★	★	★	★	116	748	0	0	35	776	21	0	0	523	0	0
Fort Belknap IR	★	★	★	★	0	0	0	0	8	428	0	0	53	100	0	0
Flathead IR	1,467	1,810	0	0	5,354	1,873	0	0	16,025	2,887	6	0	26,237*	3,522*	0*	0*
No. Cheyenne IR	★	★	★	★	0	290	0	0	0	703	0	0	★	★	★	★
Rocky Boys IR	★	★	★	★	2	22	0	0	0	465	0	0	0	0	0	0
BLM (Garnets)	★	★	★	★	502	2	0	0	26	232	0	0	162*	81*	2*	0*
Glacier NP	6*	0*	0*	12	★	★	★	★	91*	0*	0*	0*	★	★	★	★
Yellowstone NP	★	★	★	★	★	★	★	★	606	20	11,814	0	693*	0*	15,086*	0*
Total	34,174	3,498	237	714	86,480	10,924	976	898	172,050	17,434	42,516	1,495	169,794	31,546	61,301	1,001

[1]LPP = Lodgepole pine; PP = ponderosa pine; WBP = Whitebark pine; WWP = western white pine
★ = Not surveyed
* = Partially surveyed - Yellowstone includes MT and WY

Table 6. Bark-beetle-infested acres (other than mountain pine beetle and Douglas-fir beetle) in Montana, all ownerships, 2000-2003

	Engelmann Spruce Beetle				Pine Engraver Beetle				Western Pine Beetle				Fir Engraver Beetle				Western Balsam Bark Beetle			
Reporting Area	2000	2001	2002	2003	2000	2001	2002	2003	2000	2001	2002	2003	2000	2001	2002	2003	2000	2001	2002	2003
Beaverhead	6	★	42	8*	0	★	14	0*	0	★	0	14*	0	★	10	0*	18,698	★	67,669	14,437*
Bitterroot	★	27	4	10	★	0	0	0	★	63	95	55	★	34	6	34	★	814	515	873
Custer	★	0	0*	2*	★	0	0*	2,841*	★	0	0*	0*	★	0	0*	0*	★	630	972*	3,269*
Deerlodge	★	0	22	8	★	0	2	28	★	2	0	58	★	0	32	41	★	4	2,187	4,632
Flathead	118	71	93	8	2	0	0	25	64	61	57	0	56	605	8,126	16,109	3,407	6,800	5,377	13,814
Gallatin	53*	287	0	728*	0*	0	0	0*	0*	2	0	0*	0*	0	0	0*	3,123*	9,700	14,896	14,723*
Helena	0*	2	2	29	0*	0	0	22	36*	79	0	32	0*	0	0	6	78*	1,328	93	6,348
Kootenai	8	170	10	0	2	0	0	0	66	156	164	97	26	207	132	3,008	1,978	2,440	5,120	2,628
Lewis & Clark	★	8	0*	0*	★	2	0*	2*	★	0	0*	0*	★	16	0*	0*	★	3,940	164*	6,690*
Lolo	14	30	8	4*	0	13	3	0*	190	205	275	534*	22	95	295	1,444*	300	1,677	728	1,280*
Garnets	★	0	0	2*	★	0	0	0*	★	38	69	30*	★	0	0	6*	★	43	10	236*
Flathead IR	2	42	0	0*	7	2	4	1,791*	10	26	79	13*	55	90	302	0*	72	204	113	10*
No. Cheyenne IR	★	0	0	★	★	0	441	★	★	0	0	★	★	0	0	★	★	0	0	★
Fort Belknap IR	★	0	0	0	★	0	0	0	★	0	0	0	★	0	0	0	★	0	0	0
Rocky Boys IR	★	0	0	0	★	0	0	0	★	0	0	0	★	0	0	0	★	0	0	0
Crow IR	★	0	0	0	★	0	0	68	★	0	0	0	★	0	0	0	★	20	60	101
Glacier NP	★	★	0*	★	★	★	0*	★	★	★	0*	★	★	★	0*	★	★	★	0*	★
Yellowstone NP	★	★	6,049	8,748*	★	★	32	0*	★	★	0	0*	★	★	21	0*	★	★	14,120	6,394*
Total	201	637	6,230	9,547	11	17	496	4,777	366	671	739	833	159	1,047	8,924	20,648	27,565	27,600	112,024	75,435

★ = Not surveyed
* = Partially surveyed - Yellowstone includes both MT and WY

Figure 1. Reporting Area boundaries in Montana

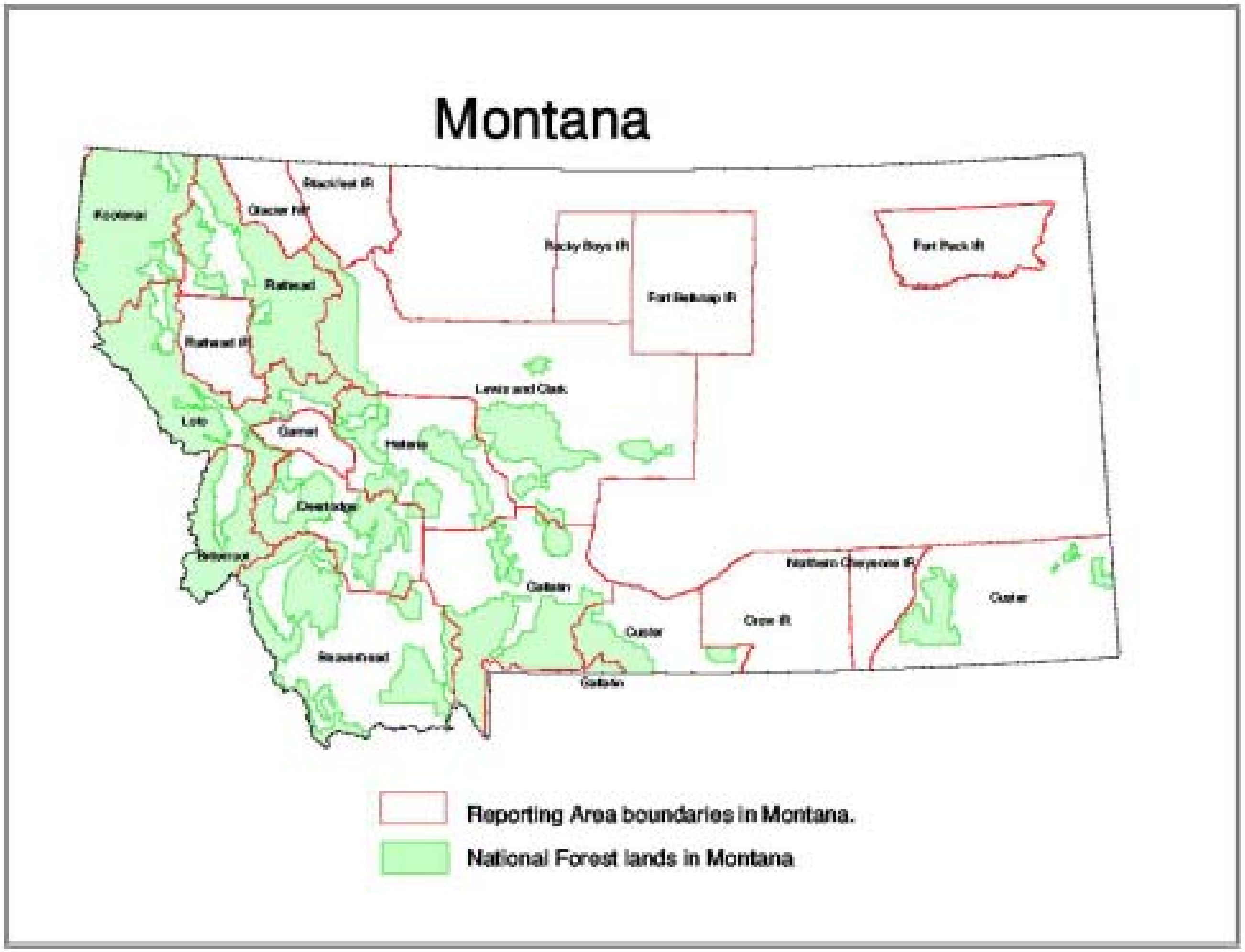

Figure 2. Area surveyed during the Forest Health Protection aerial detection survey in Montana, 2003

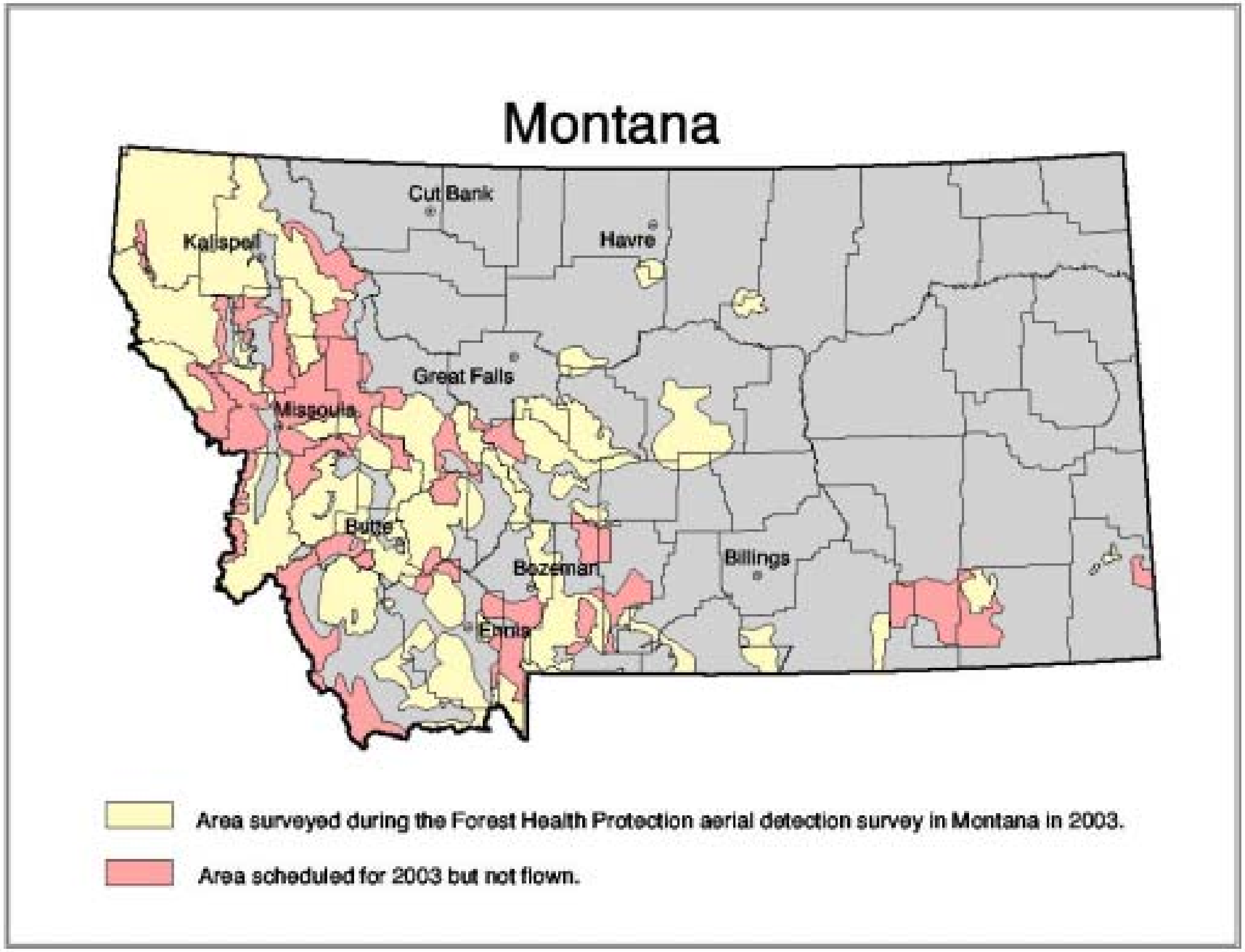

Figure 3. Mountain pine beetle infestations in Montana, 2003

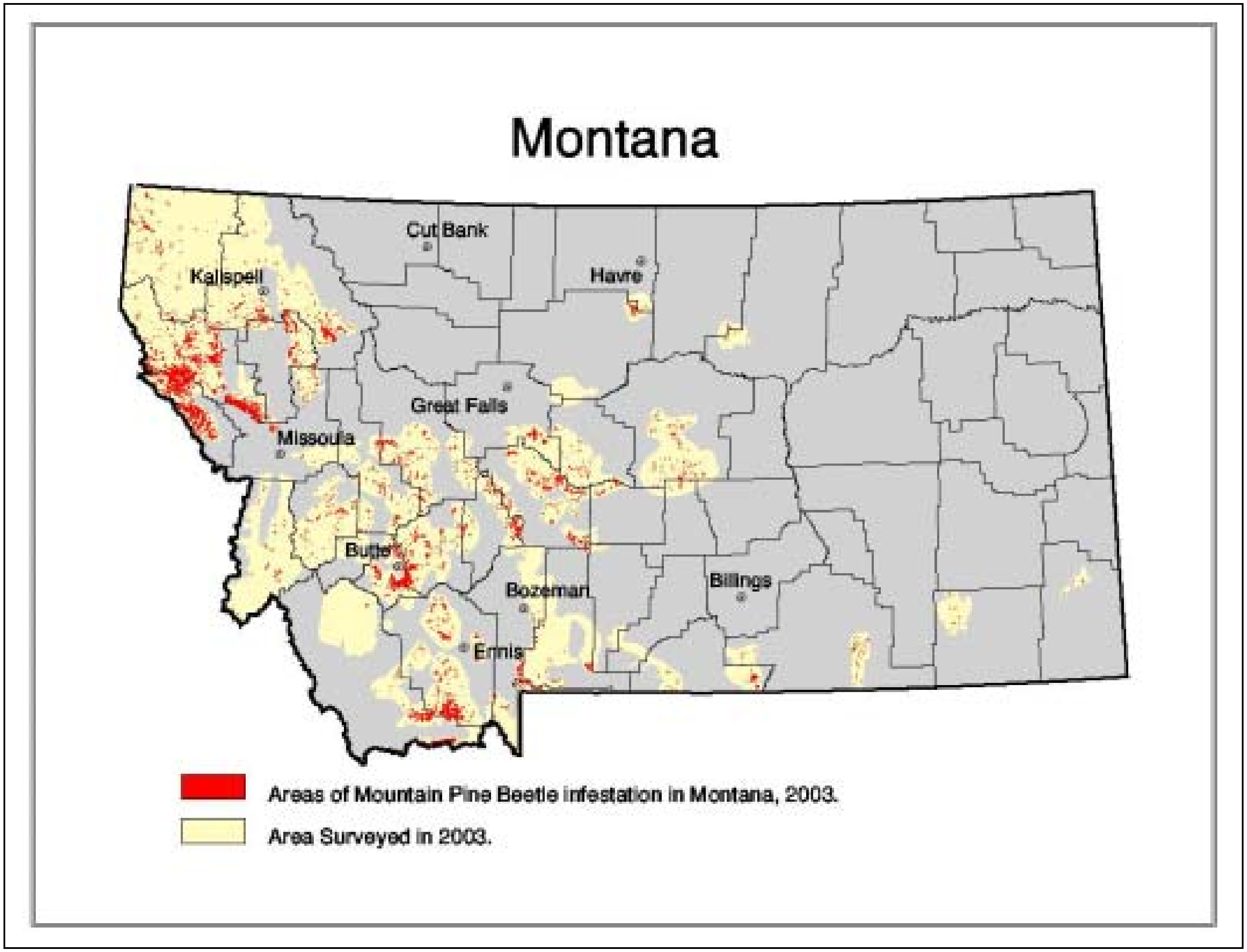

Figure 4. Douglas-fir beetle infestation in Montana, 2003

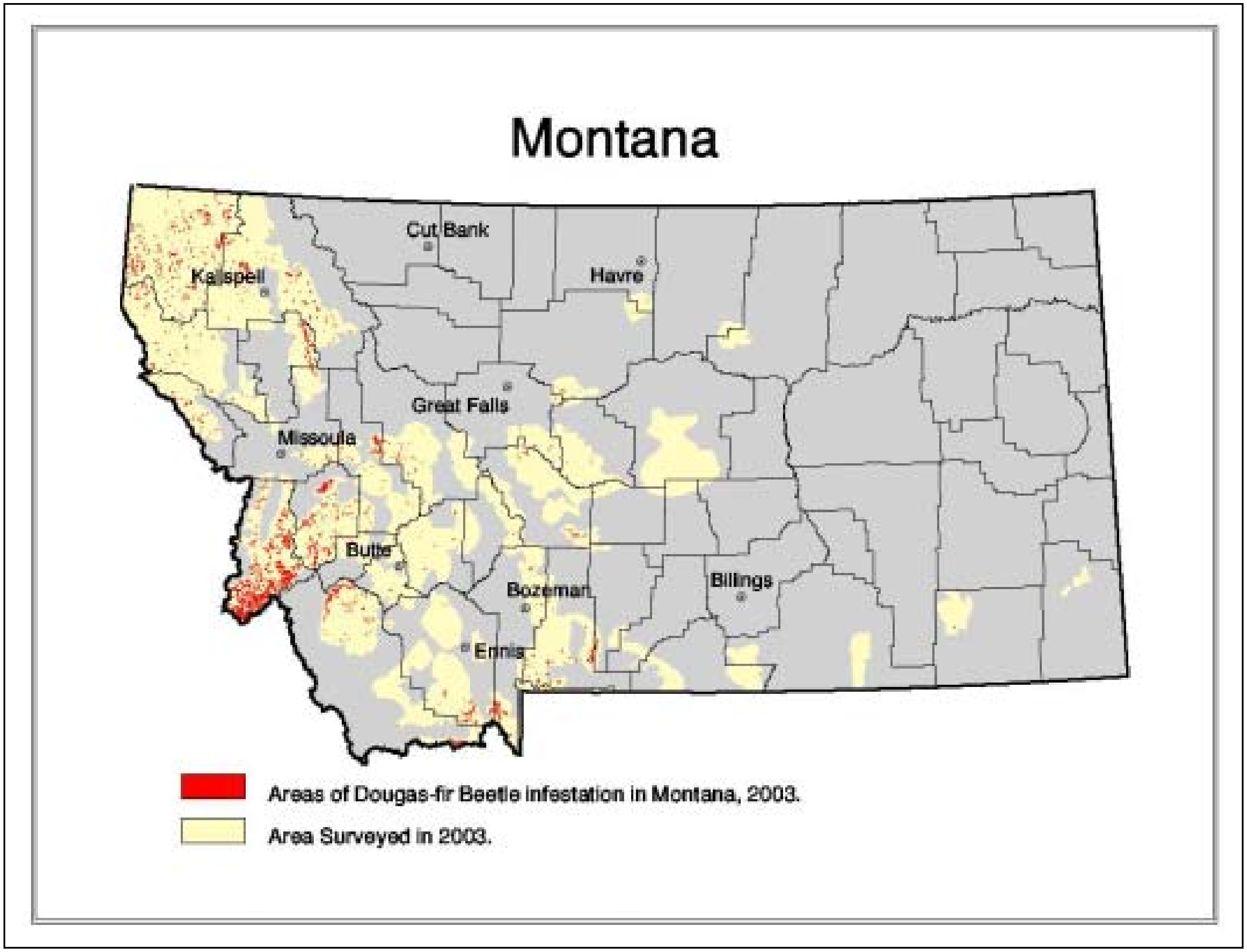

Figure 5. Fir engraver infestation in Montana, 2003

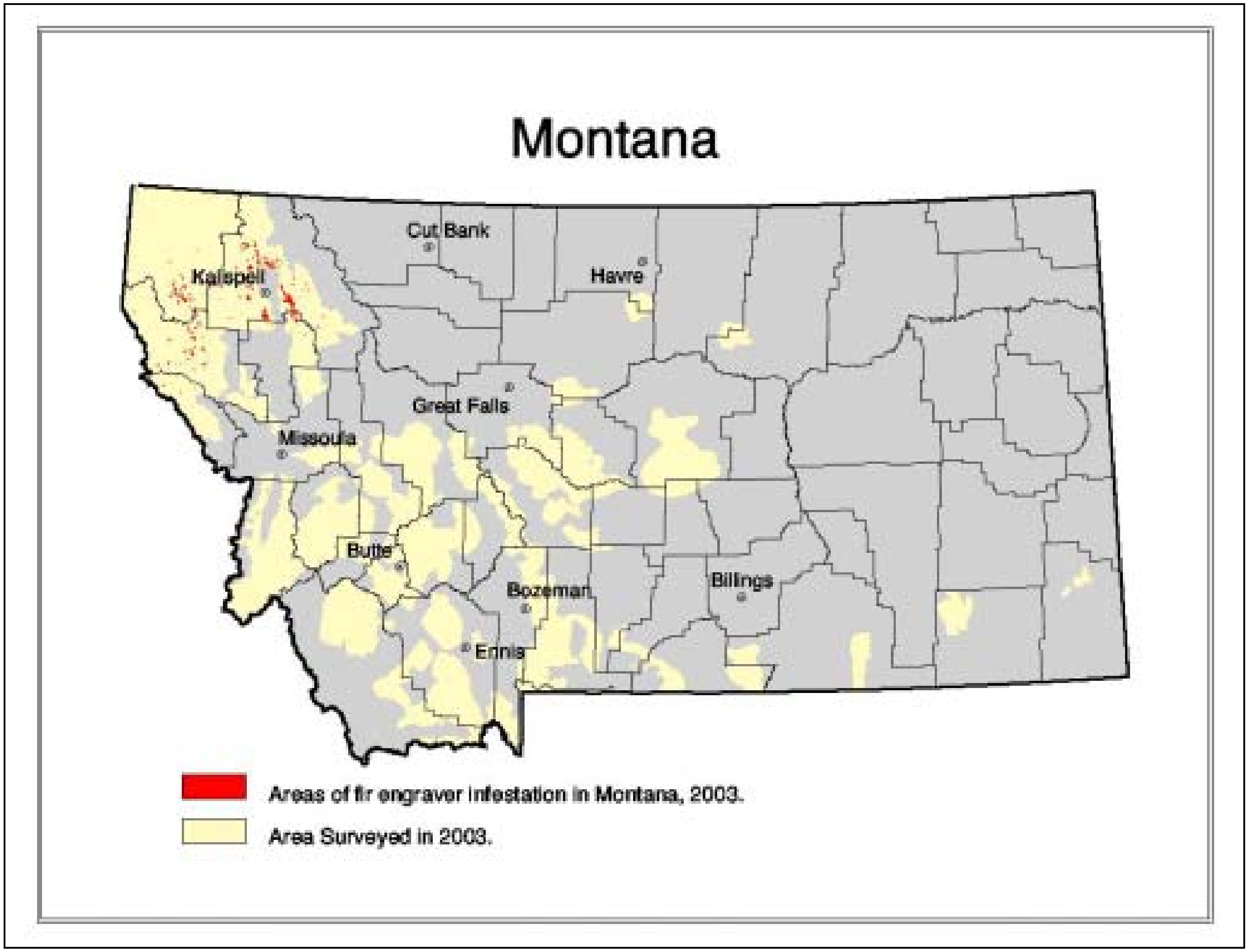

Figure 6. Western balsam bark beetle infestation in Montana, 2003

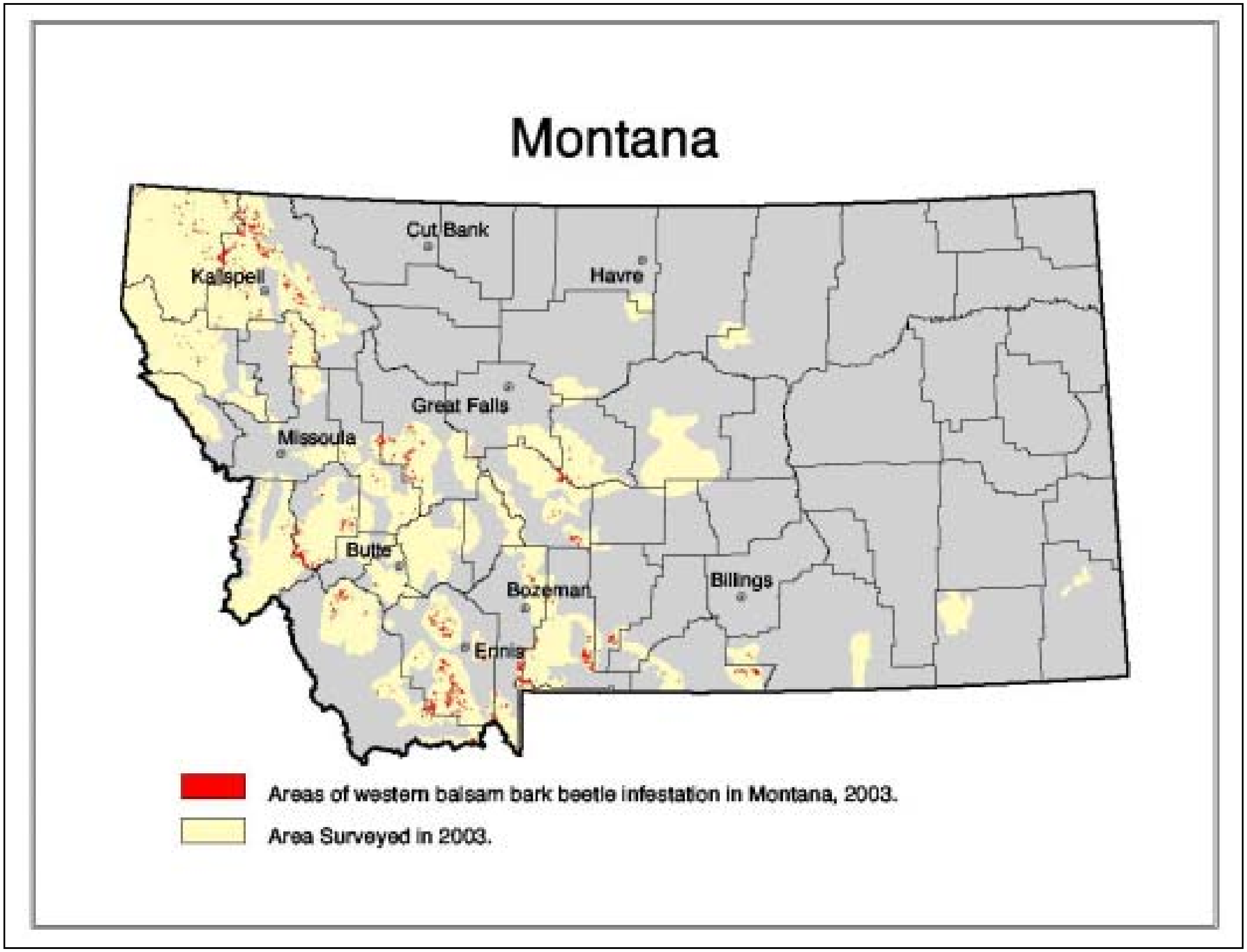

Figure 7. Western spruce budworm infestation in Montana, 2003