Montana
Forest Insect and Disease Conditions and Program Highlights

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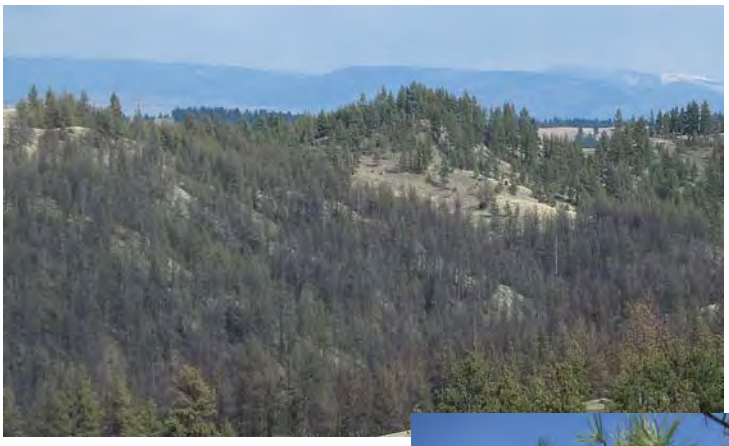
Report 08-1



Pine tussock moth in ponderosa pine

Lindgren funnel trap for Pine Engraver Beetles in thinned ponderosa pine

Montana Department of Natural Resources and Conservation Forestry Division

MONTANA

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Pine tussock moth in ponderosa pine, courtesy of Scott Sontag, USDA Forest Service.

Lindgren funnel trap for Pine Engraver Beetles in thinned ponderosa pine, courtesy of Amy Gannon, USDA Montana Department of Natural Resources and Conservation, Forestry Division

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ABBREVIATIONS

The following abbreviations are used throughout:

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
Defoliators	WSBW	=	Western spruce budworm *Choristoneura occidentalis* Freeman
	LCB	=	Larch casebearer *Coleophora laricella* Hübner
	DFTM	=	Douglas-fir tussock moth *Orygia pseudotsugata* McDunnough
	PTM	=	Pine tussock moth *Dasychira pinicola*
Hosts	LPP	=	Lodgepole pine
	PP	=	Ponderosa pine
	WWP	=	Western white pine
	WBP	=	Whitebark pine
	LP	=	Limber pine
	DF	=	Douglas-fir
	WL	=	Western larch
	GF	=	Grand fir
	SAF	=	Subalpine fir
	ES	=	Engelmann spruce
Other	NF	=	National Forest
	RD	=	Ranger District
	IR	=	Indian Reservation
	NP	=	National Park
	BLM	=	Bureau of Land Management
	FIA	=	Forest Inventory and Analysis

INTRODUCTION

This report summarizes the major forest insect and disease conditions in Montana during 2007 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 this report was derived from ground and aerial surveys within Reporting Areas across parts of Montana. A Reporting Area includes all federal, state, and private land ownerships within a particular geographic boundary (Figure 20).

SUMMARY OF CONDITIONS

Bark Beetles

In 2005 and 2006, western Montana had received essentially "normal" amounts of precipitation. Climatologists were suggesting that for most of the State—with the possible exception of southeastern counties—the long-standing drought was about over. Improved growing conditions for most bark beetle hosts during those couple of years resulted in reductions in population levels, and associated damage, of several bark beetle species.

Unfortunately, 2007 saw a return to warmer- and drier-than-normal conditions that plagued most of the State for the past few years. Western Montana recorded the warmest year on record since 1934; and as the year drew to a close, much of the area was several inches behind "normal" in yearly precipitation. So, drought effects that had shown signs of being overcome, were once again manifest in much of the State.

Some bark beetle species, especially mountain pine beetle, remained at high levels in 2007; however, even those populations have declined in some areas due to host depletion. On the other hand, populations increased markedly in a few areas just coming under attack. Other beetle species were at generally less-frequently-encountered levels; but resurges in some species, such as Douglas-fir beetle, were exhibited at a few locations.

Hot and dry conditions resulted in another very active year for wildfires, which in turn resulted in our inability to survey all infested areas. In an optimal year, we would survey most of the forested stands in 16 reporting areas in the State (including Glacier and Yellowstone National Park). In 2007, we surveyed about 70% of that potential area. Therefore, infestation levels recorded for most bark beetle species, excluding mountain pine beetle, declined in 2007. For most of the State, ground-collected data generally showed decreasing bark beetle populations; again with the exception of mountain pine beetle. However, we also found active Douglas-fir beetle populations at a few locations in western Montana. In many stands in Montana, beetle-related damage has declined because much of the susceptible hosts have been killed.

Mountain pine beetle-infested areas increased in a few locations, and populations expanded into some previously un-infested areas. However, in some stands, intensity of those out breaks has declined markedly. Decreases, at least in intensity, were recorded in some infested areas on Beaverhead, Flathead, and Lolo National Forests (NF). There was about a 70,000-acre decrease on the Deerlodge NF; however, some of that decrease was a result of not flying all of the affected area. A significant amount of the total infested area was once again recorded in whitebark pine stands, where beetle-infested stands in that forest type increased overall. More infested whitebark pine stands were flown in 2007 than in 2006, but still not all known-impacted areas were surveyed. Because aerial detection surveys (ADS) were not always complete, we still relied somewhat on 2005 surveys, the last year for which we have the most complete ADS data. In addition, we supplemented ADS data with what ground-collected data we were able to collect.

Douglas-fir beetle-infested acres decreased throughout the State, and are now lower than they have been since 1998. At a few locations in southwestern and central Montana, populations remained at higher-than-normal levels; however, in most locations, they have declined substantially. Increases were noted in Glacier NP and on the Gallatin NF. Overall, infested acres decreased in 2007 to about one-third the area recorded in 2006. A small sampling of ground surveys indicated beetle activity is nearly endemic in most areas.

Grand fir mortality attributable to fir engraver decreased once again. In many areas, beetle populations have returned to nearly endemic levels. In 2007, the infested area declined by about 700 acres. Western balsam bark beetle-killed subalpine fir was mapped on considerably fewer acres than in 2006; but fewer infested areas were surveyed. Still, notable beetle-caused mortality was found in some areas. Pine engraver and western pine beetle populations were both recorded at virtually endemic levels.

Looking forward to the field season of 2008, we are concerned because of thousands of acres of fire-damaged stands in the State, and cumulative effects of a now-prolonged drought that may be approaching 8 years in parts of Montana. Dependent almost entirely on weather for the remainder of the winter and into spring, we anticipate some bark beetle populations will rebound to varying extents in 2008. Mountain pine beetle populations, more reflective of host conditions than weather, likely will continue to expand into susceptible host stands. Our abilities to accurately predict bark beetle activity and resultant damage are not as keen as we would like. Still, there are indications that 2008 could, indeed, be a very good year to be a bark beetle!

Defoliators

Western spruce budworm continues to be the most significant defoliator in the region. In 2007, 830,186 acres were mapped as defoliated by budworm in Montana and Idaho as compared to a total of 1,158,619 acres in 2006. Of the 830,186 acres, 495,884 were defoliated by budworm in Montana. However, several forests in Montana that had large areas of defoliation in 2006 were only partially monitored using aerial detection surveys in 2007 largely because of smoke and fire impediments. Defoliation by Douglas-fir tussock moth was reported from aerial surveys on 885 acres in Montana in 2007. Larch casebearer defoliated 615 acres of larch on the Kootenai NF. Ground surveys identified areas that were defoliated by the pine tussock moth and ponderosa pine needle miner.

Root Diseases

Mortality and growth losses from root disease continue to be high throughout the state. Root disease-caused mortality is more common west of the Continental Divide, causing mortality on over one million acres. Large areas of root disease can be found east of the Divide but it tends to occur in more discreet patches, rather than being ubiquitous throughout an area. Also, root diseases can be commonly found in riparian areas east of the Continental Divide, often in spruce and subalpine fir.

Foliage Diseases

Aerial detection surveys identified larch needle disease on 137 acres in western Montana on federal and state land. Both *Hypodermella laricis* and *Meria laricis*-caused needle disease are included in these acres reported.

Dwarf Mistletoes

Forest Inventory and Analysis (FIA) data were queried to provide an estimate of dwarf mistletoe infections in Montana National Forests. The R1-FIA Summary Database was used to conduct this query. One percent of the Douglas-fir, 3.2% of the lodgepole pine, 0.2% of the whitebark pine, 0.1% of the limber pine, and 3.9% of the western larch trees were reported to be infected with dwarf mistletoe in the National Forests of Montana.

White Pine Blister Rust

Western white pine

White pine blister rust was introduced to North America in 1910 and spread throughout the range of our native 5-needle pines (western white, whitebark, and limber). This disease, along with bark beetles, fire suppression, and harvesting reduced western white pine-dominated stands to less than 5% of the original 5 million acres.

The ecological impacts of blister rust have been severe. Western white pine has been replaced by species such as grand fir, Douglas-fir, and hemlock, species that are more susceptible to native bark beetles and root diseases. Residual, mature white pine continues to be lost due to a combination of blister rust and mountain pine beetle. Lack of suitable sites, either man-made or natural, limits natural regeneration, and where it occurs blister rust may kill a high proportion of the seedlings.

Fortunately, natural resistance occurs at low levels in white pine populations, and an intense breeding program was initiated in the 1950's for western white pine. This program is now producing seedlings with increased levels of resistance (F2 stock). The resistant stock is planted operationally on suitable white pine sites on the Kootenai, Lolo, and Flathead National Forests; the Stillwater State Forest, Swan State Forest, and other state lands; as well as on both industry and private forest lands.

Although the improved stock performs much better than naturally regenerated white pine, levels of infection on some sites are far higher than original expectations. Data on blister rust infection levels and mortality has been collected through 2006 from permanent plots installed in operational plantations on federal and state lands in Idaho. A paper reporting these results, and their implications to rust-resistant white pine management, including in western Montana, is currently being compiled.

In addition to planting rust-resistant stock, pruning has been shown to be an important tool in blister rust management; removing the lower branches of white pine has been found to double the survival of white pine in areas with high infection. A booklet titled "*Pruning Western White Pine: A Vital Tool for Species Restoration*", co-authored by Chris Schnepf (University of Idaho Forestry Extension) and John Schwandt (USFS), was published in 2006 by University of Idaho Extension.

It was designed as a field guide and desktop reference for pruning white pine; foresters should obtain a copy.

The USFS Forest Health Protection, Montana DNRC, Idaho Department of Lands, and University of Idaho Forestry Extension, cooperatively and individually, provide annual training pertaining solely or in-part to management of blister rust in western white pine. For 2008 these include:

- June 20 (Friday), 2008, Newport, Washington: A one-day session on pruning western white pine is offered through UI Forestry Extension.

- The annual insect and disease management training sessions, offered cooperatively by FHP and Montana DNRC, also address management of white pine blister rust.

Whitebark & limber pines

As the fungus that causes blister rust has moved into high-elevation ecosystems the normal successional pathways of limber pine and whitebark pine have been greatly altered. The recent outbreaks of mountain pine beetle have caused additional widespread mortality in many whitebark pine stands. Although mountain pine beetle is a native insect and has historically helped recycle and regenerate pine stands, the combination of beetle-caused mortality, fire suppression, and blister rust are raising concerns about the long-term sustainability of whitebark pine ecosystems.

Standardized methodology is being used to establish monitoring plots throughout the West. Whitebark pines in the Greater Yellowstone ecosystem (including parts of Montana, Idaho, and Wyoming) are being monitored by USFS, National Park Service, US Geological Survey, and Montana State University personnel. These long-term plots are designed to provide a statistically-based assessment of the incidence of white pine blister rust in the ecosystem and the condition of whitebark pine. A database has been developed (http://www.fs.fed.us/r1-r4/spf/fhp/prog/programs2.html) to compile and provide results of surveys in limber and whitebark pine.

A comprehensive assessment of whitebark health and restoration opportunities is available online (http://www.fs.fed.us/r1-r4/spf/fhp/whitebark_pine/WBPCover_3.htm) or in hardcopy.

ANNUAL AERIAL SURVEY

The annual aerial detection survey in Montana was conducted from June 25 thru September 28, 2007. The survey covered approximately 24.8 million acres of mixed ownership, forested lands, excluding most wilderness areas (Figure 21). Four FHP sketchmappers, using three different airplanes, conducted the 2007 aerial survey.

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 a relatively short period of time. 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 sketchmapped. The intent of the survey is to cover each area once a year during which time the observer sketchmaps 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 mph, 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 were ground checked as we would like, 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.

BARK BEETLE CONDITIONS IN BRIEF

Mountain Pine Beetle (MPB)

The infested area mapped in 2007 increased very slightly from 2006 levels, but at least part of that was attributed to areas flown. Some areas were flown that were not surveyed in 2006; other areas that probably still contained some level of beetle infestation was not surveyed, or only partially surveyed in 2007. In western Montana, several formerly heavily infested areas, such as Deerlodge NF, showed a decrease in infested acres; however, the infestation continued to increase to the north and west. Lolo and Helena NF's showed significant increases as infestations moved into previously un-infested areas. Acres on which beetle-caused mortality was recorded, in all species and on all ownerships, decreased but only slightly, to more than 807,200 acres—down somewhat from the most-recent high figure of more than 820,400 acres recorded in 2005. On those infested acres, more than 2.4 million trees were killed in 2006—recorded as faders in 2007. Approximately 80% of those were lodgepole pine. Although beetle populations have declined in some host stands, they continued to expand in a few areas. In some infested areas, for which ground-collected data were obtained, as many as 230 trees (lodgepole pines) per acre have been killed within the past 2-3 years. In that particular stand (on Deerlodge NF), that represented 69% of formerly live trees.

A significant increase in beetle-caused mortality was noted in whitebark pine stands, primarily because more beetle-infested stands were surveyed in 2007—especially on Gallatin, Helena, and Beaverhead NFs and in Yellowstone NP. In the Park, aerial survey data was more similar to 2005, when most beetle-infested areas were flown. Ground surveys in some of those stands, conducted in 2006, showed 96% of the whitebark pine has been killed within the past several years. Infestations in whitebark pine stands continued to expand in most areas surveyed, and in 2007, extended to more than 145,000 acres.

Many susceptible lodgepole, whitebark, and ponderosa pine stands remain in the State. Unless weather patterns change to ones more favorable to their host and less conducive to beetle survival and population expansion, or management activities reduce availability of susceptible hosts, MPB populations and resultant tree mortality will continue until few susceptible hosts remain in many stands.

Douglas-fir Beetle (DFB)

DFB populations were found at virtually endemic levels in most parts of western Montana. With the exception of Glacier NP and Gallatin NF, every area surveyed showed a marked decline in infested area. In a few stands on Flathead, Helena, and Lolo NFs, beetle populations and resultant beetle-killed trees remain at higher-than-normal levels. But even in those reporting areas, infested areas declined in 2007. In many areas, beetle-killed trees were still noticeable; but in only a few did we find higher numbers of new attacks in 2007. Beetle populations in stands surveyed in and around areas affected by 2000 and 2003 fires, on parts of Bitterroot and Helena NFs, showed a return to near-endemic levels. Infested area recorded on Helena NF declined to less than 500 acres, and fewer than 1,900 acres on Bitterroot NF; although

most of the northern half of that Forest was not flown. Bitterroot NF was the most severely impacted area following the 2000 and 2003 fires—where beetle-infested stands not affected by fire, increased to 69,300 acres in 2005. Ground surveys and observations on the Forest continued to show decidedly marked declines in beetle populations. Surveys conducted elsewhere in the State were similar. We may begin to see more beetle activity in western spruce budworm-affected areas; some of which is being manifest on the Helena NF.

State-wide, the infested area mapped decreased to less than 22,300 acres; down from more than 60,600 acres in 2006. Approximately 59,000 beetle-killed Douglas-fir were recorded on those infested acres. In most areas, we believe populations are continuing to decline, with the exception of areas severely impacted by western spruce budworm. In some areas, still-high populations may be more perceived than real. It is often difficult to separate year of kill from the air.

There are close to 2 million acres of Douglas-fir in the State that are relatively susceptible to DFB infestation. Weather and stand disturbances—fire, defoliation, or wind throw—increase the likelihood of DFB outbreaks in those susceptible stands. Preventive management is the key to reducing outbreak potential.

Fir Engraver (FE)

Grand fir stands, in which FE-caused mortality was recorded, increased to an all-time high in 2004, at more than 298,650 infested acres—throughout the Northern Region. Improved weather over the next few years resulted in significant decreases in infested area. Most mixed-species stands in which grand fir was a component, in western Montana, showed lower levels of infestation again in 2007. Total infested area in 2005, was reduced to 38,500; dropped markedly again in 2006, to just over 2,400 acres; and declined again in 2007 to approximately 1,700 acres. Nearly 1,650 grand fir were estimated to have been killed in 2006, and were recorded as faders in 2007. We believe these dramatic decreases in FE-caused mortality were a result of better precipitation for the couple of years following 2004. Now, however, 2007 was once again warm and dry. Increasing beetle populations in some areas in 2008 would not be surprising.

Western Balsam Bark Beetle (WBBB)

The number of acres on which subalpine fir mortality, attributed to WBBB, were recorded also decreased in 2007; but affected areas were either not all surveyed, were impacted by other factors, or were not easily distinguished from the air. There may, in fact, be several factors involved in subalpine fir decline, such as balsam woolly adelgid, root diseases, and climate change. Several Forests—especially Beaverhead and Gallatin, where beetle populations have recently been high—were not flown in their entirety in 2007. In the areas surveyed, in 2006, more than 130,400 infested acres were reported. That figure declined to 115,200 acres in 2007. An estimated 260,000 subalpine fir were killed. On the Beaverhead and Gallatin NFs, we recorded the most widespread outbreaks, where a combined 55,200 infested acres were reported. Still, not all of either Forest was flown. Those combined infested areas in 2006 had exceeded 100,000 acres. In many areas, populations appeared to be decreasing, but could increase in 2008

due to unusually warm and dry conditions in 2007.

Pine Engraver Beetle (IPS)
IPS populations, and associated tree mortality in ponderosa pine stands in the State remained essentially the same in 2007 as recorded in 2006. Slight increases were recorded on Flathead Indian Reservation (IR), but similar decreases were noted elsewhere. In some areas in eastern Montana, it is often difficult to distinguish trees killed by IPS from those affected by MPB. Likely, some trees were killed by both, either singly or in combination. Whereas slightly more than 1,300 acres of beetle-killed trees had been recorded in 2006; a very similar 1,200 acres were mapped in 2007. We believe throughout the State, populations have remained fairly static within the past couple of years. About 2,300 ponderosa pines were killed by IPS in 2007.

Spruce Beetle (ESB)
ESB populations remained at endemic levels throughout Montana and Yellowstone NP. The Park had the most acres infested, at 374—a remnant of the outbreak recorded east of Yellowstone Lake and mapped at more than 8,700 acres in 2003. No other surveyed area in the State reported more than 20 infested acres. Total infested area, Region-wide was 425 acres in 2007, on which almost 600 spruce had been killed.

Western Pine Beetle (WPB)
WPB caused mortality remained at endemic levels in 2007—recorded on slightly more than 400 acres. Just under 500 acres had been reported in 2006. Only the Lolo NF reported more than 200 acres infested by WPB in western Montana. On the 402 infested acres reported in 2007, beetle-caused mortality was light and scattered, totaling fewer than 250 trees. We might anticipate a slight resurgence in 2008 because of conditions favorable to beetles and less so for their hosts.

DEFOLIATOR CONDITIONS IN BRIEF

Douglas-fir Tussock Moth
In Montana, defoliation from tussock moth, *Orgyia pseudotsugata* (McDunnough), increased from zero in 2006 to 885 acres in 2007. Seventy-two acres of defoliation from tussock moth was recorded on the Tally Lake and 123 acres were reported on the Swan Lake Ranger Districts. No defoliation was recorded in either area in 2006 nor has defoliation from tussock moth been recorded at this site previously. In 2007, traps baited with attractant tussock moth pheromone were set at 18 sites in Montana. Very few moths were caught in any of the traps at most sites. Average number of moths found in pheromone traps ranged between 0 and 0.80. Douglas-fir tussock moth traps will no longer be deployed in Montana due to changes in early detection objectives and management strategies.

Gypsy Moth
Cooperative detection monitoring continued for the gypsy moth, *Lymantria dispar*, in 2007 with Animal and Plant Health Inspection Service (APHIS), State Department of Agriculture (MDA), and State Department of Natural Resources and Conservation (DNRC). A network of more than 1000 pheromone-baited traps were placed throughout Montana. There was one gypsy moth caught in Glacier National Park. The moth was determined to be a North American hybrid. The National Park Service will conduct an intensive

delimiting survey in 2008. No other traps contained gypsy moth.

Larch Casebearer (LCB)
In 2007, we mapped 615 acres defoliated by larch casebearer, *Coleophora laricella* (Hubner), on the Kootenai NF.

Pine Tussock Moth
Two distinct outbreaks of pine/grizzled tussock moth, *Dasychira grisefacta*, were detected; one in the Knowlton region of eastern Montana (Sec36, T7N, R53E and Sec2 T6N R53E) and in Columbus in the Bearpaw Ranch subdivision. In the Knowlton outbreak, defoliation was first observed in July 2007 with light to moderate defoliation occurring over approximately 300 acres. The Columbus outbreak was first detected in the summer of 2006 and defoliation ranged from light to heavy throughout the subdivision in 2006 and 2007.

Ponderosa Pine Needle Miner
In 2007, ponderosa pine needle miner *Coleotechnites moreonella* (Heinrich), caused some defoliation on the Flathead Indian Reservation. Damage was concentrated in the larger ponderosa pine. Defoliation from the needle miner was also recorded on about 10,000 acres on the Reservation during the late 1970s. A few small spots were also recorded on the Lolo NF in 2007.

Western Spruce Budworm (WSBW)
In 2007, 830,186 acres were mapped as defoliated by western spruce budworm, *Choristoneura occidentalis* (Freeman), in Montana and Northern Idaho as compared to a total of 1,158,619 acres in 2006. Of the 830,186 acres, 495,884 were defoliated by budworm in Montana. Aerial survey reported the most heavily impacted reporting areas were on the Beaverhead (198,905 acres), Helena (127,878 acres), and Gallatin National Forests (75,958 acres) in Montana. Ground surveys reported many other areas in Montana containing static, increasing or small, endemic budworm populations. Because not all historical budworm areas were flown in 2007, the acreage figure is very likely an underestimate.

Over the past few years, we also have recorded budworm defoliation in areas where it had never or rarely been recorded. Defoliation from budworm has been recorded on the Kootenai NF over the past few years. The only other time defoliation from budworm was recorded on the Kootenai in the past 59 years was in the late 1970s.

Recent observations in heavily defoliated stands on the Helena National Forest, suggest there may be a relationship between heavy defoliation by WSBW (>90% total crown) and subsequent attack by DFB (Sturdevant and Kegley, 2006). Validity of this relationship has not been tested in the Northern Region. The importance of consecutive years of defoliation also is unknown. In 2007, we established permanent plots in several areas of current WSBW-caused defoliation which will allow us to monitor Douglas-fir mortality caused by defoliation and/or bark beetle attack. We may also be able to determine defoliation characteristics most attractive to DFB. A full establishment report outlining the study plan and documenting the first year's data is currently available.

Beaverhead RA- In 2007, defoliation by WSBW increased from 150,199 to 198,905 acres. The heaviest defoliation was reported on the Madison (39,812 acres) and Sheridan (40,059 acres) Ranger Districts. The majority of the defoliation occurred just to the North and South of Virginia City. A few polygons of defoliation from WSBW were also recorded just north of Wise River.

Bitterroot RA- Defoliation from budworm was not reported on the Bitterroot National Forest.

Custer RA- Southwest of Columbus, defoliation from WSBW was recorded on 12,818 acres. Most of the defoliation was on private land with a limited amount on Federal lands.

Deerlodge RA- Defoliation from WSBW decreased from 66,344 acres in 2006 to 19,565 acres on the Jefferson Ranger District. However, only portions of the Jefferson Ranger District were flown in 2007. However, we did observe lower levels of defoliation from WSBW in some areas of the Deerlodge. Most of the defoliation from WSBW was recorded approximately 5 miles to the northeast and to the south of Boulder on the Jefferson Ranger District.

Flathead RA- Defoliation from DFTM occurred on both the Swan Lake (123 acres) and Tally Lake (72 acres) Ranger Districts.

Gallatin RA- All of the districts in the Gallatin Reporting Area had polygons of budworm defoliation. The Bozeman Ranger District reported the most defoliation from WSBW (41,643 acres).

Helena RA- The intensity of defoliation across many parts of the Helena increased from low (<50% defoliation) to high (>50% defoliation). Heavy WSBW defoliation coupled with the effects of the lingering drought and an increase in some areas of DFB, could lead to mortality in stands that have been repeatedly defoliated. The east-side of the Helena was not flown in 2007. Therefore, acres of WSBW recorded are an underestimate because a significant amount of defoliation from WSBW was on the east-side of the Helena in 2006.

Kootenai RA- Just to the northwest of the town of Yaak, approximately 6,523 acres were defoliated from budworm on the Three Rivers Ranger District. Defoliation from larch casebearer was recorded in an area approximately 12 miles to the northwest of Libby.

Lewis & Clark RA- Most of the defoliation from WSBW occurred on the Kings Hill Ranger District (14,649 acres), followed by the Musselshell District (6,823 acres). There were large areas of defoliation from budworm just to the north of White Sulphur Springs on the Kings Hills Ranger District and south in the Castle Mountains. Areas of low and high defoliation from WSBW were found just to the North and West of the town of Neihart.

Lolo RA- We recorded low levels of defoliation from WSBW in a few areas southeast of the town of Ravalli and also in a drainage approximately 10 miles northwest of Superior.

DISEASE CONDITIONS IN BRIEF

Root Disease

Mortality and growth loss from root disease are common and continue to be major agents of change on the forests throughout the state.

BEAVERHEAD RA- Root disease in spruce and subalpine fir in the higher elevations is quite likely, but has not been confirmed. Please contact Forest Health Protection- Missoula Field Office if you think you have root disease-caused mortality on this forest.

BITTERROOT RA- Root diseases are common and are major agents of change on the forest. The pathogens most commonly found on the Bitterroot NF include *Armillaria ostoyae, Phellinus weirii*, *Heterobasidion annosum* (both s- and p-types), and *Phaeolus schweinitzii*. *Inonotus tomentosus* is found sporadically. A stump survey done in ponderosa pine stands in 2003, found an incident rate of 71% for *H. annosum* fruiting bodies across the forest.

CUSTER RA- The Custer NF has minimal amounts of root disease. We spent time looking at ponderosa pine mortality in the early 1990's, but found no conclusive root disease agent. Although p-type annosus (*Heterobasidion annosum* (Fr.:Fr.) Bref.) has not been identified on the forest, there is no reason it couldn't exist. We encourage folks to contact our office if they feel they are seeing root disease in ponderosa pine.

DEERLODGE RA- Root disease is not a major agent of change on the Deerlodge NF. *Phaeolus schweinitzii* is common in Douglas-fir, but causing decay in the butt logs and not acting as an aggressive root pathogen.

FLATHEAD RA- Root diseases are common and are major agents of change on the forest. The pathogens most commonly found on the Flathead NF include *Armillaria ostoyae, Phellinus weirii*, *Heterobasidion annosum* (s-type), and *Phaeolus schweinitzii*. These root pathogens often occur together in an area and are especially severe in mixed conifer stands. *Inonotus tomentosus* is found sporadically, affecting both spruce and Douglas-fir. P-type annosus root disease in pine is likely present, but has not been confirmed.

GALLATIN RA- Tomentosus root disease (*Inonotus tomentosus*) is known to be significant in some campgrounds on the forest. Black stain root disease (*Leptographium wageneri* var. *pseudotsugae*; confirmed by T. Harrington) has been positively identified from declining Douglas-fir on the Gallatin NF (Bozeman RD). Black stain root disease can be a significant disease in other parts of the country, but it is considered an infrequent and minor disease in Montana.

HELENA RA- Armillaria root disease can be found on the Helena NF. Brown cubical root and butt rot (*Phaeolus schweinitzii*) is quite common in various parts of the Helena NF. Especially causing significant decay in the butt logs of larger, older Douglas-firs.

KOOTENAI RA- Root diseases are common and are major agents of change on the forest. The pathogens most commonly found on the Kootenai NF include *Armillaria ostoyae, Phellinus weirii*, and *Phaeolus schweinitzii*. Other root disease pathogens are found

sporadically and include *Heterobasidion annosum* and *Inonotus tomentosus*. Root diseases are more significant on the west side of the forest, but are present on the east side.

LEWIS AND CLARK RA- Tomentosus root disease (*Inonotus tomentosus*) is known to be a significant agent in campgrounds in moist drainages. Armillaria root disease (*Armillaria ostoyae*) is present on the forest and causes very distinct pockets of mortality in Douglas-fir.

LOLO RA- Root diseases are common and are major agents of change on the forest. The root pathogens most commonly found on the Lolo NF include *Armillaria ostoyae, Phellinus weirii*, *Heterobasidion annosum* (both s- and p-types), and *Phaeolus schweinitzii*. *Inonotus tomentosus* is found sporadically. A stump survey done in ponderosa pine stands in 2003, found an incident rate of 25% for *H. annosum* fruiting bodies across the forest.

INDIAN RESERVATIONS

BLACKFEET IR- We have spent very little time looking for root disease on the Blackfeet Indian Reservation. Please contact Forest Health Protection- Missoula Field Office if you think you have root disease mortality on this reservation.

CROW IR- We have spent very little time looking for root diseases on the Crow Indian Reservation. Please contact Forest Health Protection- Missoula Field Office if you think you have root disease mortality on this reservation.

FLATHEAD IR- Armillaria root disease (*Armillaria ostoyae*) is a prevalent mortality agent in Douglas-fir and true firs on the reservation. Annosus root disease (p-type *H. annosum*) is a very serious mortality agent in ponderosa pine across the reservation. Presently, the reservation treats all large ponderosa pine stumps created during harvest activities with a registered product to prevent annosus root disease.

FORT BELKNAP IR- We have spent very little time looking for root disease on the Fort Belknap Indian Reservation. Please contact Forest Health Protection- Missoula Field Office if you think you have root disease mortality on this reservation.

NORTHERN CHEYENNE IR- We have spent very little time looking for root disease on the Northern Cheyenne Indian Reservation. Please contact Forest Health Protection- Missoula Field Office if you think you have root disease mortality on this reservation.

ROCKY BOYS IR- Armillaria root disease (*Armillaria ostoyae*), is present on the reservation, but appears to be uncommon. Butt rot and breakage caused by *Ganoderma applanatum* has been observed in quaking aspen.

NATIONAL PARKS

GLACIER NP- Root disease has been noted in some campgrounds; *Inonotus tomentosus* is known to be one of the causal agents. Other root diseases are likely present in Glacier NP, including armillaria root disease (*Armillaria ostoyae*), brown cubical root and butt rot (*Phaeolus schweinitzii*), and s-type annosus root disease (*Heterobasidion annosum*).

YELLOWSTONE NP- *Coniophora putiana* has been found

causing root decay in mountain pine beetle strip-attacked lodgepole pine in campgrounds. The presence of *C. puteana* is thought to add to the probability of failure of individual trees. *Phaeolus schweinitzii* is common in butts of older trees in campgrounds, especially lodgepole pine and Douglas-fir. Decay observed in cut stumps of spruce is indicative of *Inonotus tomentosus*, but its presence has not been confirmed.

Stem Decay

Multiple studies of fire-killed trees on the Flathead NF in recent years have resulted in isolations of several decay fungi in western larch on the forest. *Stereum sanguinolentum*, *Phellinus chrysoloma*, *Sistotrema brinkmannii*, *Antrodia serialis*, *Fomitopsis cajanderi*, and *Echinodontium tinctorium* have all been isolated from heartwood decay and *Fomitopsis pinicola*, *Cryptoporus volvatus*, *Trichaptum abietinum*, and *Gleophyllum sepiarium* have been associated with sapwood decay in the fire-killed western larch. In recent years, *Phellinus pini* and *Stereum sanguinolentum* have been isolated from Engelmann spruce stems and *Phaeolus schweinitzii* was isolated from an Engelmann spruce stump in the Lewis and Clark reporting area.

Foliage Disease

Aerial detection surveys identified larch needle disease on only 137 acres in western Montana on federal and state land. This is a dramatic reduction in affected acres compared to the 67,229 acres detected in 2006. Both *Hypodermella laricis* and *Meria laricis*-caused needle disease are included in these acres reported. Since some areas where larch needle disease was heavy in 2006 were not surveyed in 2007, there may be a greater underestimation of larch needle diseases in 2007. However, a large reduction in larch needle disease was generally seen across areas surveyed in both 2006 and 2007. Although timing of the flights can also influence needle disease detection, a lack of synchronization of *H. laricis* spore release and larch needle expansion was probably important in the reduced level of spring infections.

ADS identified light *Lophodermella concolor* infections of lodgepole pine on 7,798 acres in western Montana. Most of the acres affected (7,173) were in Glacier National Park, while the remaining 625 acres were on the Bitterroot National Forest.

Dwarf Mistletoe

FIA data were queried to provide an estimate of dwarf mistletoe infections in each reporting area. Data are presented as percentages of all trees inventoried for the given area. The conditions provided here for dwarf mistletoe are all provided by the FIA database.

Since the Beaverhead NF and Deerlodge NF are combined in the FIA database, the following information is combined data for the Beaverhead and Deerlodge NF. One limber pine (0.4% of the 248 inventoried), eight whitebark pine (0.4% of the 2,133 inventoried), eight Douglas-fir (0.4% of the 2, 048 inventoried), and 525 lodgepole pine (9.8% of the 5,367 inventoried) were reported to be infected.

On the Bitterroot NF 93 Douglas-fir (5.4% of the 1,727 inventoried), 28 lodgepole pine (2.7% of the 1,019 inventoried), and five western larch (13% of the 40 inventoried) were reported to be infected with dwarf

mistletoe on the Bitterroot NF. On the Lolo NF 37 Douglas-fir (1.5% of 2,516 inventoried), 37 lodgepole pine (2.2% of 1,715 inventoried), and 36 western larch (5.8% of 620 inventoried) were reported to be infected with dwarf mistletoe.

On the Flathead NF six whitebark pine (0.7% of 910 inventoried), 44 Douglas-fir (2.5% of the 1,749 inventoried), 35 lodgepole pine (1.7% of 2,032 inventoried), and 18 western larch (2.6% of 698 inventoried) were reported to be infected with dwarf mistletoe. On the Kootenai NF no Douglas-fir (0% of 2,863 inventoried), 13 lodgepole pine (0.7% of 1,767 inventoried), and 103 western larch (7.7% of 1,346 inventoried) were reported to be infected with dwarf mistletoe.

On the Gallatin NF one Douglas-fir (0.1% of 1,046 inventoried) and thirty-one lodgepole pine (2.3% of 1,351 inventoried) were reported to be infected with dwarf mistletoe. On the Helena NF one Douglas-fir (0.1% of 1,045 inventoried) and 46 lodgepole pine (3.5% of 1,312 inventoried) were reported to be infected with dwarf mistletoe. On the Lewis & Clark NF one Douglas-fir (0.1% of 1,759 inventoried) and 48 lodgepole pine (2.4% of 1,972 inventoried) were reported to be infected with dwarf mistletoe. On the Custer NF five lodgepole pine (1.8% of the 283 inventoried) were reported to be infected with dwarf mistletoe.

Reporting Areas in Detail

Reporting Area (RA) 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.

INSECT AND DISEASE CONDITIONS BY REPORTING AREA

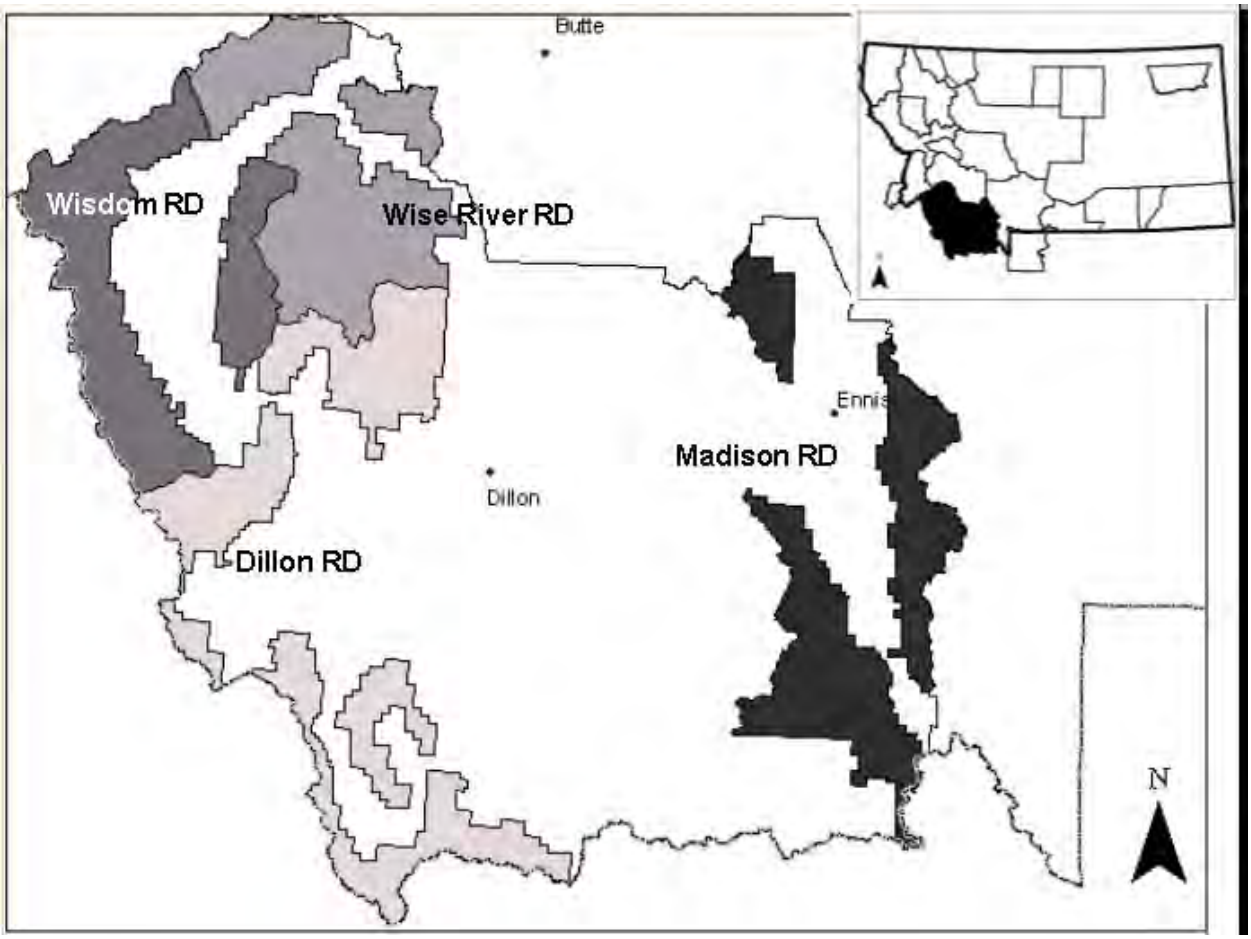

Figure 1. Beaverhead Reporting Area and Beaverhead National Forest Ranger Districts.

Beaverhead Reporting Area

Dillon RD.
Forest Service-administered lands within District boundaries were not flown in 2007, but on private land south and east of Dillon, scattered mortality in WBP/LP, caused by MPB, was mapped south of Dillon and east of Clark Canyon Reservoir. (Note: this year, surveyors recorded damage in both WBP and LP stands as one because of the difficulty in distinguishing the two species from the air. In ranges where the two species overlap, they are typically separated on an elevational gradient.) In that same area, MPB-killed LPP was also widely scattered in small groups. At higher elevations, in that same general part of the State, WBBB-killed SAF was noted in mostly small and very widely scattered groups. Only a few DFB-killed DF were noted in DF forest types, but western spruce budworm

(*Choristoneura occidentalis*, Freeman [WSBW])-caused defoliation was so prevalent throughout that area that DFB populations may well increase within the next few years.

The western portion of the District has not been flown since 2005 when the following was noted: To the south, in the Tendoy Mountains, widely scattered groups of WBBB and MPB-killed LPP were observed. South and west of Dillon, from Lemhi Pass to Bannock Pass, scattered groups SAF, were infested by WBBB. In a more general pattern, from Jeff Davis Peak, south to Morrison Lake, scattered WBBB-killed SAF and minor amounts of DFB-killed DF were noted. There were, in that same area, a few small groups of MPB-infested LPP and WBP recorded.

District-wide in 2005 (last year for which we have data), 4,000 DFB-killed DF were recorded on about 1,800 acres; MPB-killed 6,100 LPP on almost 3,400 acres and 1,200 WBP on nearly 600 acres; and almost 10,000 SAF were killed by WBBB on 4,700 acres.

Wise River RD.
MPB-killed LPP was commonly found in the Pioneer Mountains, both west and north of Wise River. Most groups were relatively small and widely scattered, but a few very large polygons, ranging up to several thousand acres each, and averaging 2-3 trees per acre, were found in the vicinity of Fleecer Mountain. Smaller groups, but still significant ones, were found to the north towards Sugarloaf Mountain, and west of there towards Mount Haggin Wildlife Management Area. Further west, towards Anaconda-Pintler Wilderness Area, MPB-killed LPP and DFB-caused mortality was much more widely scattered and found in much smaller groups. Around Fleecer Mountain, large groups of DF, defoliated by WSBW, were noted. That damage, coupled with drier weather, could result in a resurgence of DFB populations.

For the areas surveyed, DFB-caused mortality was observed on less than 500 acres (almost 6,600 acres last year), where about 1,000 DF were killed; 1,200 SAF were killed by WBBB on about 330 acres (nearly 4,700 acres in 2006); and 36,000 LPP were killed on almost 13,600 acres—compared to 3,900 acres in 2006—by MPB. Lesser amounts of mortality were recorded on adjacent State and private lands.

Wisdom RD.
Numerous small groups of DFB-caused mortality were generally scattered throughout the West Pioneer Mountains, east of Wisdom. Most groups were less than 20 trees. That was the only portion of the District flown in 2007.

Wisdom RD was also not flown in 2006, but in 2005 there was much widely scattered beetle activity recorded throughout the Pioneer Mountains. Small groups of DFB-killed DF were concentrated in the north, with larger groups northwest of Wise River, and south towards Table Mountain. Significant amounts of WBBB-caused mortality and MPB-infested LPP were scattered throughout the District. We believe those conditions remained about the same this past year.

In the Beaverhead Mountains, west of Wisdom, many widely scattered, but generally smaller groups of SAF killed by WBBB and LPP infested by MPB were noted in 2005. DFB activity was also occasionally observed there, but down from past years. In the Anaconda

Range to the north, larger groups of WBBB-killed SAF and MPB-killed LPP had been mapped. Those continued to expand somewhat.

Area-wide, almost 1,400 DF were killed by DFB on close to 650 acres (5,750 acres last year); 350 LPP by MPB on 110 acres (2,900 acres in 2006); and WBBB killed just over 1,000 SAF on 220 acres, where flown; 4,800 acres were reported in 2006.

Madison RD.
In the southern portion of Tobacco Root Mountains, many large groups of MPB-killed LPP were mapped from just north of Willow Creek, south to Granite Creek. Fader groups were generally scattered throughout the surveyed area. Heaviest concentrations were noted to the north and south of Smuggler Mine. In higher-elevation stands of WBP, MPB has killed significant numbers of trees, especially in the vicinity of Mount Bradley.

In the Ruby Range, west of Ruby River Reservoir, MPB was found killing groups of both LPP and WBP in generally small, but numerous groups. Fader groups ranged from about 10-80 trees each. WBBB was also found killing SAF in that area. To the southwest, in tributaries of Sweetwater Creek, MPB was found infesting small groups of LPP and WBP. WBBB was found there as well; and a few DF, killed by DFB were noted.

Throughout Gravelly, Greenhorn, and Snowcrest Ranges, southwest of Ennis, MPB was commonly found killing MPB and WBP; but in generally small, though numerous groups. In SAF stands, WBBB-killed trees were also quite commonly recorded. WBP mortality was particularly heavy in the Standard Creek drainage and near Black Butte. LPP mortality was heaviest in the West Fork Madison River drainage. WBBB activity was especially pronounced in the Snowcrest Range. WSBW activity was also heavy in DF stands throughout the reporting area and could lead to increased DFB activity. The latter is now found at generally moderate to high endemic levels, particularly in the southern Gravellies.

East of Ennis Lake, from the Madison River south to Tolman Creek, MPB-killed LPP and WBP were commonly encountered. A few large groups of SAF, killed by WBBB were also noted. Most beetle-killed groups were small (10-20 trees each), but they were quite generally scattered throughout that portion of the Madison Range.

In the past few years, largest concentrations of WBBB-killed trees were mapped south and west of Ennis in the Ruby Range, throughout the Snowcrest Range, and southern end of the Gravelly Range. Total affected area on the District in 2007 was estimated at 5,500 acres (10,700 acres in 2006) on which an estimated 12,700 trees were killed. More than 77,000 WBP and another 57,900 LPP were killed by MPB on 21,300 acres (29,400 acres last year) and 22,600 acres (12,000 acres in ’06), respectively. DFB killed about 3,300 trees on 1,100 acres (113 acres reported last year).

To the south, in the Centennial Range, on lands administered mostly by BLM, still significant amounts of SAF, DF, and WBP—and to a lesser extent LPP—have been killed by their respective bark beetle pests. Amounts have generally increased, except for a decline in WBBB activity, from levels recorded in 2006. Much of the DF in that area has been

defoliated by WSBW and DFB activity, already at a high-endemic level, could increase. WBBB killed about 15,000 SAF on 5,900 acres (20,800 trees on 10,900 acres in 2006).

Although not all infested areas were flown, total aerial survey estimates for the Beaverhead RA, on lands of all ownerships, were recorded nearly at 4,200 acres (9,000 acres in 2006) infested by DFB; 105,900 acres infested by MPB (all hosts) (87,900 acres in 2006); and just over 21,800 acres infested by WBBB (54,000 acres in 2006). Approximately 396,000 trees were killed by bark beetles throughout the area in 2006, recorded as faders in 2007. In addition, nearly 200,000 acres showed some level of WSBW defoliation. Dependent upon weather over the next few years, many of those damaged trees could be killed by DFB.

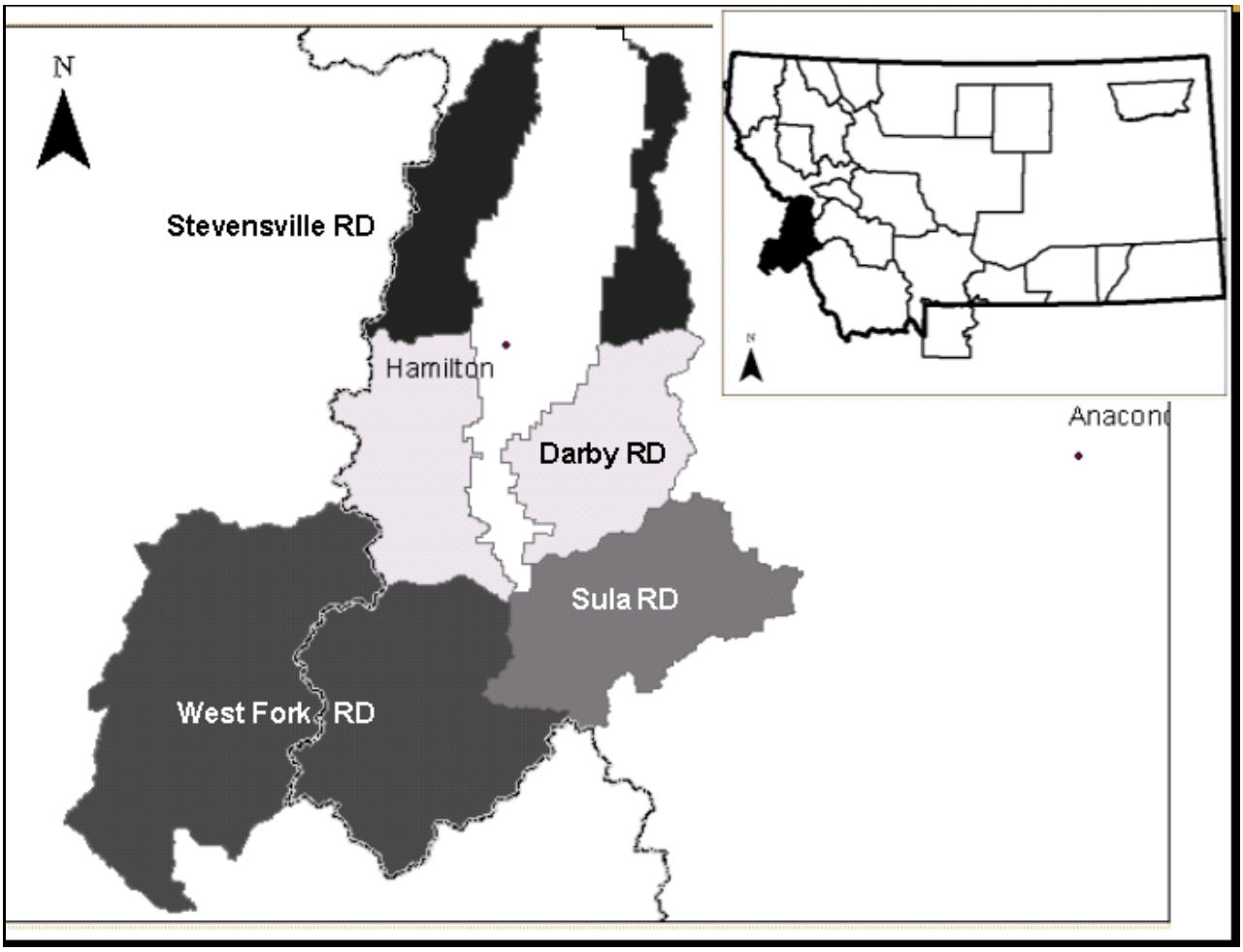

Figure 2. Bitterroot Reporting Area and Bitterroot National Forest Ranger Districts

Bitterroot Reporting Area

Stevensville RD.
Stevensville RD was not flown in 2007. The following report from 2006 is reproduced here to provide continuity: Considerable MPB-caused damage was mapped in LPP stands northeast of Stevensville, near Three-Mile State Wildlife Management Area. The largest

continuous damage is just east of Three-Mile Point, but smaller areas were noted both to the north and south. In the same vicinity, but at lower elevations several small areas of DFB-killed DF were observed and even smaller areas of MPB-damaged PP. There were many more—but much smaller and widely scattered spots—of MPB in LPP and DFB-impacted stands throughout the Sapphire Mountains.

On the west side of the Bitterroot Valley, observers found many small spots of MPB-killed trees in both LPP and PP stands throughout that portion of the District. None were of significance, although they could be building. Slightly more was recorded in 2006 than in 2005.

District totals, generally down from those mapped in 2005 showed about 1,400 acres of DFB-infested DF (1,800 in 2006); and a marked decrease in MPB-caused mortality—6,300 LPP on approximately 2,100 acres (14,000 LPP on 7,000 acres in 2005); another 2,400 WBP on 2,400 acres (3,000 WBP on 3,700 acres last year). WBBB activity declined dramatically. Where more than 6,300 acres were affected and 11,100 SAF were killed in 2005; comparable figures for 2006 were 1,400 trees on 780 acres.

Darby RD.
Only the western half of the District was flown this year. In the area surveyed, widely scattered and mostly small groups of DFB-killed DF, and PP killed by MPB or WPB were mapped along the east-facing slopes of the Bitterroot Mountains from Sawtooth Creek on the north, to the District boundary on the south. Heaviest concentrations were found in the vicinity of Como Lake, and southward. MPB-killed LPP was also mapped in a widely scattered fashion throughout Lost Horse Creek drainage. Most groups were small—generally 15 trees or less. WBBB-infested SAF was also seen in higher elevation stands. Most groups were small, but one totaling 300 trees was located in North Lost Horse Creek drainage. Others were smaller and widely scattered.

District-wide, at least for the portion surveyed, DFB-infested acres decreased significantly in 2007, to fewer than 100 acres, on which 200 DF had been killed (compared to 3,100 acres and 5,300 trees last year). MPB activity also decreased: 400 LPP were killed on 170 acres (500 acres and 1,300 trees in 2006); 200 PP on 105 acres (none n 2006) and only a few scattered WBP were reported in 2007 compared to 1,600 beetle-killed trees on 600 acres in 2006. Slightly more than 780 SAF were killed on 880 acres (1,300 SAF on 1,060 acres last year). Minor amounts of other bark beetle-related mortality were occasionally observed.

Sula RD.
Only a fairly small amount of the District was flown—generally west and south of Highway 93. At lower elevations, DFB-killed DF was very widely scattered in small groups. A few larger groups—some up to 100 trees each—were located in the upper reaches of Warm Springs Creek. Generally, the extreme outbreak of a few years ago has returned to nearly endemic levels. WBBB-infested SAF stands were common at higher elevations; larger groups were mapped near Saddle Mountain.

Total area infested by DFB decreased significantly to slightly more than 400 acres (15,500 acres in 2005). Approximately 1,100 DF were killed on

those infested acres, compared to 32,000 last year.

Also on the District several small groups of LPP and PP, killed by MPB and each totaling less than 10 acres (20 acres in 2006), were recorded. At higher elevations, SAF stands generally contained a few larger groups of WBBB-killed trees; totaling about 550 trees on 260 acres—figures had been 800 trees on 720 acres in 2006.

West Fork RD.
Not all of the District was flown in 2007—only the northeastern part, from about the District boundaries on the north and east, to Horse Creek Pass on the south and Nez Perce Pass on the west. Numerous, but generally small groups of DF, killed by DFB; and PP killed by either WPB or MPB were mapped throughout the surveyed area. MPB-killed LPP groups were found at several locations, some of the larger ones in Sheephead Creek drainage, north of Nez Perce Pass. At higher-elevation sites, MPB-killed WBP was common, and even more pronounced was WBBB-killed SAF. Some groups were large—up to several thousand trees each—in the vicinity of Blue Nest Lookout, Thunder Mountain Lookout, and Horse Creek Pass. Other large groups, mostly ones of several hundred faders each, were mapped in the Blue Joint Creek drainage, southwest of Painted Rocks Reservoir. Elsewhere throughout the surveyed area, bark beetle-caused mortality was prevalent, but mostly in small and widely scattered groups.

District-wide, DFB infested slightly more than 1,300 acres and killed just over 4,000 DF. Those figures can be contrasted to 9,600 DF on 6,900 acres in 2006. MPB activity increased somewhat in 2007—almost 2,600 LPP, 370 PP, and 150 WBP were killed on a combined 2,700 acres (most was LPP). In 2006 MPB had killed about 150 trees of all species on approximately 55 acres. WBBB killed approximately 2,900 SAF on 1,600 acres in 2006; and increased to 14,500 trees on 8,400 acres in 2007.

DFB populations, extremely high following the fires of 2000 and again in 2003 have apparently returned to endemic levels. Surveys conducted in fire-affected and adjacent stands during the past few years continued to show declining numbers of new attacks. In some areas, host depletion has been responsible for beetle population reductions.

Bitterroot RA totals for 2007 showed 1,800 acres infested by DFB, on which slightly more than 5,400 DF were killed. In 2006, 49,500 DF were killed on 27,100 acres. Slightly less than 2,500 acres LPP; 180 acres WBP; and about 380 acres PP contained varying amounts of MPB-caused mortality. Comparable figures for 2006 had been: 2,700 acres LPP; 3,000 acres WBP; and 330 acres PP. About 4,000 MPB hosts were killed; compared to 13,000 last year. Just over 9,500 acres of SAF stands were infested by WBBB (4,100 last year), on which 15,800 SAF were killed (4, 200 in 2006). Mortality attributed to other bark beetles was much less significant.

Lodgepole pine needlecast (caused by *Lophodermella concolor*) was identified through ADS on 625 acres. These affected acres are predominantly in two areas; one just north of Beaver Point and a larger area south of Beaver Point, located between the West Fork of the Bitterroot River and Woods Creek.

Figure 3. Custer Reporting Area and Custer National Forest Ranger Districts

Custer Reporting Area

Beartooth RD.
Numerous groups of MPB-killed WBP were mapped in the Beartooth Mountains west of Red Lodge, from Grizzly Peak northwestward to Burnt Mountain; and from there south to the Montana/Wyoming border. Most groups were relatively small—generally of 5-10 trees each; but along Line Creek Plateau, larger groups—some of several hundred trees each—were found. Significant amounts of WBBB-caused mortality in SAF stands were also found in those general areas. Largest of those groups were found not far from Basin Creek Lake, Wapiti Mountain, and along the Beartooth Plateau. A few small and very scattered groups of MPB-killed LPP were observed at a few locations, as were small and very scattered groups of DFB-killed DF.

In the Pryor Mountains, groups of MPB-killed WBP, SAF killed by WBBB, and DFB-infested DF were prevalent. Largest groups of beetle-killed WBP, some numbering 100 or more, were found north of Red Pryor Mountain and north of Big Ice Cave. Largest groups of WBBB were found on East Pryor Mountain, but many groups were common throughout the area. DFB activity was mostly recorded in the southern part of the reporting area, especially near Red Pryor Mountain and Keyhole Cave. Minor amounts of MPB-

killed LPP were recorded at a few locations. None were bigger than 35 trees.

To the west, from Picket Pin Mountain, southeastward towards Red Lodge, MPB-killed WBP was common. Largest groups were found near Picket Pin Mountain and Benbow Mine. At lower elevations, MPB had killed small and widely scattered groups of LPP. WBBB activity was widely scattered throughout SAF stands, with larger groups noted near Picket Pin Mountain, above Iron Creek, and near Mystic Lake.

In 2006, for the part of the District surveyed; MPB killed about 50 PP on 10 acres, another 1,550 WBP on about 180 acres, and 770 LP on 80 acres. WBBB was credited with killing approximately one tree per acre on 680 acres. Contrasting figures for 2007 showed almost 3,800 DF killed on 950 acres; MPB killed 4,700 LPP and 9,000 WBP on 1,200 and 3,300 acres, respectively; and WBBB was attributed with having killed 16,800 SAF on 5,400 acres.

Sioux RD.
Small and very widely scattered groups of MPB-killed PP were mapped in the Slim Buttes, South Cave Hills and North Cave Hills. Few groups exceeded 5 trees each—most were fewer. Much the same was observed in the West Short Pine Hills and East Short Pine Hills where 1-3 tree groups were recorded, but they were few. South and east of Ekalaka, in the Chalk Buttes and Ekalaka Hills, much the same was recorded. Beetle-killed groups were small and few. Southeast of the Ekalaka Hills, in the Long Pines, a few more MPB-killed groups of PP were found, but they were still very small and very scattered.

MPB killed an approximate 70 PP and IPS another 1,100 trees on a combined 1,300 acres, District-wide in 2005; no data was obtained in 2006. In 2007, District-wide, MPB accounted for the death of fewer than 300 PP on about 200 acres.

Ashland RD.
Small and very widely scattered groups of MPB-killed PP were mapped at a few locations throughout the District. Most were located north of US Highway 212. While total number of groups was small, concentrations of several were found in the vicinity of Whitetail Campground and Upper Deer Creek Well. South of the highway, groups were even fewer and more widely scattered, but there were several in Tenmile and Fifteenmile Creek drainages, and other groups concentrated in Lee Creek and East Fork Creek drainages, west of Fort Howes. A few small groups of IPS-killed PP were mapped north of the highway, north of Whitetail Campground.

Throughout the District, beetles killed about 12,000 PP on a combined 5,300 acres in 2005. We had no report for 2006, but in 2007, MPB killed close to 400 PP on 500 acres.

The 2005 report noted that Custer RA-wide, reported bark beetle-caused mortality totaled 3,900 DF killed by DFB on 4,300 acres. MPB was attributed with killing 500 LP on 320 acres; 400 PP on 600 acres, 760 LPP on 740 acres; and 1,340 WBP on 1,100 acres. And an estimated 8,300 WBBB-killed SAF were reported on 4,300 acres. Most of those were increases over 2004 levels. An abbreviated survey in 2006 showed: nearly 2,800 trees killed by MPB (most were WBP) and 650 SAF killed on 1,125 acres. Comparable results in 2007 showed 4,300 DF killed on 1,100 acres;

MBP had infested 1,400 acres of LPP, 530 acres PP, and 3,350 acres WBP—on which a total 13,800 trees had been killed (about 66% were WBP); and WBBB killed 17,000 SAF on 5,500 acres.

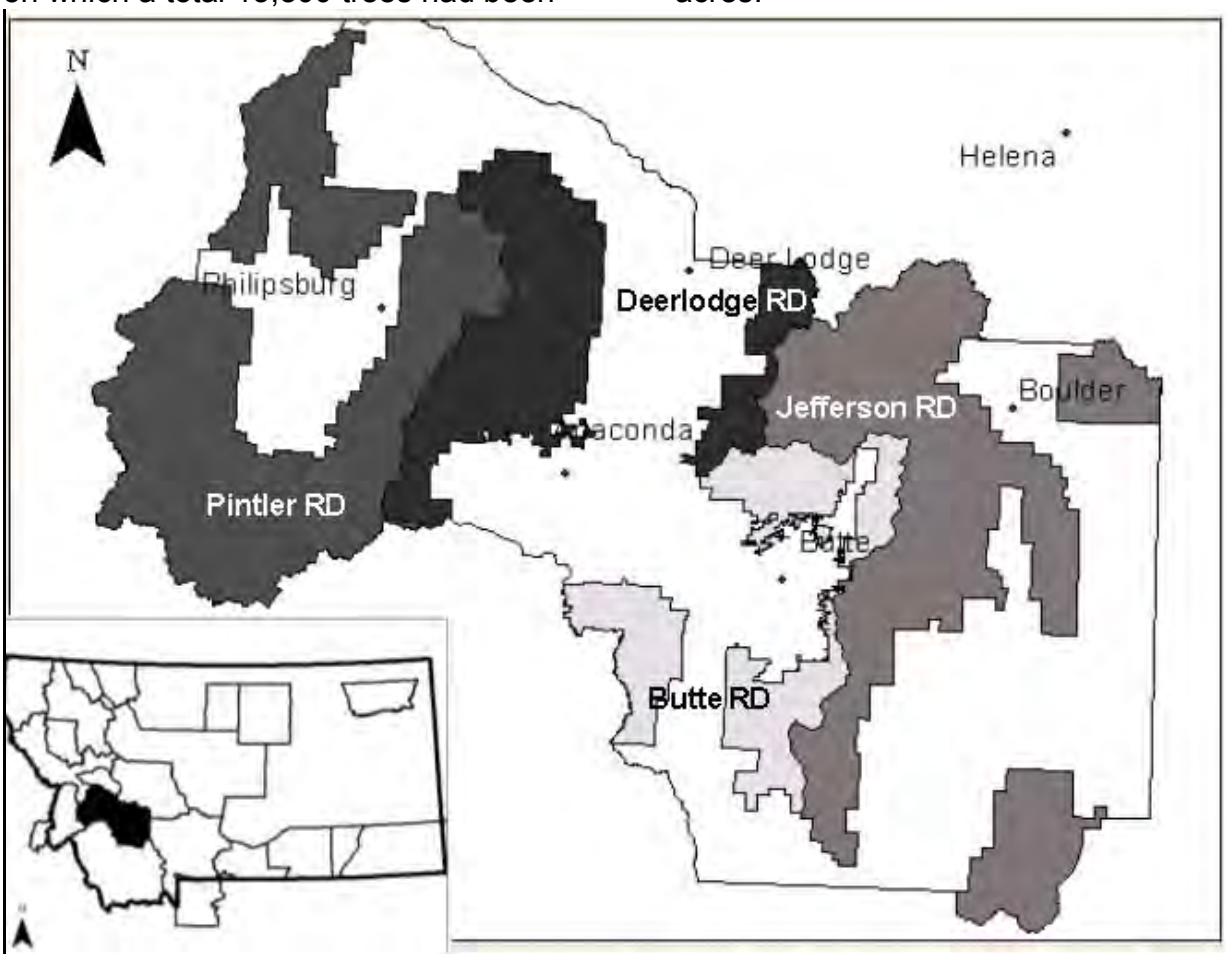

Figure 4. Deerlodge Reporting Area and Deerlodge National Forest Ranger Districts

Deerlodge Reporting Area

Butte RD.
Only a small part of the District was flown—between Butte and Homestake Pass. Very large polygons, covering most of the LPP in that part of the Forest were still heavily infested by MPB. Intensity varies from 1-20 trees per acre of faded trees (ones killed in 2006). Many of the beetle-infested stands south and east of Butte; and to the northwest, which were not flown, are experiencing slowly declining levels of infestation due to host depletion.

Ground surveys conducted there in 2007 showed the infestation on the District was still quite active although decreasing in some areas due to host depletion. In the Lime Kiln area, new attacks, for one 10-plot area, averaged 26 per acre in 2007; but 76 in another. Total beetle-killed trees per acre in those two areas were 153 and 127, respectively. In American Gulch, ten plots revealed high numbers of new attacks, averaging 52 per acre; and a total of 240 total dead trees per acre killed during the past 3 years. To the west, in German Gulch, where outbreaks were more recent, an average 70 trees per acre were killed in

2007, and 163 per acre more had been killed in the preceding two years.

District-wide, an estimated 276,000 LPP were killed on approximately 87,200 acres in 2006. Those estimates represented moderate increases from 2005 when more than 264,000 LPP were killed on about 69,800 acres. In 2007, while not all of the District was surveyed, those figures have been reduced to about 117,000 beetle-killed LPP on 22,600 acres. Many of those infested areas, especially south and east of Butte, have experienced significant amounts of host depletion.

No DFB-killed DF were reported in 2007 in the areas surveyed. District-wide, DFB-caused mortality totaled 1,100 trees on 450 acres in 2005; but had been reduced to only 110 trees on 45 acres in 2006.

Jefferson RD.
Not all of the District was flown, but much of the LPP stands from the Continental Divide, east to the Boulder River were mapped. Most LPP stands in that area, and in the area near Hidden Lake and Elkhorn Peak, south to Whitehall, were still heavily impacted by MPB. Very large polygons, ranging in intensity from 1 to 20 faders per acre were mapped throughout the surveyed area. In the Bull Mountains, west of Boulder River, a few groups of MPB-killed WBP were observed. In the southern part of the District, northern portion of the Tobacco Root Mountains, numerous large polygons of MPB-infested LPP were recorded. For the most part, however, LPP stands in that area are not as heavily infested as they are farther to the north. To the south, intensity is generally one tree per acre or less. At higher elevations, WBP stands have also been infested by MPB. At several locations, WSBW defoliation was sufficiently heavy that bark beetle activity could increase in the near future.

Infestations on the District were the still most extensive on the Forest, increasing significantly in 2007. The infested area in this year was recorded at 150,300 acres; on which at estimated 754,000 LPP were killed. That same area had been reported as 119,600 acres in 2006; and 75,000 acres in 2005. An estimated 216,000 LPP were killed in 2005, but that number increased to almost 371,500 in 2006. Beetle-killed trees more than doubled in 2007. WBBB activity declined considerably, from about 1,500 SAF killed on 500 acres in 2006; to 350 trees killed on 120 acres in 2007.

North of Boulder, on lands administered by both BLM and FS, MPB had killed numerous groups of PP and a few groups of LPP. Beetle populations there did not increase significantly.

Defoliation from WSBW decreased from 66,344 acres in 2006 to 19,565 acres on the Jefferson Ranger District. However, only portions of the Jefferson Ranger District were flown in 2007.

Deer Lodge RD.
Deer Lodge RD was not flown in 2007. The 2006 report follows: MPB activity in LPP stands increased east of Deerlodge, especially near Sugarloaf Mountain, Black Mountain, and Orofino Mountain. West of Deerlodge, significant MPB-caused mortality in LPP stands was noted from Cup Lake, south nearly to Anaconda. Minor amounts of DFB-killed DF were noted in that general area as well.

MPB outbreaks on the District totaled about 12,400 acres in 2005, up to

15,000 acres in 2006. Approximately 22,000 LPP were killed last year, 42,400 in 2006. DFB- and WBBB-caused mortality was much less significant—found on about 170 and 40 acres, respectively

Pintler RD.
The Pintler RD, likewise, was not flown this past year. We know MPB populations continued to increase in many locations. The following is from the 2006 report and likely represents on-going conditions: On the east side of the District, in Powell and Deerlodge Counties, several large areas of MPB-infested LPP were mapped within Dempsy Creek, Racetrack Creek, Lost Creek and Tin Cup Joe Creek drainages and some of their tributaries. Ground surveys near Georgetown Lake indicated MPB populations are just beginning to build in LPP stands there. Only small amounts of DFB activity were noted, some just north of Anaconda; however, increased WSBW defoliation could easily result in increased DFB activity.

The southern portion of the District had only small spots of DFB and WBBB activity. Most of that was found in East Fork Rock Creek and Rock Creek drainages. To the west, there were once again, many small groups of DFB-killed trees located near Stony Creek. There were a few small areas where WBBB had killed a few SAF along Little Stony Creek and elsewhere in that general vicinity.

East of the Clark Fork River, areas heavily defoliated by WSBW were mapped. Those stands are likely to become more susceptible to DFB in the future. There were a few small groups of DFB-killed DF in that area. Throughout that area there were widely scattered, mostly small groups of LPP killed by MPB.

DFB killed about 32,000 DF on almost 15,000 acres in 2005; however, those figures were reduced dramatically in 2006, to 4,200 DF on 1,180 acres. MPB accounted for 1,500 dead LPP (5,100 in 2005) and another 100 PP (370 last year) on a combined 1,100 acres (3,700 in 2005). WPB activity was noted on about 15 acres.

For Deerlodge RA, only about half of which was flown, recorded MPB-infested LPP stands decreased somewhat in 2007. Found on slightly more than 246,130 acres in 2006, that figure declined to 177,200 acres in 2007. Nearly 720,000 LPP were killed last year, but increased to nearly 892,000 in 2007, even though fewer infested acres were reported. Most infested LPP stands were on FS-administered lands. MPB also killed a reported 4,200 WBP on 3,100 acres. Similar figures of 4,900 WBP on 2,500 acres were reported in 2006. DFB infested but 107 acres (2,100 acres in 2006) and WBBB was recorded on 120 acres (700 in 2006). Those beetles killed fewer than 800 trees, combined.

A survey of campgrounds on the district found very little root disease. A decay column in a cut lodgepole pine in the Lodgepole Campground resembled *Coniphora puteana*, but subsequent culturing did not confirm its presence. Root disease appeared to be involved in blow down trees in Flint Creek Campground in Douglas-fir, Engelmann spruce and subapline fir, but the causal agent was not confirmed (Trip Report pending). Decay in the stumps appeared to be *Inonotus tomentosus*.

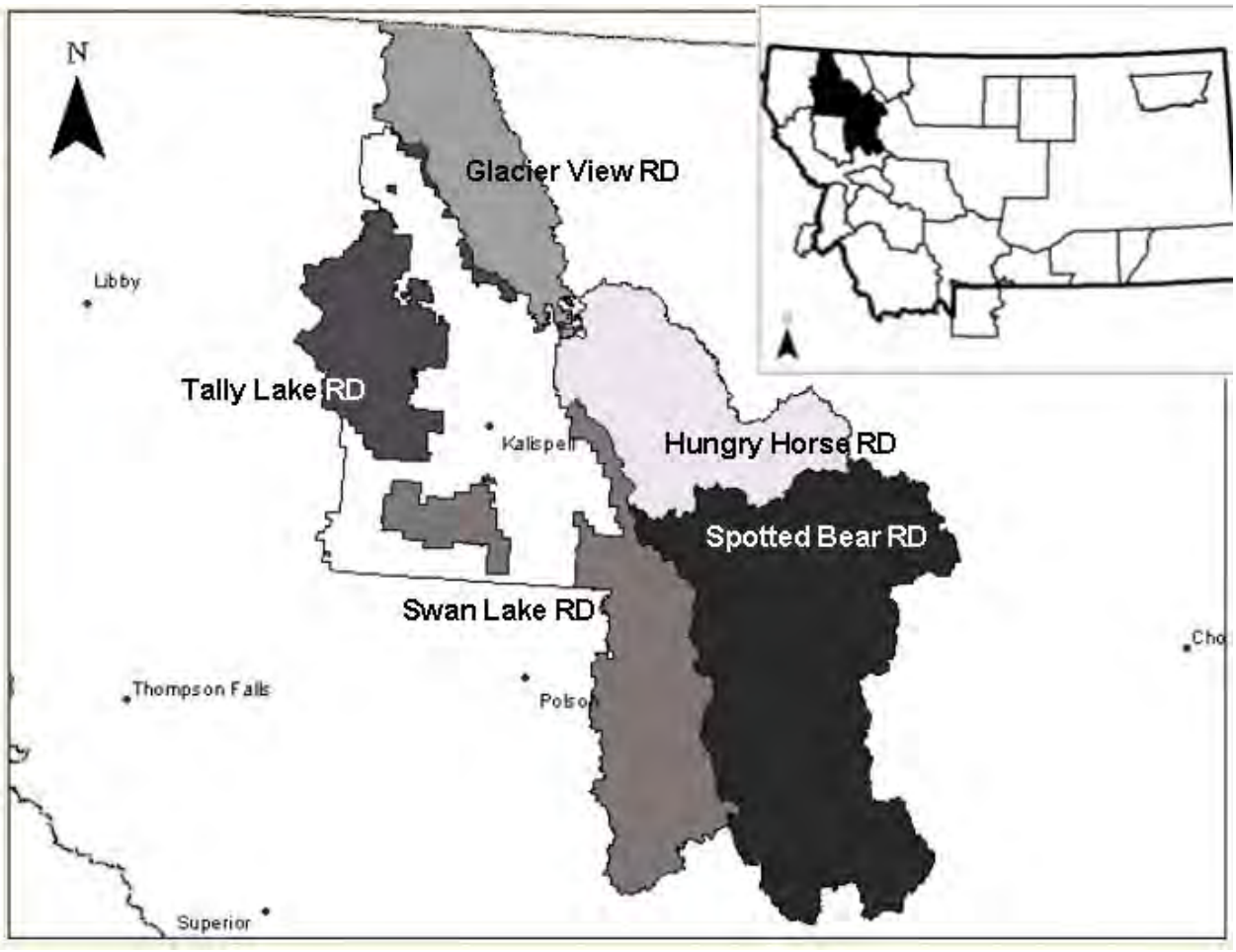

Figure 5. Flathead Reporting Area and Flathead National Forest Ranger Districts

Flathead Reporting Area

Swan Lake RD.
MPB in LPP was the most prevalent mortality agent in the Swan Lake/Swan Valley portion of the District, though it has decreased slightly from levels recorded in 2006. Numerous polygons of MPB-killed LPP were mapped throughout the Swan Valley from about the northern end of Flathead Lake, south to District/Forest boundary near Grey Wolf Lake. Largest groups, covering several thousand acres each, and containing 2-3 beetle-killed LPP per acre, were mapped near Sixmile Mountain, near the southern end of Swan Lake, east of Cedar Lake, within Elk Creek drainage, north of Lindbergh Lake, and south of Holland Lake. Elsewhere throughout the District, MPB-caused mortality was prevalent in LPP stands, but more scattered and generally in smaller groups. DFB-caused mortality was still found at a few locations, but it is much reduced from previous levels. Several small groups were concentrated a few miles southeast of the town of Swan Lake. At higher elevations, WBBB-killed SAF was also commonly reported. Larger groups were found near the head of Blue Bay Creek and between Piper Lake and Moore Lake. A few MPB-killed PP and even fewer FE-killed GF were mapped; but they are a minor component of the bark beetle-caused mortality on the District.

On the Island Unit, MPB-killed LPP has increased near and surrounding Blacktail Ski Area. Several large polygons were mapped on the slopes of Blacktail Mountain—the largest of which covered several thousand acres and averaged an estimated 2 beetle-killed LPP per acre. Elsewhere in the Unit, MPB activity was much less pronounced, more light and scattered. To the west, MPB was recorded as having killed several groups of PP. Throughout the Unit, DFB and FE have killed small and very scattered groups of their respective hosts. WBBB activity was found killing SAF—and may be associated with high levels of root disease.

The once widespread FE outbreak of a few years ago has subsided to nearly endemic levels. In 2005, more than 16,000 GF were killed on 7,500 acres. Comparable figures for 2006 showed 1,700 trees killed on less than 1,000 acres. They have declined even further in 2007 to 600 trees on 360 acres. MPB activity in LPP was still noticeable throughout the District, but has declined slightly from the 22,400 acres on which 56,200 trees were killed in 2006; to 37,300 dead trees on 22,100 acres. Throughout the District, DFB activity also declined, to 2,800 dead DF (5,000 in 2006) on about 1,800 acres (2,200 acres last year). WBBB-caused mortality increased significantly—going from about 3,400 SAF killed on 1,100 acres in 2006; to 9,400 trees on less than 2,600 acres this year. DFTM defoliated 123 acres on the Swan Lake Ranger District.

Spotted Bear RD.
MPB-killed LPP was still very prevalent around Spotted Bear, but at only slightly elevated levels from those recorded in 2006. Largest fader groups were still located within a few miles of the Ranger Station, and generally were in groups of several hundred each. Largest of those was a 700-tree group west of Spotted Bear and another several thousand-acre group to the east, near Big Bill Mountain. Except for near the southern-most end of Hungry Horse Reservoir, MPB-killed groups of LPP are small and fairly widely scattered along both sides of the Reservoir, north to the District boundary. Elsewhere throughout the District, DFB- and WBBB-killed trees are noticeable, but generally in smaller groups and much less prevalent than MPB-caused mortality.

A set of 30, variable-radius plots that have been monitored yearly for the past 26 years, in the Cedar Creek area, south of Spotted Bear, showed an average 63 LPP per acre have been killed by MPB—mostly within the past 6-8 years.

District-wide, MPB infested LPP stands totaled 10,700 acres, on which nearly 13,000 trees were killed. In 2006, those figures were 10,250 acres and 25,000 trees. DFB-affected stands on the District remained about static, totaling just over 1,070 acres, whereas 1,100 acres had been recorded in 2006. Slightly fewer than 2,200 DF were killed, compared to 2,700 last year. Other bark beetle-related activity was less significant—WBBB killed 950 trees on 410 acres and 200 FE-killed GF were recorded on 180 acres.

Hungry Horse/Glacier View RD.
MPB-caused mortality in LPP stands was very heavy south of Middle Fork Flathead River, in the extreme eastern portion of the District. Large groups were mapped along Patrol Ridge, and immediately south of the River, north of Baldhead Mountain. East of Square

Mountain, significant groups of both MPB-killed LPP and SAF affected by WBBB were mapped. Throughout the remainder of the District—along both sides of the Reservoir and towards Martin City, MPB activity in LPP is still noticeable, though much less prevalent. Some of the larger groups are just west of Mount Cameahwait. Towards the northern end of the Reservoir, and throughout Coram Experimental Forest, DFB-caused mortality was still noticeable—at about the same level as recorded in 2006. South of Hungry Horse, and along the western side of the Reservoir, WBBB-killed SAF and DFB-caused mortality was more noticeable. Larger groups of DFB-killed DF were mapped in the Doris and Lost Johnny Creek drainages. South of there, WBBB and DFB activity was much less pronounced.

On Stillwater SF, adjacent to the old Glacier View RD (which was not flown), WBBB-killed SAF was found in abundance. Several large groups were mapped along Stryker Ridge. Those infested areas totaled about 900 acres, on which close to 1,500 SAF were killed. Elsewhere, small and nearly insignificant amounts of MPB-killed LPP and FE-killed GF were mapped. A few small groups of DFB-killed DF were also observed.

On the Hungry Horse portion of the District, in 2006, MPB killed a reported 19,000 LPP on 7,600 acres. Beetle-killed trees declined slightly in 2007 to about 16,300; however, infested acres were up somewhat, to 9,400. Very few WBP were reported killed, whereas 500 WBP were reported killed on 200 acres, in 2006. District-wide, on lands of all ownerships, WBBB infested acres increased from also declined, from almost 750 acres last year, to 2,000 in 2007 (almost 4,000 SAF were killed); and FE-infested acres were up slightly, from 30 to 85 acres.

Very little Forest Service-administered lands, in North Fork Flathead River drainage (Glacier View RD) were flown in 2007. In 2006, WBBB and DFB activity was very widely mapped throughout the District. Largest DFB groups were noted in upper reaches of Hay Creek and Whale Creek drainages, while most noticeable WBBB-killed groups of trees were noted along Coal Ridge. MPB-affected LPP was lightly scattered in host type throughout the District, with the more notable groups of MPB-killed LPP being mapped near Cleft Rock Mountain.

Last year, District-wide, MPB has infested fewer than 650 acres (1,200 acres last year), DFB actually increased to almost 1,600 acres, on which 3,400 DF were killed; and WBBB activity decreased to less than 2,200 infested acres—down from nearly 5,000 acres in 2005.

A service visit confirmed the presence of armillaria root disease in the 12-year old Firefighter Douglas-fir Tree Improvement Test Plantation (MFO-TR-07-24). Other species affected included naturally seeded lodgepole pine and subalpine fir.

Tally Lake RD.

DFB activity was much reduced throughout the District, but still found in small and widely scattered groups. Several small groups were mapped around Tally Lake and throughout Logan Creek drainage. WBBB-killed SAF was still found in several relatively large groups near Elk Mountain and along Reed Divide, south of Tally Lake;

also along Ashley Divide, north of Ashley Lake. Other bark beetle activity, MPB in LPP and FE in GF, was mapped in small and very scattered groups.

On District and adjacent lands, 510 acres (compared to 670 acres in 2006) showed some level of DFB-caused mortality; about 75 acres (600 acres in 2006) had MPB-killed LPP; only about 50 acres (30 acres last year) of FE-related activity; and less than 900 acres (550 acres in 2006) of WBBB-infested SAF. Most were at similar levels to those previously reported. DFTM defoliated 72 acres on the Tally Lake Ranger District.

Throughout the Flathead RA, and on lands of all ownerships, nearly 45,000 acres have been infested by MPB (compared to 44,000 acres in 2006); 1,600 acres by FE (1,500 acres in 2006); 5,400 acres by DFB (8,000 acres last year); and 7,000 acres by WBBB (5,000 acres reported in 2005). Forest-wide, slightly more than 97,400 bark beetle-killed trees were recorded in 2007. Those were substantial decreases from 2006 levels, when 143,000 trees had been killed.

The 2007 aerial detection surveys identified larch needle disease on only 52 acres of state lands in the Flathead Reporting Area. This compares to 22,332 acres on the Flathead National Forest and 7,715 acres on state and private lands in 2006. The 52 affected acres were about 5 miles north of Olney on the Stillwater State Forest.

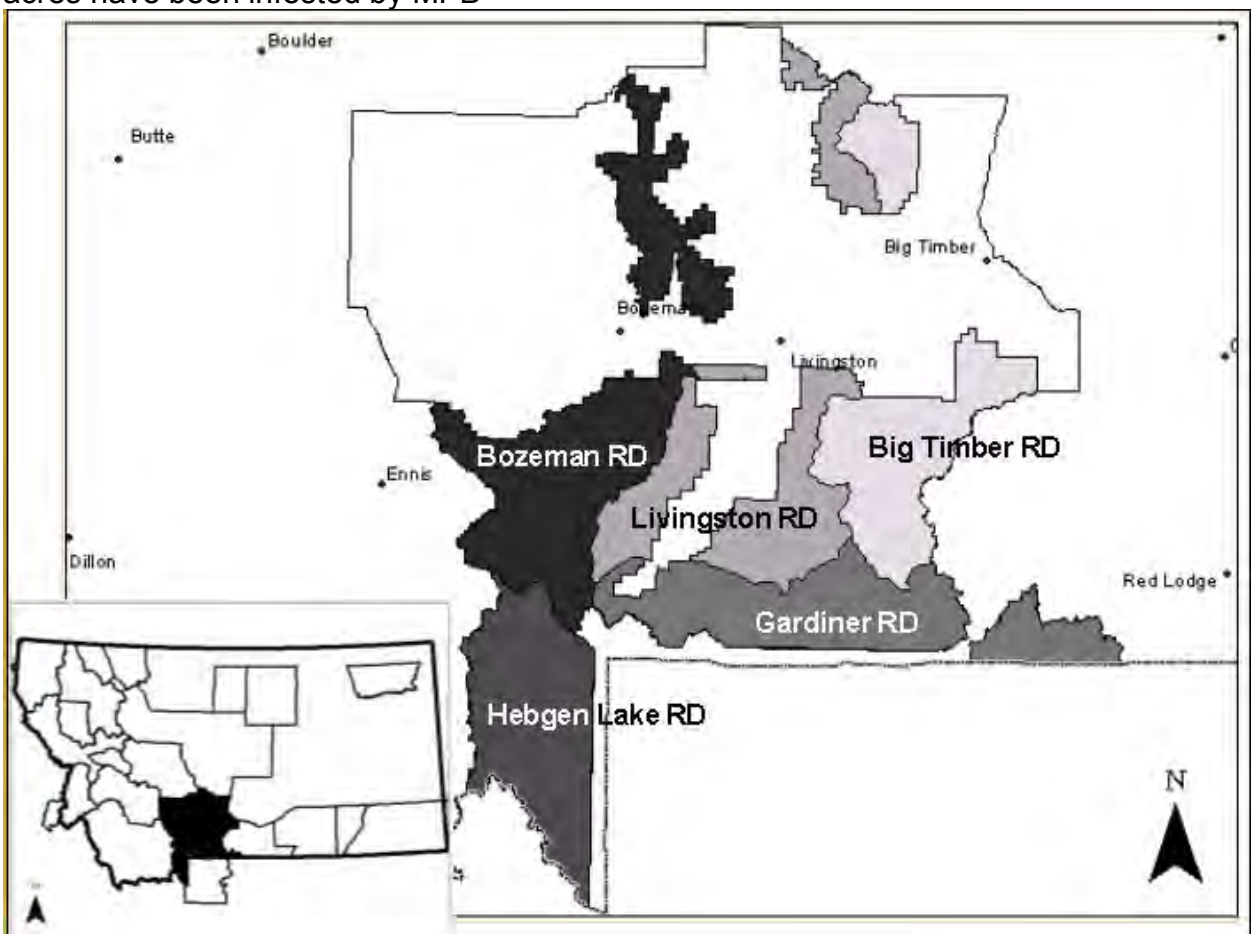

Figure 6. Gallatin Reporting Area and Gallatin National Forest Ranger Districts

Gallatin Reporting Area

Big Timber RD.

In the Boulder River drainage, south of Big Timber, bark beetle activity was much reduced from previous levels. DFB-caused mortality was recorded in only a few small groups within the Boulder River Corridor. A few of the larger groups were noted near Hicks Park and Hells Canyon Campgrounds. Other DFB-caused mortality was noticeable, but mostly in small and more scattered groups.

MPB-caused mortality was noted once again near Independence Peak, but groups were smaller than in previous years. MPB-killed WBP were also recorded to the north of there, in the Beartooth Mountains, south of Big Timber. Larger groups were mapped near Contact Mountain, Chrome Mountain, and Teepee Mountain. In that part of the District, WBBB-killed SAF was also commonly found. Largest groups were also near Chrome and Contact Mountains. Other groups were more generally scattered throughout the host type. A few MPB-killed LPP and DFB-infested DF were mapped in that area, but groups were small and widely scattered. Rest of the District was not flown.

DFB-infested stands appeared to have increased somewhat throughout the District in 2007; however, more of the District was surveyed this year. Where infested acres totaled only about 40 acres—mostly in the Boulder River drainage—in 2006; in 2007, that had increased to close to 400 acres. Only 90 DF were reported killed, last year; but that increased to more than 2,200 in 2007. MPB had killed 1,100 WBP on 1,200 acres in 2006; those figures increased to 7,600 trees on 2,800 acres in 2007. In 2006, 2,300 SAF were affected by WBBB on nearly 1,400 acres. Tree tallies increased to 4,400; but on fewer acres—1,300—in 2007. Most of those figures were increases from 2006; but more areas were flown in 2007.

Livingston RD.

Very large groups of MPB-killed WBP were mapped in the southern Gallatin Mountains, especially near Ramshorn Peak, Eaglehead Mountain, near headwaters of Fridley Creek and South Fork Eightmile Creek. Still others were located south of Bald Knob. Also found throughout the Madison Range, in smaller and less-significant groups, were DFB-killed DF, WBBB-killed SAF, and MPB-infested LPP. Larger groups of WBBB-caused mortality were found near Ramshorn Peak, Eaglehead Mountain, The Sentinel, and near the head of South Fork Eightmile Creek. MPB-killed groups of LPP were mostly small and fairly scattered in LPP forest types.

South of Livingston and east of Yellowstone River, in the Absaroka Range, MPB activity in WBP and LPP stands was prevalent, as was WBBB impacts in SAF stands. Generally, fader groups were not as large as those found to the west; but a few large groups of MPB-killed WBP were found near Mineral Mountain, Emigrant Peak, and Dexter Point. MPB in LPP was more widely scattered, and fader groups were generally smaller. Some of the larger groups of SAF, killed by WBBB, were located near Barbara Ann Mine and Dexter Point. Other groups were smaller and somewhat generally scattered through the host type. A few DFB-killed DF were noted, but DFB populations appeared to be largely endemic. Rest of District was not flown.

DFB infestations on the District had declined dramatically in 2006, when only 40 acres were reported—down from 2,400 acres in 2005; but a slight increase was noted in 2007 when almost 400 acres were recorded. Approximately 7,000 beetle-killed DF had been recorded in 2005, 80 last year, and 1,600 in 2007. MPB activity in WBP stands increased significantly—from 1,750 dead trees on 2,900 acres in 2006; to 40,000 trees on 11,000 acres in 2007. MPB activity in LPP on the District also increased markedly in 2006. In 2006, 4,700 LPP were mapped on almost 4,000 acres; comparable figures for 2007 showed 30,000 beetle-killed trees on about 8,000 acres. A set of 10 variable-radius plots established near Ibex Guard Station showed approximately 66 newly infested trees in 2007. WBBB activity in SAF stands also increased; from 5,300 trees on 4,200 acres last year; to 18,400 trees on 5,400 acres in 2007.

Tomentosus root disease (*Inonotus tomentosus*) is known to be a significant agent in spruce trees in some campgrounds on the forest. It has been positively identified in spruce from Snowbank and Pine Creek Campgrounds south of Livingston (July 18, 1996 Service Visit and MFO-TR-05-06). A *P. scheinitzii* conk was found adjacent to a large symptomatic Douglas-fir tree in the Snowbank Campground.

Gardiner RD.

Very large groups of MPB-killed WBP were mapped in the northwest portion of the District, north of Yellowstone NP. Especially large groups were noted near Deaf Jim Knob, Sheep Mountain, and Black Mountain. A few large groups of WBBB-killed SAF were also mapped in that general area, and especially near Ramshorn Peak.

North and east of Gardiner, MPB-killed WBP was found in several large groups near Ash Mountain and Sheep Mountain. MPB was also found affecting LPP stands near Ash Mountain and Red Mountain. WBBB activity was also found in many of the same mixed-species stands where MPB was killing WBP. DFB activity was noted in a widely scattered pattern in DF type, but several small groups were concentrated near Dome Mountain, northwest of Gardiner.

To the east, in Beartooth Mountains, MPB was found affecting both LPP and WBP stands; however, no groups were especially large. In higher-elevation SAF stands, WBBB-caused mortality was recorded in a few large groups south of Sheep Mountain and south of Soda Butte Creek near the Montana/Wyoming border. Other groups were mapped near Russell Lake and Lake Elaine, to the east.

Throughout the District, about 35 acres of DFB-infested stands were noted in 2006. That figure remained relatively static in 2007 at 170 acres. About 900 DF were killed. Approximately 2,000 acres SAF were found to contain noticeable amounts of WBBB-caused mortality in 2006, an increase over 2005 figures. Those increased once again in 2007, to just over 4,000 acres. Approximately 10,400 SAF were killed. MPB-killed WBP increased markedly as well. Whereas 1,130 beetle-killed WBP had been reported on 2,000 acres in 2006; in 2007 an estimated 74,400 trees were killed on nearly 8,400 acres in 2007. Blister rust is still known to infect many of the WBP stands in that area. Quite likely, many also contained MPB-

caused mortality. Almost 3,900 LPP were also killed by MPB, on additional 1,000 acres.

Bozeman RD.
South of Bozeman, in Madison Range, MPB had killed very large groups of WBP from Cinnamon Mountain on the south to Pioneer Mountain on the north. Several groups extended to a thousand acres or more and averaged an estimated 3-5 beetle-killed trees per acre. Other large groups were mapped to the north, in the headwaters of Cherry Creek drainage. Throughout Gallatin Range, to the east, WBP mortality caused by MPB was also quite prevalent. Large, beetle-killed groups of WBP were mapped near Fortress Mountain, northward to Eaglehead Mountain, and at a few other locations, north to Squaw Creek. Throughout both Madison and Gallatin Ranges, south of Bozeman, WBBB-killed SAF and MPB-impacted LPP were also frequently noted. Larger groups of the former were mapped near Fortress Mountain, Hidden Lakes, Mount Blackhorse, and south of Little Bear Lake. Largest groups of the latter were noted near to the west above Bear Trap Creek and to the east in Bozeman and Hyalite Creek drainages, a few miles south of Bozeman. Elsewhere throughout the District, small groups of beetle-killed trees—killed by DFB, MPB, and WBBB—were commonly found in the beetles' respective hosts. In total, bark beetle activity increased from 2006 levels.

In total, MPB and blister rust in WBP stands once again increased substantially in 2007. In 2006, 18,000 acres of WBP had been recorded as infested by MPB, on which 3,800 trees had been killed. In 2007, even though blister rust was not specifically recorded, it is certainly a factor in the nearly 41,000 dead WBP recorded on 13,300 acres. Acres of WBBB-affected SAF stands decreased substantially—from 27,000 acres in 2006 to nearly 18,100 acres in 2007—but not all beetle-infested areas were flown. However, beetle-caused mortality on those acres increased—from 27,000 to 55,500 trees. DFB activity was up somewhat, from 50 acres last year to 220 in 2007. About 1,200 DF had been killed. However, WSBW defoliation was reported on more than 40,000 acres in the Bridger Mountains. Many of those trees could attract DFB within the next few years. The Bozeman Ranger District reported defoliation from WSBW on 41,643 acres.

Tomentosus root disease (*Inonotus tomentosus*) is known to be a significant agent in spruce trees in some campgrounds on the forest. It has been positively identified in subalpine fir from the area around Fairy Lake Campground north of Bozeman (2005 Insect and Disease Training Session) and appears to have been involved with significant blow down of Douglas-fir in 2006 near Battle Ridge Campground north of Bozeman (MFO-TR-07-05). *Phaeolus schweintizii* appears to have also been involved in the weakening of the roots of these Douglas-fir trees.

Hebgen Lake RD.
DFB activity has declined significantly on the District, but DFB-killed DF were still mapped in small and scattered groups north of both Hebgen Lake and Quake Lake, northwest of West Yellowstone. Some of the larger groups were located in the Beaver Creek drainage, near Boat Mountain. South of Hebgen Lake, DFB-caused mortality was widely scattered and most groups

were small, but a few contained as many as 50-60 dead DF.

Most significant beetle-caused mortality continued to be MPB in WBP—especially in the southern and central portions of the District. Large groups of beetle-killed WBP were mapped near Coffin Mountain, west of Hebgen Lake, and north of Hebgen Lake, along Kirkwood Ridge. Other large groups were mapped in the Beaver Creek drainage, and north of Madison River near Triple Lakes. Even larger groups were noted in Madison Range, in District's extreme northern part. One large polygon, east of Woodward Mountain, covered approximately 3,000 acres and contained an average 20 beetle-killed WBP per acre. Other groups in that vicinity were pronounced, but smaller and less intense.

East of there, and in lower elevation LPP stands, MPB-caused mortality was recorded in Wapiti, Sage, and Taylor Creek drainages. That activity has increased over 2006 levels, as well. WBBB-caused mortality was noticeable, but at a reduced level from past years. Some of the larger groups were found in Henrys Lake Mountains, south and west of Hebgen Lake, and at a few locations in Madison Range, west of the northwestern corner of Yellowstone NP.

District-wide, an estimated 28,400 WBP killed on approximately 24,500 acres in 2004; 24,100 trees on 11,600 acres in 2005; another 5,700 trees were killed on 7,200 acres in 2006, and now 141,400 additional WBP on 17,300 acres were recorded in 2007. That totals to nearly 200,000 trees in the past 4 years. Mortality of that magnitude is having a drastic effect on those stands; and those estimates may be conservative. Data collected on ten variable-radius plots near Lightning Lake in 2004 showed, for the area surveyed, more than 160 trees per acre had been killed in the preceding 2-3 years. MPB beetle-killed LPP also increased in 2007. More than 8,700 trees were reported on 7,500 acres in 2006; but increased to more than 27,000 trees on 8,500 acres in 2007. DFB activity once again declined to just less than 800 acres (900 acres reported in 2006), on which about 3,300 dead DF were recorded. WBBB killed an estimated 12,200 SAF on nearly 11,000 acres in 2006. In 2007, those figures declined to 10,000 trees on 4,500 acres.

For the entire Gallatin RA about 2,060 acres of DFB-infested DF stands were observed, compared to 1,100 in 2006. About 9,800 DF were killed. Another 30,300 acres of MPB-infested LPP were mapped—up markedly from 18,100 recorded in 2006. More than 52,900 acres of MPB-killed WBP—an increase from 31,200 acres last year—was noted (almost 307,000 WBP were killed); and about 33,400 acres were mapped on which approximately 99,000 WBBB-killed SAF were killed. Nearly 46,000 acres of WBBB-caused mortality had been recorded in 2006. WSBW activity was recorded on fewer acres, only 76,000; but much of the infested area was not surveyed. That level of defoliation could influence DFB activity in the near future.

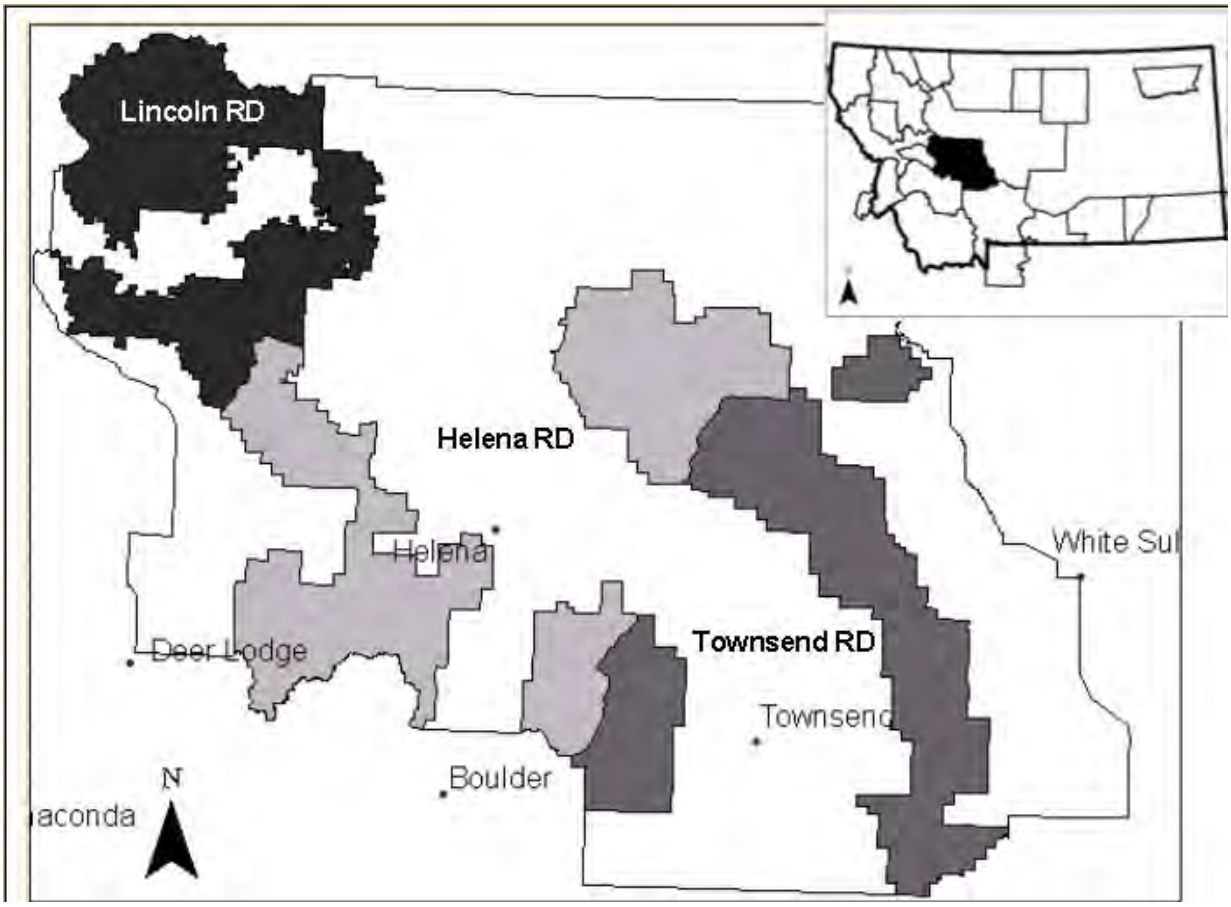

Figure 7. Helena Reporting Area and Helena National Forest Ranger Districts

Helena Reporting Area

Townsend RD.
Townsend RD was not flown in 2007. The 2006 report is included here: DFB populations have nearly returned to endemic conditions following several years of outbreak levels. Small and very widely scattered groups of DFB-killed trees were mapped throughout the Big Belt Mountains, east of Townsend; but no large groups were recorded. Overall, the previously affected areas have been much reduced. Extensive amounts of defoliation caused by WSBW on nearly 52,000 acres in that same general area could result in increasing DFB populations if weather conditions further weaken affected trees.

MPB populations in both LPP and WBP stands continued to expand significantly throughout their respective hosts in the Big Belts. Groups of beetle-killed trees ranging in size from 5 to several thousand trees each were mapped from the upper reaches of Beaver Creek southward to Mount Edith. WBP stands near Boulder Mountain, Mount Baldy and Mount Edith, have experienced extreme amounts of MPB-caused mortality, and it continued in 2006. Ground-collected data in the vicinity of Mount Edith showed in some areas nearly 70% of the WBP over 5” dbh. (more than 200 trees per acre) has been killed in the last three years. Blister rust was also prevalent in those stands.

Numerous small groups of WBBB-killed trees were noted throughout the Big

Belts in stands high enough and moist enough to support SAF. West of Townsend, beetle-killed groups are small and very widely scattered in DF, PP, and LPP types.

District-wide, DFB-infested trees were observed on almost 900 acres (down from 2,300 last year); MPB-killed LPP on 10,500 acres (up significantly from 8,700 acres in 2005), and beetle-impacted PP on fewer than 10 acres. MPB-caused mortality in WBP stands was reported as totaling 19,700 trees on 6,200 acres—not substantially different from the 18,300 trees on 7,800 acres recorded in 2005, nor the 16,000 trees on 6,760 acres recorded in 2004. Many of those trees were also infected by blister rust. WBBB-caused mortality was recorded on about 300 acres—virtually the same level recorded in 2005.

Significant pockets of mortality are known to occur west of Canyon Ferry Reservoir. In this area, Armillaria is killing Douglas-fir and quaking aspen and causing large and very discrete pockets of mortality across the hillsides. The species responsible for this extensive mortality has not been identified, but is thought to be *Armillaria ostoyae*.

Helena RD.

Eastern half of the District was not flown. In the western portion, MPB was still found killing PP in mostly small and widely scattered groups to the west and south of Helena. Fifteen or so miles south of Helena, near Gregory Mountain and Spring Creek, larger groups of MPB-infested PP were mapped. Some of those were 2-3,000 acres in size and contained an estimated 1-2 beetle-killed trees per acre.

MPB in LPP, however, increased significantly in 2007 from near Mount Jackson, south of Helena, south nearly to Boulder. From Lava Mountain, southeast of Helena, west to the Little Blackfoot River and beyond Elliston, groups of MPB-killed LPP were large and numerous. Many groups extended to several thousand acres, with dead-tree intensities of generally 1-3 trees per acre each. From McDonald Pass, north to Belmont Mountain, LPP stands experiencing MPB outbreaks were also prevalent. Ground observations in the McDonald Pass vicinity showed nearly two-thirds of the LPP in some stands were infested by MPB in 2007. Infestations in that part of the State appeared to building rapidly. Into the extreme northern and northwestern portions of the District, LPP stands near Flesher Pass and within the Nevada Creek drainage were also severely impacted by MPB activity.

Throughout much of the District, DF stands were heavily defoliated by WSBW. We believe DFB populations may soon begin to take advantage of those seriously weakened trees. Surveys in the vicinity of Flesher Pass suggest that is already occurring.

Fairly minor amounts of DFB-killed DF were noted on the western portion of the District, but that is likely to change with continuing WSBW activity and drier-than-normal weather. On privately owned land west of Holter Lake, small amounts of MPB-killed PP were recorded.

Almost no DFB-infested areas, for the part of the District flown, were recorded in 2007. About 1,500 acres had been reported in 2006. However, WSBW outbreaks on more than 32,000 acres could lead to DFB increased activity. In

fact, ground surveys conducted in the vicinity of Flesher Pass showed a significant amount of DFB attraction to severely defoliated DF. MPB-killed LPP were observed on 78,000 acres, an incredible increase from the 3,800 acres recorded last year. An estimated 95,000 LPP have been killed in those stands. MPB-killed PP were reported on 3,500 acres (only 1,800 in 2006), and MPB killed 400 WBP on another 500 acres (200 acres in 2006). MPB killed a total 98,300 trees in 2006 (2007 faders) in all hosts, compared to only 14,800 last year. WBBB activity was noted on only a few acres in 2007.

Lincoln RD.

While WSBW activity in DF stands to the east and south of Lincoln, and continuing east to Rogers Pass, was the most commonly mapped disturbance in forest stands, and may soon lead to increased DFB-caused mortality; significant amounts of MPB-killed LPP were located south and west of Lincoln. Groups near Trapper Mountain, Ogden Mountain, Dalton Mountain, and Baldy Mountain were especially noticeable. DFB-killed DF, found in a few small and widely scattered groups was much less prevalent in 2007.

District-wide, about 270 acres were infested by DFB (1,400 in 2006); 13,200 acres of LPP (6,000 acres last year), less than 10 acres of PP (260 in 2006), and fewer than 30 acres of WBP (670 in 2006) showed some level of MPB-caused mortality. No WBBB activity was recorded, whereas about 500 acres were mapped in 2006. WSBW activity, however, was recorded on more than 35,000 acres, suggesting increases in DFB-caused mortality are possible.

Throughout the Helena Reporting Area, and especially northwest of Helena, WSBW populations are increasing significantly—up to 128,000 acres in 2007. Defoliation, coupled with prolonged drought, could result in increased amounts of DFB activity within the next few years. Area-wide survey estimates for bark beetle-caused mortality for areas flown totaled: DFB 420 acres—compared to 5,300 acres last year; MPB 118,300 acres (34,300 acres in 2006), of which 106,200 acres were LPP, 11,500 PP, and 530 WBP (almost 144,000 trees, of all species [92% LPP] were killed); and WBBB on less than 10 acres—down considerably from 1,300 acres last year.

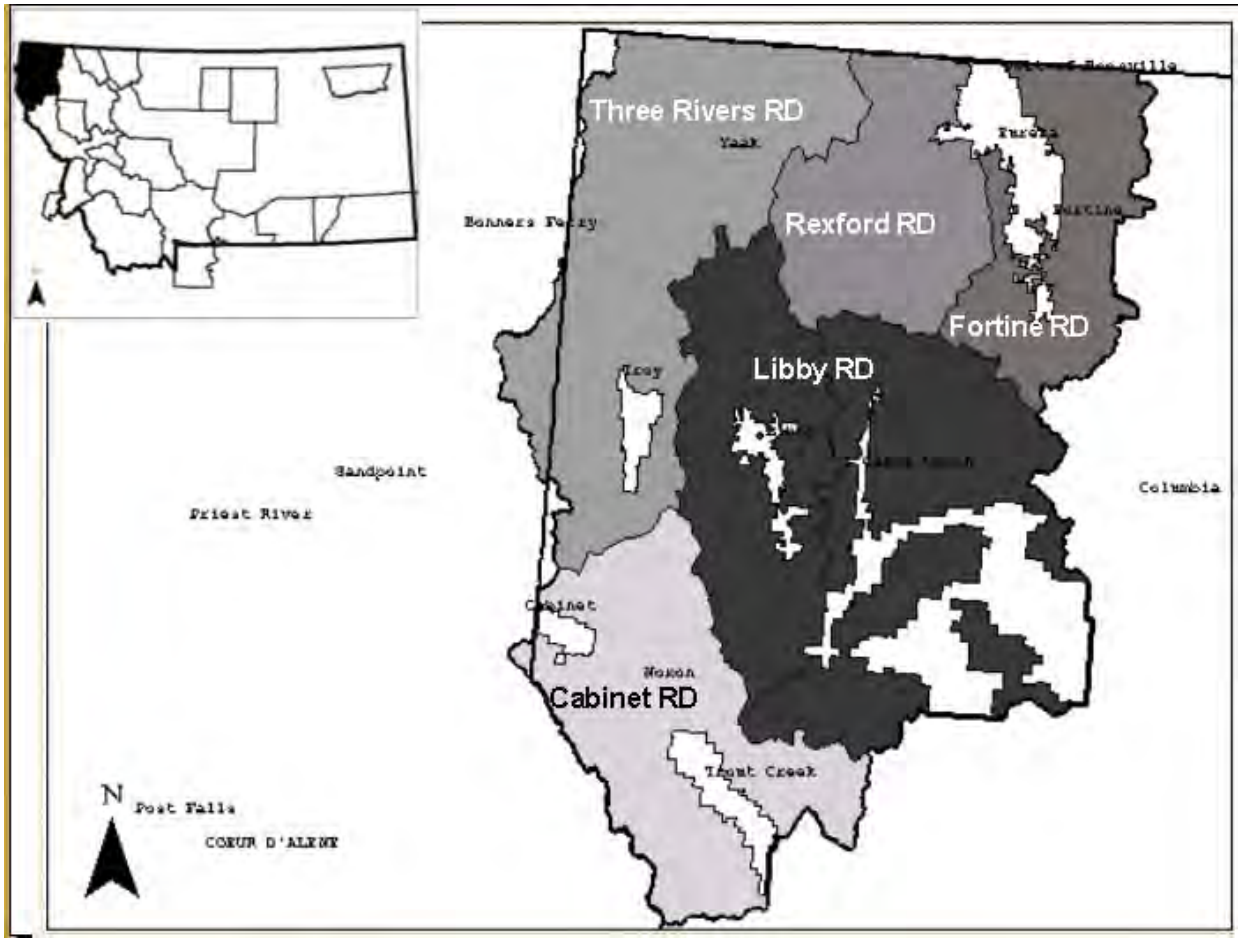

Figure 8. Kootenai Reporting Area and Kootenai National Forest Ranger Districts

Kootenai Reporting Area

Only northern portion of the Forest—parts of Rexford, Fortine, and Three Rivers RDs—was flown in 2007. Reports for the other Districts are reproduced from the 2006 conditions report. Bark beetle conditions on most of the Forest have not changed dramatically in the past year.

An unidentified agent caused premature loss of two-year-old and older needles on ponderosa pine in several locations across the Kootenai National Forest in recent years. In 2007, field observations were made on the Cabinet and Three Rivers Ranger Districts.

Although *Dothistroma septospora* is a good candidate for causing the needle loss, we have been unable to collect that pathogen from the damaged trees to date. However, a *Lophodermium* sp. collected near Troy is also a candidate. We were unable to identify those collections to species. Lab records show that a *Lophodermium* sp. was collected in 2000 at an unspecified location on the Kootenai National Forest and the pathologist was unable to identify that collection to species as well. Various *Lophodermium* spp. can be saprophytes, endophytes, weak pathogens, or strong pathogens. Understanding the role of this particular

Lophodermium species will require additional investigation.

Rexford RD.
WBBB-killed SAF was noted near Lydia Mountain, Sutton Mountain, and Little Sutton Mountain, just east of Lake Koocanusa. DFB-killed DF was also recorded in small groups throughout Pinkham Creek drainage. Most of those groups were of 15 faders, or less, and were quite scattered. In the southern part of the District, there were also a few small groups of DFB-killed trees, as well as a few groups of MPB-killed PP. West of the Lake, WBBB-killed SAF was noted near Parsnip Mountain. Other small and mostly insignificant groups of WBBB- DFB-, and MPB-killed hosts were lightly scattered north ward to Canada/US border.

On the portion of the District flown in 2007, DFB had killed 300 DF on 305 acres; MPB had killed 1,260 LPP and another 20 PP on 750 and 15 acres, respectively; and WBBB activity had resulted in the death of 1,800 SAF on 1,500 acres.

The 2007 aerial detection surveys identified larch needle disease on 85 acres of the Kootenai National Forest. This is far less than 14,942 acres affected on the Forest and 3,001 acres on state and private lands of the Kootenai Reporting Area in 2006. The 2007 affected acres were about one mile west of Thirsty Mountain, which is about 15 miles west southwest of Eureka.

Fortine RD.
Several groups of MPB-killed LPP were mapped in the vicinity of Mount Wam. Some of those were of several hundred acres each and contained an average 2-3 beetle-killed trees per acre. In that same general area, SAF, killed by WBBB, was noted in quite a few large groups from Green Mountain and Therriault Lakes, south to Mount Locke, Krag Peak, and Krinklehorn Peak. A number of those polygons were several hundred acres each and averaged about 2 dead trees per acre.

Totals for the District in 2006 showed about 1,500 acres of DFB-killed DF; 700 acres of MPB-impacted LPP and another 900 acres WBP; and 2,200 SAF were killed by WBBB on 1,800 acres. For the portion surveyed in 2007, comparable figures were 85 beetle-killed DF on 40 acres; about 30 LPP and 20 PP killed by MPB on a combined 30 acres; and 10 SAF killed by WBBB on 5 acres.

Three Rivers RD.
Only northern portion, mostly Yaak River drainage, was flown in 2007. In that portion surveyed, large groups of WBBB-killed SAF were mapped near Mount Henry. A few other, smaller groups, were scattered north of there, throughout SAF stands. A few larger groups of MPB-infested LPP were observed near Robinson Mountain. Small groups of LPP, killed by MPB; and DFB-infested DF, were found widely scattered in the northeastern portion of the District. From there, west to District border, very small and widely scattered groups of bark beetle-killed trees were found. WBBB, DFB, MPB, and FE had accounted for the death of numerous of their respective hosts. MPB was found infesting both LPP and WWP. None of those infestations were widespread, nor of particular significance.

WSBW infestations in Yaak River drainage are extensive, with heavy defoliation noted on more than 6,500

acres. Future DFB activity may increase in that area as a result. To the south, MPB-killed LPP was mapped in small groups in Pine Creek drainage, northwest of Troy. Generally, MPB-killed LPP and WWP was very widely scattered in small groups throughout Yaak River drainage. In that same general area, WBBB, FE, and DFB activity was noted, but in small and mostly insignificant amounts.

District wide, about 50 DF were killed by DFB on 40 acres—down from 900 trees on 300 acres in 2006; WBBB killed 2,800 SAF on 1,700 acres—down considerably from 5,700 acres and 4,600 trees last year; and 30 FE-killed GF were noted on 50 acres—both significant decreases. MPB-killed trees were recorded on 1,150 acres of LPP stands; less than 10 acres of WBP; and another 10 acres of WWP. Approximately 10 WBP; 2,300 LPP; and 5 WWP were reported killed. Though all mortality estimates were lower in 2007, not all of the District was flown. Approximately 6,523 acres were defoliated from budworm on the Three Rivers Ranger District.

A service visit to stand 449010285 early in the season found active Armillaria root disease in Douglas-fir and lodgepole pine, and *Phaeolus schweinitzii* in the root ball of Douglas-fir (MFO-TR-07-02). Both of these agents can be commonly found throughout the forest.

Off-site (some referenced as Lolo stock) ponderosa pine in the Rocky Pine Fuels Reduction Watershed area north of Troy was extensively defoliated in recent years. A January 2007 site visit showed that some trees had lost nearly all foliage other than that put on in 2006. Extensive red transverse banding (classic symptom of "red band needle disease" caused by *Dothistroma septospora*) was observed on foliage of several trees. A *Lophodermium* sp. was collected; however, no pathogen had yet been identified as the cause of the defoliation at the time this report was printed.

Libby RD.

Libby RD was not flown in 2007. Following is the 2006 report: Bark beetle activity of all species, in their respective hosts, was greatly reduced throughout the District in 2005 and again in 2006. In 2006, very small and widely scattered groups of MPB-killed LPP and DF, killed by DFB, were reported south and west of Libby. Nearly endemic amounts of DFB activity were recorded both north and south of Libby (in 2005)—totaling but 1,200 acres. FE activity was a little more common in 2005, but reduced from 2004 levels—4,600 acres compared to 7,800 acres. Those figures were reduced once again 2006, for the part of the District surveyed. Notable concentrations were mapped south of Libby in the Cameron Creek drainage, and to the north in Quartz Creek and Bobtail Creek drainages in 2005. Minor amounts of MPB-killed trees were noted at a few isolated locations in WPB, WWP, and LPP stands.

Beetle-infested stands on the District totaled: DFB, 1,200 acres—3,000 dead DF; FE, 4,600 acres—7,300 beetle-killed GF; MPB (all hosts, but mostly LPP), fewer than 300 acres; and minor amounts of WBBB- and WPB-caused mortality in both 2005 and 2006.

A service visit to the Farm to Market Fuels Project Area (Unit 28A) found symptoms in ponderosa pine indicative

of infection by *Heterobasidion annosum*, causal agent of annosus root disease. A follow-up visit is planned for spring 2008.

Cabinet RD.
Cabinet RD also was not flown this past year. Report for 2006 was as follows: As DFB populations, and associated damage returned to near-normal levels in 2005; MPB-killed LPP was increasing in parts of the District. Small amounts of DFB-killed trees were noted in Stevens Creek and Pilgrim Creek drainages and to the north in Rock Creek drainage and near Government Mountain last year, but those infestations have been reduced to small, scattered groups in 2006. Most DFB activity was recorded to the north and south of Noxon Reservoir, but no groups were larger than about 10 trees. Significant, however, were large groups of MPB-infested LPP mapped in Little Beaver Creek and White Pine Creek drainages south of the Clark Fork River, and throughout the Vermilion River and its tributaries to the north in 2005. Those infested areas had increased markedly just within the past few years. In 2006, MPB activity in LPP stands on the District was recorded as more widely scattered, but in much smaller groups. Notable activity was reported throughout the Vermillion River drainage, and the Silver Butte River drainage to the north (actually on Libby RD); but most groups were small. Few were larger than about 50 trees. South of Noxon Reservoir, small fader groups were also found scattered throughout LPP stands in the Beaver Creek and White Pine Creek drainages.

FE activity was still noted in a few GF or mixed-species stands, with a few of the larger groups mapped in the upper Trout Creek drainage. WSBW activity on the District, not recorded in the past quarter century prior to 2005, has increased and significant amounts of defoliation was recorded in many DF and mixed-species stands. Heavy defoliation, coupled with drier-than-normal conditions, could lead to an increase in DFB activity within the next few years.

District-wide in 2006, DFB-killed DF was found on 400 acres (220 acres in 2005); MPB infested 40,500 LPP (30,300 last year) on 13,000 acres (9,400 acres in 2005) and another 200 PP on 260 acres; FE killed 115 GF on 130 acres (1,300 trees on 2,000 acres in 2005); and WBBB activity was minor—recorded on less than 200 acres.

Total mortality attributed to bark beetles in the portion of the Kootenai RA surveyed in 2007 was: 800 DF killed by DFB on 725 acres (12,000 trees on 5,400 acres in 2005); 45 GF killed by FE on 65 acres (11,000 trees and 7,700 acres in 2005); 6,200 LPP killed by MPB on 3,400 acres (34,200 trees on 11,500 acres in 2005); 40 WBP and 5 WWP on a combined 20 aces (16,500 WBP and 1,700 WWP killed by MPB had been recorded in 2006); and 12,000 SAF killed by WBBB on 6,700 acres (13,000 trees on 12,400 acres in 2005). Minor amounts of mortality attributed to IPS were also recorded in 2005.

Extensive Armillaria root disease was noted in Big Eddy and Marten Creek campgrounds (MFO-TR-07-32). Also noted in Big Eddy was extensive root decay in a blow down ponderosa pine. Decay samples and a fruiting structure were collected- preliminary identification indicates the causal fungus to be *Phellinus ferrugineofuscus.* This fungus is described as a saprophyte, which means the tree was dead before the roots were invaded and decayed. We

will alert the forest when we get a positive identification of this fungus. During a service visit (Trip Report MFO-TR-07-32), lion-tailed (only needles at branch tips) crowns were observed in ponderosa pine at the Big Eddy Campground. Elytroderma needle disease was considered since this disease was found causing problems in ponderosa pine near Marten Creek in 2005. Martin Creek is only about 15 miles south southeast of the Big Eddy Campground. It's likely that some other agent is responsible for the needle loss since other symptoms typically found in Elytroderma infected trees, such as brooming, were not observed.

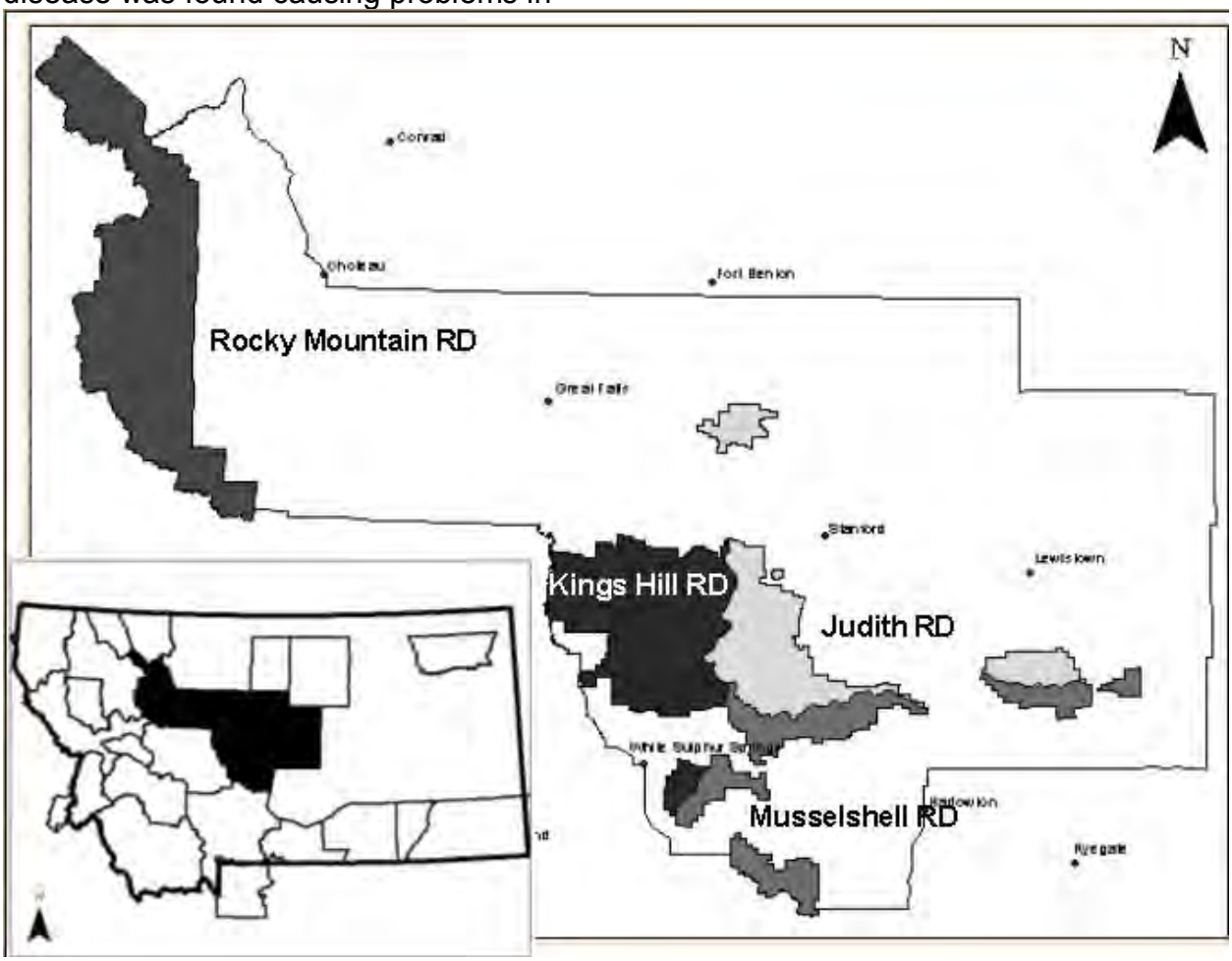

Figure 9. Lewis and Clark Reporting Area and Lewis and Clark National Forest Ranger Districts

Lewis & Clark Reporting Area

Rocky Mountain RD.
District was not flown in 2007 nor has it been for the past several years. We have no current record of bark beetle activity on the District. We plan to survey the District in 2008.

Judith RD.
On BLM-administered land, north of Lewistown, in North and South Moccasin Mountains and in Judith Mountains to the east, widely scattered small groups MPB-killed PP were recorded. Few groups were larger than 25-50 trees each. Largest groups in the Judith's were found near Whiskey Gulch

and Crystal Peak. South and east of Lewistown, a few small groups of MPB-killed PP were mapped in Mill Creek and North Fork McDonald Creek drainages.

On Forest Service-administered lands in Big and Little Snowy Mountains, MPB-affected PP stands were also observed in small and widely scattered groups. A few, in North Fork Flatwillow Creek drainage, extended to 100 or more faded trees. Most were considerably smaller.

In the Highwood Mountains, east of Great Falls, minor amounts of MPB-killed LPP and DFB-killed DF were mapped. No groups exceeded 10 trees, and appeared to be in relatively endemic levels. Small concentrations were noted near Round Butte and Square Butte. Most of the rest of the District was not flown.

For the part of the District flown, DFB was found on less than 25 acres (200 acres last year); MPB on slightly more than 140 acres—on all hosts, but most was PP (115 acres), next most prevalent being LPP at 25 acres, then WBP 10 acres. MPB killed a total 300 trees, most were PP. WBBB-killed SAF was mapped on nearly 30 acres, and 70 trees were killed. All figures for 2006 were considerably higher, but are not comparable because so much more of the District was surveyed in 2006.

Musselshell RD.

In 2006, a few fader groups of MPB-killed PP were mapped in the southern portion of Big and Little Snowy Mountains. Several were of 100 trees each, most were much smaller. Highest concentrations of faders were noted south of West Peak in Big Snowies and near Ashbridge Spring in Little Snowies.

That portion of the District in Crazy Mountains was not flown in 2007. Last year, widely scattered small groups of WBBB-infested SAF and MPB-impacted WBP were observed. Almost no DFB activity was noted. MPB activity in WBP stands was concentrated near Box Canyon and south of Mount Elmo, with the largest group mapped northeast of Bald Ridge. Numerous small groups of WBBB-killed trees were found near Loco Mountain. Small amounts of MPB-killed trees were noted in LPP type.

Throughout surveyed portion of the District, about 950 PP were recorded as killed by MPB (1,450 in 2006) on roughly 1,760 acres (1,400 acres last year). MPB and blister rust affected WBP and LP on more than 2,740 acres (3,850 acres in 2005); and MPB alone on 6,300 acres of LPP—up from the 4,500 acres recorded last year. Total MPB-caused mortality, all hosts, exceeded 18,900 trees (14,400 were LPP; 3,600 WBP/LP). DFB killed 120 trees on 30 acres—reduced from 200 acres and 300 trees last year. WBBB killed 500 trees on 165 acres, down substantially from last year's 1,600 trees on 1,950 acres. WSBW defoliation was noted on 6,823 acres.

Kings Hill RD.

Not all of the District was flown in 2007. In the part that was, MPB caused more mortality, in LPP, WBP, and PP stands, than any other bark beetle species, by far. Most infested stands were comprised primarily of LPP—but significant damage was also caused in WBP and PP stands. LPP mortality was widely scattered in the northern part of the District, from Riceville, south to Kings Hill. From Kings Hill, west to Woods Mountain, MPB-killed groups of LPP were very numerous, but mostly

small—generally in 5- to 20-trees each. South of Strawberry Butte, towards White Sulphur Springs, larger groups were mapped near Coxcombe Butte and south towards Abbott Gulch.

MPB activity in PP stands was also extensive, but overall less than in LPP. Groups of beetle-killed trees were located from Tiger Creek on the north, down across the slopes of Monarch Mountain, and south to the Park Hills, just north of White Sulphur Springs. The largest groups were found near Monarch Mountain where some fader groups extended for several hundred acres and averaged 5 beetle-killed trees per acre.

WBP mortality was not quite as extensive, but was very intensive where it was found. Stands near Bald Mountain, Kings Hill, Porphyry Peak, and Mizpah Peak were extensively damaged by combinations of MPB and blister rust. Largest groups were mapped near Kings Hill and Mizpah Peak. A few affected stands covered hundreds of acres and average 5 beetle-killed trees per acre. Ground-collected data obtained near Kings Hill showed 42 new MPB attacks per acre in 2007, and nearly one-half of the WBP in some stands have been killed within the past 2-3 years. A few DFB-killed trees were noted, but in minor amounts. Those could increase in the next few years due to extensive WSBW activity.

Totals for the District were about 2,460 SAF killed on 830 acres (5,300 trees, 5,100 acres last year); 9,600 LPP and 3,000 PP were killed by MPB (14,350 LPP and 2,800 PP in 2006) on 3,650 and 875 acres, respectively (6,900 and 1,700 acres in 2006); MPB and blister rust have affected 4,600 WBP on more than 1,200 acres—down considerably from 6,200 acres in 2006; and DFB killed 300 trees on 105 acres—down from 350 DF and 560 acres in 2006. Most of the defoliation from WSBW, 14,649 acres, occurred on the Kings Hill Ranger District.

Area-wide mortality attributed to bark beetles, for portion of Lewis & Clark RA surveyed, totaled almost 650 DF on 200 acres (considerably reduced from 1,000 trees and 1,200 acres in 2006); and 43,600 MPB-killed trees on 19,300 acres—of all hosts, half of which was LPP, a third PP, the remainder WBP. All figures were somewhat reduced from the 47,500 trees and 33,400 acres reported in 2006. Another 3,000 SAF were killed on 1,000 acres, much reduced from the 11,400 acres recorded in 2006. Minor amounts of IPS-caused PP mortality were also noted. In addition, WSBW defoliated more than 36,700 acres.

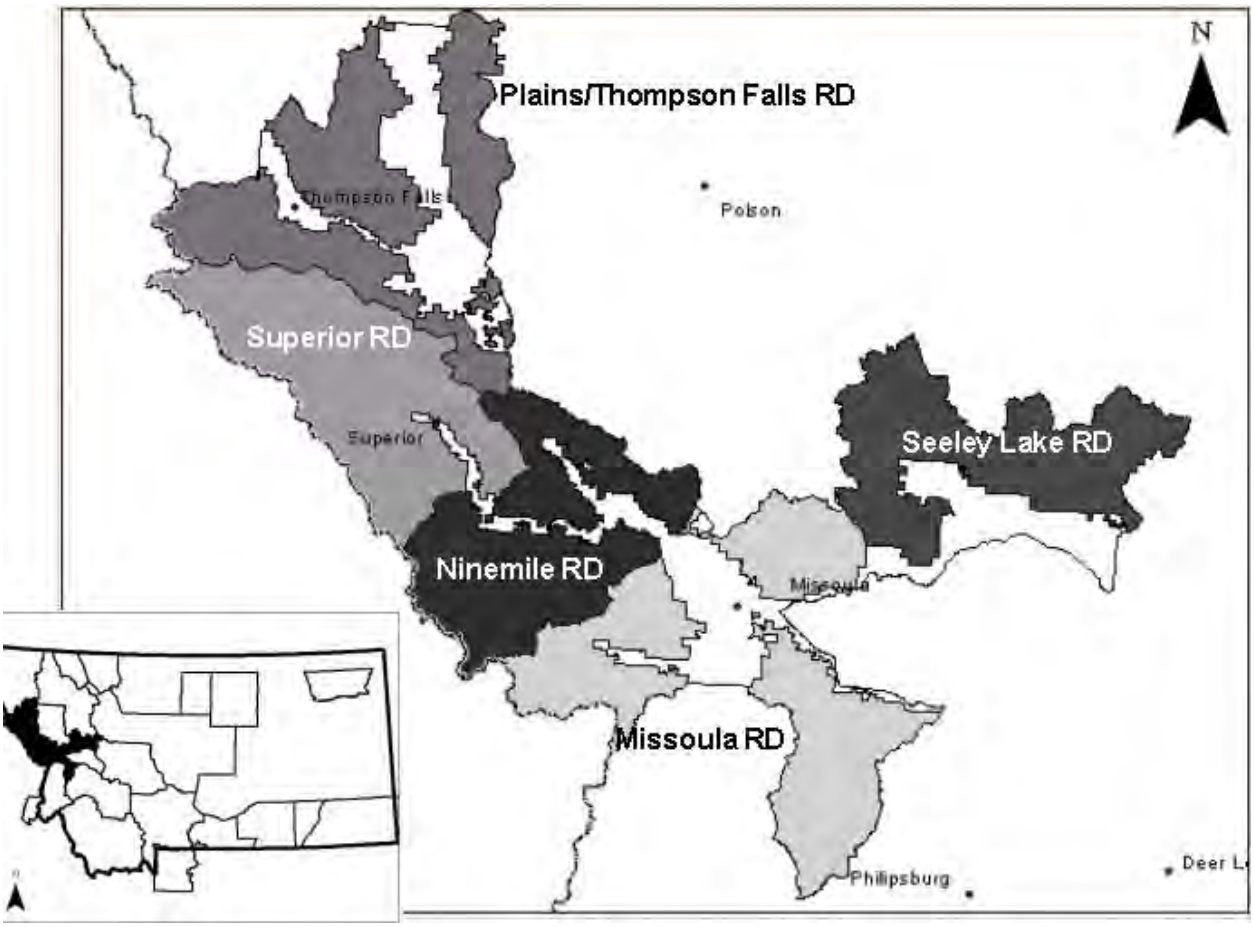

Figure 10. Lolo Reporting Area and Lolo National Forest Ranger Districts

Lolo Reporting Area

Missoula RD.
Eastern portion of the District was not flown in 2007. To the west of Missoula, MPB activity in both LPP and PP stands was prevalent from Blue Mountain on the south and east, to Petty Mountain on the north and west. From a line between those two points, west to the Missoula/Ninemile RDs boundary, MPB-killed LPP was commonly encountered. Largest groups in that area were mapped near Telephone Butte, Garden Point, in the Burden Creek drainage, and south of there throughout much of the Howard and Lolo Creek drainages. Ground-collected data obtained near Butte Lookout (Lolo Creek drainage) showed an average 49 trees per acre attacked in 2007 in some stands. At a few relatively isolated locations, small groups of DFB-killed DF were also noted; but they appeared to be at nearly endemic levels.

In 2006, in northern end of Sapphire Mountains, especially in upper Miller Creek and Allen Creek drainages, southeast of Missoula, MPB-killed LPP increased once again. Numerous groups were mapped in that area, many covering several hundred acres and averaging 2-3 beetle-killed trees per acre in each. Those outbreaks likely continued.

North of Missoula, in Rattlesnake Creek drainage, in 2006, MPB-infested LPP was also quite prevalent, and increased notably from 2005 levels. Largest

groups were observed near Sheep Mountain, Mineral Peak, Stuart Peak, and east of Boulder Lake. To the west of Missoula, in Grave Creek Range, MPB activity in LPP stands increased once again in 2006. Particularly large groups of faders were noted in upper O'Brien Creek drainage and from there northward to Telephone Butte. A few groups of faders extended to a few thousand acres each and averaged 2-3 beetle-killed trees per acre.

District totals in 2006 included 35,300 acres of MPB-killed LPP and another 1,300 acres of PP. Those totals for the area surveyed decreased in 2007 to 7,700 acres LPP and 185 PP. In 2007, 18,600 LPP and 430 PP were killed. Minor amounts of IPS- and WPB-caused mortality was noted in PP, as well as small amounts of WBBB activity in SAF were reported in 2007.

A service visit to Clearwater Campground revealed active armillaria root disease in Douglas-fir within the managed area of the campground (MFO-TR-07-33). Previous visits had not detected this agent.

Trip report (MFO TR-07-33) reports observations of *Elytroderma deformans* needle disease in the Clearwater Crossing Campground.

Ninemile RD.
MPB activity throughout Ninemile Creek drainage has declined significantly once again in 2007. Few groups larger than 100 acres each were recorded. Some of the largest of those were noted near Edith Peak, north of Frenchtown, Stark Mountain, Lookout Mountain, one or two near Seigel Pass. Throughout the rest of the drainage, MPB activity was very light, scattered, and recorded as very small beetle-killed groups of LPP and PP.

South of Clark Fork River, and especially in Cache Creek and Fish Creek drainages, MPB activity remained high—but at somewhat lower levels than in 2006. Large groups of faders were still found near White Mountain, above Cache Creek; east of Straight Peak, in the upper Fish Creek drainage; and near Patriot Peak, above Quartz Creek. Generally, wherever else MPB activity was recorded, it was of a more light and scattered pattern. Once again, MPB-killed PP and DFB-affected DF were found at lower elevations along the Clark Fork River. Occasional groups of IPS- or WPB-killed PP were noted, but in minor amounts.

In 2006, throughout the District, more than 84,000 LPP were killed by MPB on nearly 32,000 acres. MPB-killed PP were recorded on another 6,400 acres. In 2007, MPB killed 74,300 LPP and 1,200 PP on 26,500 acres and 515 acres, respectively. Last year, 720 DF were killed by DFB on 300 acres. In 2007, mortality declined to 300 trees; but affected area was recorded as 925 acres. WBBB killed 500 SAF on 115 acres. Very minor amounts of WPB, IPS, and FE activity were also reported. WSBW-caused defoliation was recorded on about 1,000 acres.

Plains/Thompson Falls RD.
Although MPB activity has declined on the District for the past few years, mostly due to host depletion, MPB-killed LPP remains the most prevalent bark beetle-related concern in the western part of the Lolo NF. Where only a few years ago, very large groups of MPB-killed LPP had been mapped between the Clark Fork River and CC Divide, to the south; and from the confluence of

the Clark Fork and St. Regis Rivers west to the Montana/Idaho border; in 2007, most of that area now harbors only small and relatively scattered groups of beetle-killed trees. Larger groups still existed within Prospect Creek drainage, and its tributaries; but even those are less intensely infested than in previous years. Some of the largest groups were mapped in Clear Creek drainage, east of Beaver Peak and along the Clark Fork/St. Regis divide, within the Coeur d'Alene Mountains. Larger groups to the east were noted near Sunset Peak and Sacagawea Peak.

North of the Clark River, between Lolo NF/Flathead IR divide, and west to boundary between Lolo and Kootenai NFs, MPB-killed LPP was still very commonly found, but at reduced levels from recent years. Some larger groups were mapped in upper reaches of Little Thompson River, Bear Creek, Chippy Creek, and Big Rock Creek drainages. West of there, a few large groups were found in Beartrap Creek drainage. Near Forest's western edge, largest beetle-killed groups were mapped near Cougar Peak and Cube Iron Mountain. Elsewhere, although MPB-killed groups were common, they were smaller and more generally scattered throughout host type. At lower elevations, MPB-affected PP was also broadly recorded; but most of those groups were quite small and very widely scattered. Stands along both the north and south sides of Clark Fork River harbored some MPB activity. DFB and IPS were also found causing host-tree mortality at various spots throughout the District, but incidences of those beetles were minor. A few groups of MPB-killed WBP were noted near Mount Silcox.

Totals for the District and adjacent State and private lands in 2006 showed 85,000 MPB-killed trees on more than 28,300 acres—most of which were in LPP stands. Comparable figures for 2007 showed significant increases, particularly in the Thompson Falls part of the District—43,600 acres of LPP infested and another 1,500 acres of PP. In total, about 161,100 LPP and another 2,600 PP were killed. DFB activity also increased somewhat—to 540 acres, up from 145 acres in 2006. Approximately 1,100 DF were killed. WBBB-caused mortality was recorded on but 50 acres (20 acres last year), another 110 acres were infested by WPB, and IPS-caused mortality in PP stands was noted on 320 acres.

Seeley Lake RD.

The District was not flown in 2007. Because significant amounts of beetle-caused mortality had been reported in 2006, that report is reproduced here. MPB-caused mortality was prevalent in LPP stands throughout the District, and has increased significantly in the past few years. Large groups of beetle-killed trees were noted near Black Mountain and Belmont Point, west of Placid Lake; near Hidden Lake and in Slippery John drainage, north of there; west of West Fork Point and east of Summit Lake to the north; near Richmond Peak and Florence Lake to the east of Seeley Lake; and throughout the Monture Creek drainage farther to the east. WBP has been heavily impacted by MPB, especially near Morrell Mountain, East Spread Mountain, and Conger Point. In most of those locations, beetle populations have declined.

To the west, other groups were once again mapped near Mount Henry and West Fork Point. MPB infestations in LPP intensified considerably in 2006.

MPB-affected stands totaled about 9,850 of LPP, where MPB was the sole mortality agent, and another 12,600 acres of WBP with mortality attributed to both MPB and blister rust in 2005. In 2006, comparable data showed 25,100 acres LPP infested, almost 700 acres WBP, and another 200 acres of PP. Total MPB hosts killed exceeded 74,000 trees. It is possible some of the increases in LPP-infested acres and associated decreases in WBP were attributable to areas where those species overlap and the difficulty in distinguishing them from the air.

Elsewhere on the District, DFB-killed trees were more widely scattered and in smaller groups than in 2005. Throughout the DF type, DFB-caused mortality increased was about the same as recorded last year—approximately 1,100 acres, on which 2,600 trees were killed. WBBB-caused mortality was observed on nearly 600 acres (620 acres last year) in a few high elevation SAF stands.

Superior RD.
Large groups of MPB-killed LPP were once again mapped throughout the District—most of them south of the St. Regis and Clark Fork Rivers—but at a reduced level from 2006. Some of the largest groups of faders south of the Clark Fork, and southwest of Superior were noted near Silver King Mine, Golden Sunset Mine, west of Mount Baldy, and north of Fourth of July Gulch. West of St. Regis, along both sides of the St. Regis River, large groups were again mapped in Big Creek and Silver Creek drainages south of the River; and fairly extensively north of the River from about Hawk Mountain on the east to Lookout Pass to the west. In that area, polygons were large, but intensity of kill was relatively light—averaging 0.5-5 trees per acre. MPB activity in PP stands was very lightly recorded north of St. Regis; west of Superior, south of the Clark Fork; and north of Superior, north of the River. Minor amounts of DFB-killed DF were reported in a few DF or mixed-species stands.

District-wide more than 47,200 acres had been infested in 2003. Since then, while there have been yearly fluctuation in infested area, populations have declined north of the Clark Fork River and increased to the south. In 2007, MPB-caused mortality was recorded on nearly 49,000 acres—where more than 98,000 LPP had been killed. MPB-caused mortality in LPP stands had been recorded at 120,000 trees on 34,500 acres in 2006. Ground-collected data for a few sites on the District showed extreme amounts of MPB-caused mortality in LPP stands during the past few years: East Fork Dry Creek, 138 trees per acre; CC Divide, 103 trees per acre; Dry Creek (permanent plots), 143 trees per acre.

Throughout Lolo RA, MPB-infested area declined significantly from 2006 levels, but not all affected areas were surveyed. In 2007, MPB in LPP extended to more than 128,500 acres in the area flown, and nearly 360,000 trees were reported killed. IMP also killed slightly more than 7,000 PP on just over 3,100 acres. MPB-caused mortality in other hosts was nearly insignificant. In 2005, MPB had killed more than 1.4 million LPP on 204,400 acres; 9,600 PP killed on 5,400 acres; and nearly 10,800 WBP on 7,800 acres in 2005. Those figures had declined to 612,000 LPP on 210,000 acres; 32,300 PP on 15,100 acres; and 1,600 WBP on 730 acres. For the area surveyed, DFB activity was also much reduced. Just over 3,000 DF were killed on almost 1,300 acres—

markedly down from 16,400 DF killed on 5,100 acres in 2006. WPB killed 160 PP on 270 acres, also down from 2006 levels. WBBB-caused mortality was noted on 460 acres and totaled 1,400 trees; also down from the 3,400 dead SAF on 1,200 acres recorded last year. FE activity has returned to nearly endemic levels, fewer than 15 trees were reported killed by that beetle. IPS killed an additional 500 PP on 1,200 acres—fewer trees on more acres than the 1,700 PP on 750 acres reported in 2006.

Active armillaria root disease was detected and its impact discussed in the Trout Creek and Cabin City Campgrounds (MFO-TR-07-08). This agent has been detected in the past and is responsible for much mortality and decline in Douglas-fir and grand fir.

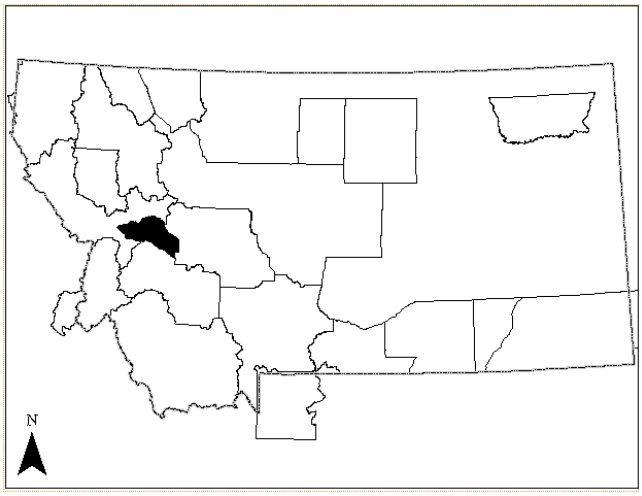

Figure 11. Garnet Reporting Area

Garnet Reporting Area (BLM)

Most of the western part of the reporting area was not flown in 2007. Only that portion between Green Mountain, Elevation Mountain and Wildhorse Parks on the west, and Nevada Valley and Douglas Creek drainage on the east was flown. In that area, MPB-infested LPP stands were prevalent. Relatively large groups of faders were mapped near Dunigan Mountain, south towards Chamberlain and Elevation Mountains, and south to Douglas Creek. Some of the larger groups covered several hundred acres each and averaged about 2-3 faders per acre. Throughout most of the area flown, MPB activity was prominent, but many groups were small and widely scattered. Minor amounts of MPB- and IPS-killed PP were also noted, as was a small amount of DFB-affected DF.

In total, for area flown, only about 150 DF were reported killed on approximately 50 acres—compared to 2,400 trees on 1,200 acres in 2006. In 2006, MPB reportedly killed 33,000 LPP on 14,000 acres and 1,600 PP on 825 acres; in 2007 respective figures were 14,200 LPP on 5,300 acres and 200 PP on 105 acres. IPS accounted for an additional 100 dead PP (on 35 acres); and about 350 WBBB-killed SAF were reported on 335 acres (up somewhat from 150 acres reported in 2006).

INDIAN RESERVATIONS

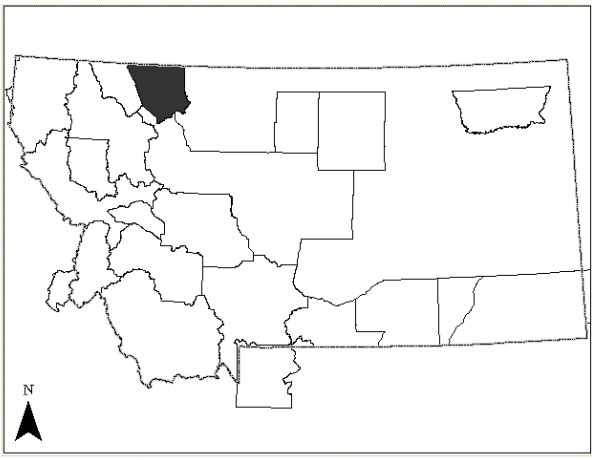

Figure 12. Blackfeet IR

Blackfeet IR

The Reservation was not flown in 2007. In 2004, the western portion was surveyed along with Glacier NP. In 2004, a few small groups of DFB-killed DF and MPB/IPS-killed LPP were mapped near Lower Saint Mary Lake. The most significant bark beetle-caused damage, however, was several large groups of SAF, killed by WBBB, recorded near Cut Bank Ridge and in upper tributaries of North Fork Cut Bank Creek. On the part of the Reservation flown in 2004, an estimated 4,000 SAF were killed on about 2,600 acres.

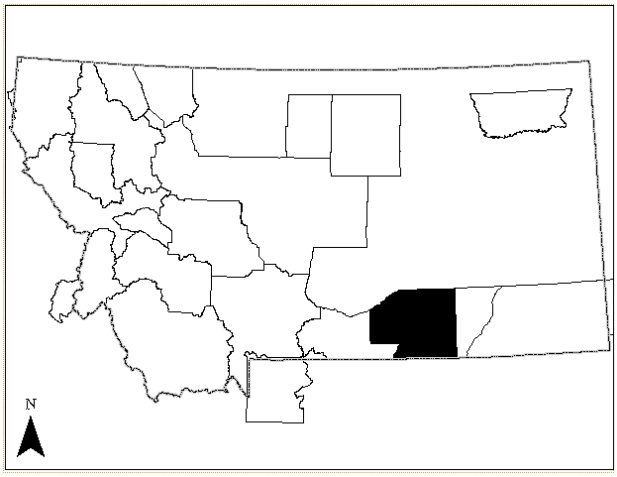

Figure 13. Crow IR

Crow IR

In the Wolf Mountains, a very few, small groups of MPB-killed PP were mapped in several of the west-flowing tributaries of Little Bighorn River. None harbored more than a few 1- to 5-tree groups. A small concentration of a few groups was noted in Kid Creek drainage, southeast of Lodge Grass.

In Bighorn Mountains, just east of Bighorn River, several small groups of LPP, killed by MPB were mapped south of Fort Smith. Largest of the groups was but 50 trees, but smaller groups were numerous throughout Black Canyon Creek drainage. At higher elevations, WBBB-caused mortality was prevalent in SAF stands from about Black Canyon Basin, south to the Montana/Wyoming border. The largest group covered approximately 2,000 acres and contained an estimated average 5 trees per acre. Several other groups were only slightly smaller. To the east of Big Bull Elk Ridge, observers mapped numerous small groups of DFB-killed DF. Those groups were especially prevalent south of Crystal

Cave Spring. Several other large groups were located north of Black Tail Spring.

In Pryor Mountains, numerous groups of beetle-killed trees were recorded, but most were relatively small. In West Pryor Mountains, DFB-killed DF was common, but no group was larger than 5 trees. East of Castle Rocks, several small groups of MPB-killed LPP were found; and south of there, towards Reservation boundary, several groups averaging about 20-30 dead SAF each were mapped between Pryor Creek and Lost Creek. That mortality was attributed to WBBB. Minor amounts of MPB-killed PP were also noted.

Throughout the Reservation, only 25 PP were reportedly killed by MPB on 12 acres in 2006. Similar figures for 2007 showed 300 PP on 165 acres. In 2006, 235 LP were killed by MPB on 40 acres in the Pryor Mountains. In 2007, those figures declined to 120 trees on 30 acres; however, also in that area, 1,120 LPP had been killed on 290 acres. No DFB activity was reported in 2006, but in 2007 350 acres were recorded on which 1,370 DFB-killed DF were observed. Mortality attributed to WBBB also increased in 2007—up from 650 SAF killed on 4,000 acres in 2006—to 16,600 SAF on 4,740 acres in 2007.

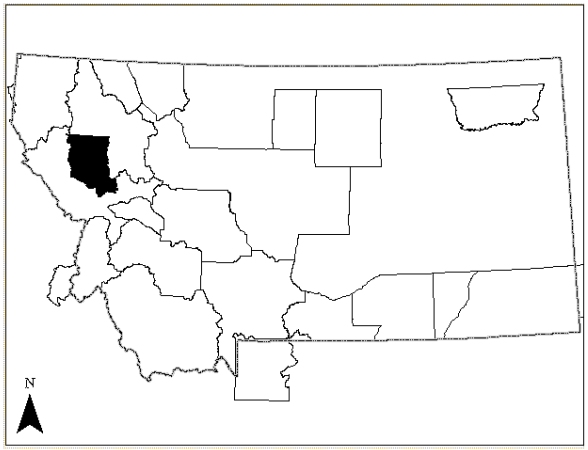

Figure 14. Flathead IR

Flathead IR

MPB activity that had been very heavy along Ninemile/Reservation Divide for the past several years declined significantly in 2007. All that remains of those large outbreaks are small and very widely scattered groups of beetle-killed trees. One group of a few hundred acres remained north of Three Lakes Peak, but it was fairly lightly infested at about 2 faded trees per acre.

On the other hand, MPB outbreaks in the southeastern corner of the Reservation, adjacent to Rattlesnake Wilderness and Lolo NF, increased markedly in 2007. Numerous large groups of faders were mapped from Hidden Lake north to Grey Wolf Lake and westward from the Reservation boundary to St. Mary's Lake. Many of those polygons extend for several thousand acres and contain as many as 10 trees per acre killed in 2006 (recorded as faders in 2007). In the northwest portion of the Reservation, near Bassoo Peak, MPB infestations remained prevalent in LPP stands. They have increased significantly in the past year and several groups extended for hundreds of acres and contained as

many as 10 beetle-killed trees per acre. South of there, towards Hot Springs, MPB-affected groups were much less noticeable, although one large group was mapped west of Hot Springs. In that general area, at lower elevations, a few small groups of MPB-killed PP were observed.

Northward from St. Marys Lake, along the Reservation's eastern boundary, between Flathead Lake and Mission Mountain Divide, bark beetle activity was much lighter and much more scattered. A few large groups of MPB-killed LPP were recorded above Middle Crow Creek, east of Ronan; near Goat Peak, east of Pablo; near Moss Peak; and from Station Creek, north to the Reservation boundary. Several groups of WBBB-killed SAF were also noted in a few high-elevation stands. Largest of those was mapped near head of Talking Water Creek. Numerous very small groups of MPB-killed PP, DFB-impacted DF, and a few PP killed by WPB were also noted; however, they were found in fairly minor amounts.

Generally, throughout PP stands on the Reservation, MPB-killed trees were noted, though in very small and widely scattered groups. As a rule, beetle-killed PP was recorded at about the same level in 2007 as it had been in 2006. Very little IPS or WPB activity was noted anywhere on the Reservation; however, there may have been more than was recorded, either in conjunction with MPB, or mapped as MPB.

In 2006, total bark beetle-infested areas on the Reservation had generally declined. Reports indicated 350 DF had been killed by DFB on 180 acres; MPB had killed almost 250,000 trees on 45,000 acres of affected LPP stands, 2,200 acres of PP, and another 20 acres of WBP. IPS had killed 50 PP on 13 acres. WBBB had killed 750 SAF on 280 acres; and FE was still active—having killed 900 GF on 440 acres. In 2007, DFB activity increased slightly—up to 1,100 beetle-killed trees on 550 acres; MPB generally declined, although some new areas were infested—112,000 LPP were killed in 27,800 acres, about 1,500 PP on 1,040 acres and close to 20 WBP on just fewer than 20 acres. IPS activity was higher—almost 700 PP killed on 610 acres; and WBBB-killed SAF also increased—2,400 trees on 1,050 acres. WPB accounted for 90 dead PP on 125 acres, but almost no FE-caused mortality was noted.

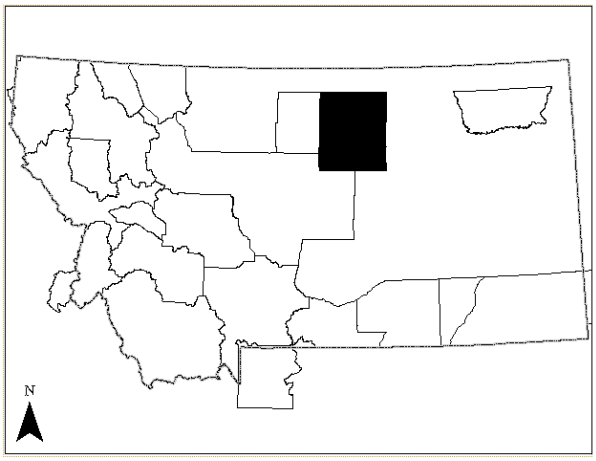

Figure 15. Fort Belknap IR

Fort Belknap IR

Most of the forested portion of the Reservation was flown, but little bark beetle activity was reported. A few, small and widely scattered groups of MPB-killed LPP and PP were mapped east of Beaver Mountain and near Damon Hill. Another cluster of small groups of PP, killed by MPB, was observed near Spring Park Butte. Minor

amounts of DFB-infested DF were reported, but one 50-tree group was mapped north of Damon Hill. A few small groups of IPS-killed PP were also noted.

In total, 69 DFB-killed DF were recorded on 13 acres; MPB killed 140 LPP and 260 PP on a combined 135 acres; and IPS activity was reported on 20 acres where 60 PP had been killed.

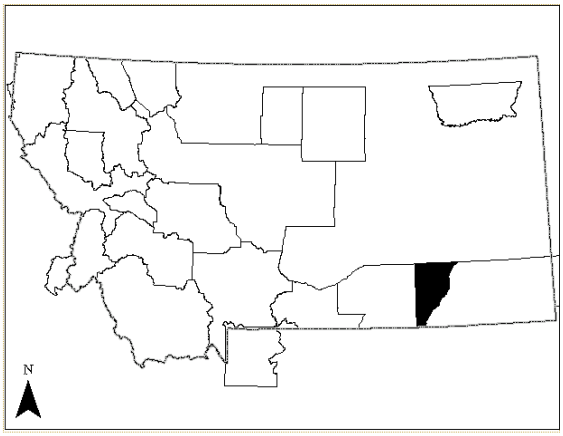

Figure 16. Northern Cheyenne IR

Northern Cheyenne IR

All but the southwest portion of the Reservation (south of Rosebud Creek) was flown, but little beetle-caused mortality was recorded. Several small groups of MPB-killed PP were mapped in Logging Creek, Lame Deer Creek, and East Fork Muddy Creek drainages; but none were larger than 5 trees each. Most were smaller. One large group, containing an estimated 100 beetle-killed trees, however, was noted southeast of Fisher Butte. Elsewhere, bark beetle activity appeared to be light and mostly at endemic levels. A few small groups were also found in the northwest portion of the Reservation, in the Sarpy Mountains. In all, only about 250 PP were recorded as having been killed by MPB on 310 acres.

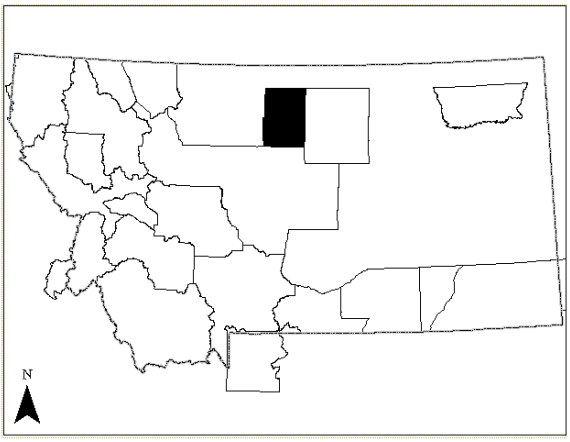

Figure 17. Rocky Boy's IR

Rocky Boy's IR

The Reservation's southern portion was flown and revealed still-active MPB populations in LPP stands, and to a lesser extent, PP. Several large groups of beetle-killed LPP were mapped near Centennial Mountain, Black Mountain, and along Twomile Ridge. Others were noted near Wellen Peak, Baldy Mountain, and close to Pecora Ridge. PP faders were observed near Bailey Peak and in Big Sandy Creek drainage, but were nearly insignificant when compared to mortality in LPP stands. A very minor amount of DFB-caused mortality was recorded in Big Sandy Creek drainage.

In 2006, slightly more than 3,100 beetle-killed LPP were mapped on about 930 acres, and another 320 PP were killed on 330 acres. In 2007, MPB-killed LPP totaled 17,000 trees on 1,900 acres and an additional 460 PP on 140 acres. In 2007, DFB had reportedly killed about 400 DF on 160 acres; in 2006 only 25 beetle-killed DF were noted on but a few acres.

NATIONAL PARKS

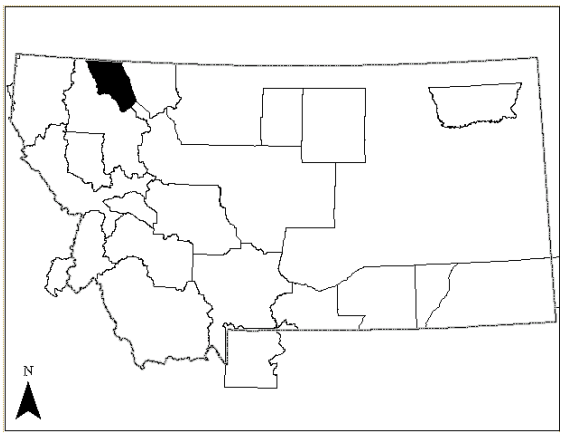

Figure 18. Glacier NP

Glacier NP

Only western half of the Park was flown in 2007, but that is more than has been flown in the past few years. Not since 2004 has entire Park been surveyed. As with much of western Montana at present, MPB activity in LPP stands was the most prominent insect-related damage noted in 2007. Though a pittance compared to MPB outbreaks that ravaged the Park in late 1970s and early 1980s, MPB-killed LPP was still significant in a few locations. Several large groups of faders were noted just north of Kintla Lake. A few covered several hundred acres each, and averaged about 3 beetle-killed trees per acre. Several other large groups were mapped southwest of Bowman Lake, along Logging Creek and northern shore of Logging Lake; and to the south, a few large groups were mapped near Threetops Mountain, along Middle Fork Flathead River near Riverview Mountain and in the Bear Creek drainage, northeast of Nimrod. Elsewhere, there were numerous small and widely scattered groups of MPB-killed LPP within the LPP type.

Of note were several large groups of DFB-killed DF—especially noticeable near Trout Lake, Stanton Mountain, within the Lincoln Creek and Nyack Creek drainages, and close to Threetops Mountain. Smaller groups were scattered through DF or mixed-species stands near Bowman, Quartz, Logging, and McDonald Lakes.

WBBB was also mapped as the mortality-causing agent in high-elevation SAF stands near Packet Lake, West Flattop Mountain, and Logging Mountain. In other parts of the Park, throughout the Livingston Range, bark beetle-caused mortality was very widely scattered in mostly small groups. Some noticeable amounts of WSBW activity could lead to increases in DFB populations and resultant damage.

Park totals for 2004 (the last year most of the Park was flown) showed 5,100 DF killed by DFB on 3,300 acres; 4,800 GF killed by FE on 4,050 acres; 720 of various MPB hosts were killed on 850 acres; and WBBB killed 18,300 SAF on just over 8,200 acres. All those had been increases over previously recorded figures. In 2007, most of those figures have increased significantly. DFB-killed DF totaled almost 9,000 trees on 3,600 acres; 26,500 MPB-killed LPP were recorded on 10,000 acres; and almost 4,400 SAF were killed by WBBB on 1,600 acres. Other beetle-related mortality was at barely more than endemic levels. MPB had killed 20 WBP on 24 acres, but FE and ESB were found only in very minor amounts.

Lodgepole pine needlecast (caused by *Lophodermella concolor*) was identified through ADS on 7,173 acres. Damage was observed on the east and south edge of Lake McDonald and areas west of the lake. Several areas of lodgepole

needlecast were also identified in the far southern area of the park, southwest of Marias Pass and southeast of Pinnacle.

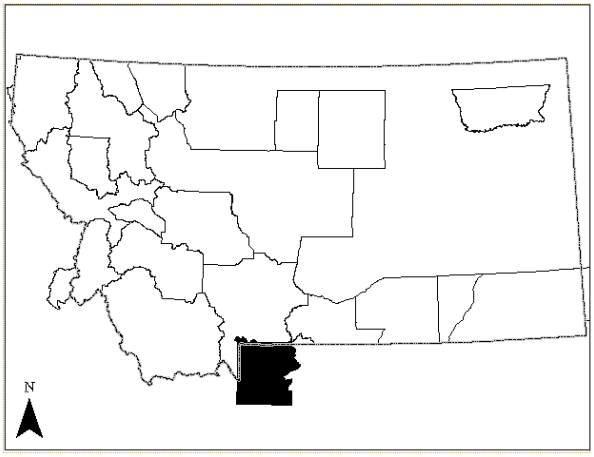

Figure 19. Yellowstone NP

Yellowstone NP

In previous years, we have mapped large groups of MPB-killed WBP in the eastern and central portions of the Park. While MPB is still active in many of those stands, sufficient of the susceptible-size trees have been killed that current faders were significantly reduced in 2007. MPB activity in WBP stands was still quite prevalent around Avalanche Peak and Sylvan Pass; but in 2007 most beetle-caused mortality in that part of the Park was recorded in lower-elevation LPP stands. MPB-killed LPP were widespread from just south of Yellowstone Lake, north nearly to Lamar Valley. Largest infested areas were mapped from about Avalanche Peak on the north to Troll Lake on the south; and from Yellowstone Lake, east to the Park boundary. Groups of faders covering several thousand acres, and averaging 1-3 beetle-killed trees per acre, were common in that area—especially near Grizzly Peak and Mount Sullivan. Smaller, but still-significant groups were noted from Pelican Cone, east to Hoodoo Basin. To the west, MPB-killed LPP was noted in the Specimen Creek drainage, and widely scattered is small groups, south nearly to the Madison River.

MPB-killed WBP was still very common and in general covered more acres, but in eastern part of the Park at reduced levels from past few years. Some of the larger groups were mapped near Electric Peak, Quadrant Mountain, and Sheep Mountain in the Park's northwestern corner; and from there east to Buffalo Plateau, Mount Hornaday and Druid Peak; then south through still-active spots near Mount Washburn and Amethyst Mountain; and farther south still, to stands near Hoyt Peak, Mount Langford and Colter Peak.

WBBB was also quite active in SAF stands in surveyed portions of the Park. Especially large groups were located near Electric Peak and Quadrant Mountain and across the Park's northern tier to Meridian Peak in the northeast corner. To the northwest, significant groups of SAF faders were noted above Grayling Creek. Smaller groups of WBBB-killed trees were smaller and more widely scattered throughout the Park's interior, nearly to its southern border.

A few small DFB-killed DF were observed in a very scattered pattern throughout DF stands in the surveyed area. They were relatively insignificant. Too, the large ESB outbreak of a few years ago in the Park's southeastern corner has been reduced to a few widely scattered and very small groups or beetle-killed ES. Populations of both DFB and ESB appeared to be endemic. In the northern part of the Park, WSBW-infested stands of DF were common. Defoliation coupled with warmer- and

drier-than-normal weather could trigger a resurgence of DFB populations.

In 2004, ground observations detected a very large MPB outbreak in WBP stands in the vicinity of Avalanche Peak. Ground-collected data obtained in both 2004 and 2006 in that area showed in some stands more than 170 WBP per acre (and up to 96% of the stand) had been killed within the preceding 2-3 years.

Beetle-killed totals for the Park in 2005—the last year for which we had relatively complete figures—showed 860 dead DF, attributed to DFB on 350 acres; 2,100 ES on 1,800 acres killed by ESB; 1,650 LPP on 1,300 acres killed by MPB; 365,200 WBP killed by MPB on 29,200 acres; and finally, 24,300 SAF were killed by WBBB on 11,690 acres. In 2006, for the part of the Park surveyed, we noted nearly 17,000 LPP and 830 WBP were killed by MPB, on 6,900 and 290 acres, respectively. About 700 SAF were killed by WBBB on 450 acres. DFB-killed trees had been recorded in very minor amounts. In 2007, with most of the Park flown, we found most beetle-caused mortality has increased. DFB had killed 1,300 DF on 380 acres; and 540 ESB-killed ES were noted on 375 acres. But major increases in MPB activity were recorded in both LPP and WBP stands—48,700 LPP had been killed on 28,000 acres and 66,700 WBP on 37,000 acres. Another 32,000 SAF have been killed by WBBB on 22,000 acres. In addition, WSBW defoliation was reported on nearly 30,000 acres—and could result in a resurgence of DFB populations.

State Nursery

Over the last five years, the State Conservation Seedling Nursery has experienced losses due to a number of insects and diseases. Cutworms have been in the bareroot seedling beds resulting in heavy losses in past years. Willow leaf beetles caused significant growth reductions and leader dieback in bareroot and container Salix exigua (but no plant mortality). Fungous gnats were also present in greenhouse crops.

Seed borne fungous diseases posed the greatest disease problem and resulted in damping off and greatly reduced germination. Various root rot diseases were detected in container grown Douglas-fir, and occasionally pine and larch; not all pathogens were identified but fusarium spp. was most common. Damping off occurred in all crops, especially container and bareroot conifers. Fusarium species was identified in the fascicle sheafs of ponderosa which caused some mortality and higher seedling cull rates.

SPECIAL PROJECTS

1. Evaluating the Effectiveness of Thinning Treatments on DFB-Caused Tree Mortality

In 2005, in cooperation with Jose Negron (RMRS), a long-term thinning study was initiated in DF stands on the Helena, Lewis & Clark, and Bitterroot NFs to evaluate effectiveness of two thinning treatments on DFB populations and associated beetle-caused mortality. Replicated treatments consist of: (1) basal area reductions, and (2) stand density index (SDI) treatments to maintain or approximate uneven-aged stands. Basal area reduction treatments will be included in ongoing projects on all three Forests; SDI treatments will be evaluated on the Helena and Lewis & Clark NFs only.

Evaluations are in varying stages, dependent upon project status on each Forest. Pre-treatment evaluations were conducted in 2006. Post-treatment evaluations were conducted in 2007 and will be done annually thereafter, if DFB are active in treatment units. If beetle activity is not found, monitoring will be conducted at 5-year intervals. This project is on-going.

For additional information, contact Nancy Sturdevant, MFO.

2. Evaluating Efficacy of Verbenone and GLV on Rocky Boy's IR

Within the past few years, the anti-aggregation pheromone for MPB, verbenone has been evaluated for individual tree and stand protection against beetle attacks in several of its hosts. In cooperation with Rocky Boy's IR, and Synergy Semiochemicals, we evaluated the efficacy of verbenone (7.5 g pouches), leaf alcohol (Z-3-hexenol or cis-3-hexanol) (GLV), and a combination of the two, in preventing beetle attacks on LPP in two adjacent drainages on Rocky Boy's IR. Untreated nearby stands served as controls. In June, we selected several drainages that had low to moderate levels of 2006 MPB-caused tree mortality in which management activities are planned within the next few years. We hoped pheromone protection would reduce additional beetle caused-mortality until stands could be treated silviculturally. Treatments were installed in late June.

Following beetle flight, all treatments were evaluated. All trees greater than 5 inches dbh. were recorded by dbh. and rated as follows: 1) live (not attacked), 2) 2007 MPB attack, 3) 2006 MPB kill, 4) older beetle-caused mortality, 5) 2007, unsuccessful attack (pitchout), 6) 2007 MPB strip-attack, 7) older MPB strip-attack, 8) 2007 secondary beetle attack, and 9) older secondary-beetle mortality.

Data is being analyzed and a final report is forthcoming.

For additional information, contact Nancy Sturdevant, MFO.

3. Testing Efficacy of Verbenone and Green-leaf Volatile in Reducing MPB-Caused Mortality in PP and WBP on Lewis & Clark NF

A project was established in PP and WBP stands on Belt Creek RD, Lewis & Clark NF, in an attempt to determine efficacy of a still relatively new, 7.5-gram verbenone pouch (produced by Synergy Semiochemicals, Inc) and a new, 7.0-gram pouch (produced by Pherotech, Inc) in protecting trees from MPB attack. An additional treatment, the addition of green-leaf volatile (GLV) (50:50 blend of hexenol and hexanol; Synergy Semiochemicals, Inc.) pouches was also assessed. In a randomly-assigned-treatment test in ponderosa pine stands on east-facing slopes of Monarch Mountain (north of Neihart, MT), we selected 200 trees. Forty of each would receive the following treatments: No treatment (controls); two 7.5-gram verbenone pouches per tree; two 7.0 verbenone pouches, one, 7.5-gram verbenone pouch and one 10-gram GLV pouch per tree; and a final treatment, two GLV pouches per tree. Pouches were stapled to individual trees about 6 feet high and on the northeast/northwest side of the tree. A standard MPB tree bait (Synergy Semiochemicals, Inc) was hung on an adjacent non-host tree or stake, approximately 5 feet from the treated tree. Treatments were installed in late June and evaluated in late September.

A similar test, identical in all respects except that we did not evaluate two GLV pouches in WBP, was installed in a WBP stand near Kings Hill (south of Neihart). In that area, we selected 160 trees, again 40 of each treatment. Treatments were installed in late May/June and evaluated in mid-September.

Test results were encouraging; but in PP stands MPB populations were not as robust as we had hoped. The following table shows unanalyzed percentages by treatment. These data represent a combining of “no attacks” and “pitchouts” as Not Attacked, and “mass attacks” and “strip attacks” as Attacked.

	--------Whitebark Pine----------		---------Ponderosa Pine----------	
	% Attacked	**% Not Attacked**	**% Attacked**	**% Not Attacked**
Synergy verb.	12.5	87.5	10	90
Phero. verb.	17.5	82.5	7.5	92.5
Verb + GLV	25	75	12.5	87.5
GLV alone	--	--	37.5	62.5
Control	87.5	12.5	55	45

Treatment effects were significantly different from controls, in both areas. Results were promising, and “GLV” treatments especially encouraging.

For additional information, contact Sandy Kegley, CFO; or Ken Gibson, MFO.

4. Bark Beetle Trapping on Wild Horse Island

In spring 2007, Amy Gannon (MT DNRC) was questioned about bark beetle threats in a forest health improvement project in second-growth PP stands on Wild Horse Island—a several thousand-acre island, within Flathead Lake, administered as a Montana State Park by Montana Fish, Wildlife and Parks. About half is forested, those resources being managed by FWP with assistance from Polson Field Office, MT DNRC. Part of the funding for the project was provided by the USDA Forest Service, and administered by DNRC.

A dozen or so private residences, there since before the island was a state park, are surrounded by second-growth PP. Those stands, regenerated after a fire 50-60 years ago, are no longer growing vigorously; and fire hazard has increased significantly within the past few years. In order to increase vigor of those stands, and reduce fire hazard; DNRC proposed thinning 100-200 acres of the most densely stocked stands. Approximately 70 were thinned in 2007.

Due to the unique situation on the island, stands were hand-thinned and piled in spring 2007 by fire crews from Salish-Kootenai Tribes, Flathead IR (CSKT); and DNRC. Piled material was to be burned in fall 2007 and spring 2008. Threats of IPS infesting piled slash and subsequently infesting leave trees was a concern; and typical ameliorating actions for IPS populations—lopping and scattering, spring burning, or chipping—were not options. We concluded threats could be reduced by using pheromone-baited funnel traps to attract flying IPS away from standing trees.

In early June, after beetles had infested slash piles, we (crews from DNRC, CSKT and FHP) hung 80 funnel traps throughout the thinned area. Subsequent evaluations showed thousands of beetles collected in traps, and one beetle-infested tree. At present, it appears beetle trapping, to the benefit of leave trees, was successful. Thinning will resume in 2008, and traps may once again be installed.

This project, a multi-agency venture between USFS, DNRC, FWP, and CSKT; was designed to promote and foster more healthful forest conditions and reduce fire hazard. It appears to have met objectives.

For additional information, contact Amy Gannon, DNRC; or Ken Gibson, MFO.

5. Elytroderma Needle Disease Thinning and Pruning Project

This project is in the Elk Bed area of the Darby RD, Bitterroot NF. Elytroderma has been moderately severe for a number of years in this area. Twelve ponderosa pine stands were randomly assigned one of five treatments: thinning to 12x12 spacing with and without pruning, thinning to 18x18 spacing with and without pruning, and control (no treatment). Annual monitoring began in 2006 and continued in 2007. See FHP Numbered Report 08-03 for establishment data and 2006 remeasurement data.

For additional information, contact Blakey Lockman, MFO.

6. Limber Pine Monitoring Plots

Sixteen plots were established in central Montana in 2007 as part of a study to assess the long-term ecological health of limber pine within white pine blister rust-infested and threatened areas of the Rocky Mountains. The plots are distributed across much of the range of limber pine in Montana with nine plots below 6,500 feet in elevation and seven plots above 6,500 feet in elevation. Eleven plots are on National Forests, 3 plots on Montana Department of Natural Resources and Conservation School Trust lands, one plot on the Blackfeet Indian Reservation, and one plot on lands owned and managed by The Nature Conservancy. Some preliminary analyses of the data were completed. White pine blister rust was found on 13 of the 16 (81%) plots. Of those plots where WPBR was found, 15 to 91 percent of the trees were infected and 2 to 53 percent of the trees had dead tops caused by blister rust. Among all 16 plots, 15 to 92 percent of the trees on any given plot were rated as declining, dying, or dead. Very old dead trees (no needles retained) were mostly excluded from data collection. A report concerning the current status of Montana limber pine will be compiled using these and other available data.

For additional information, contact Amy Gannon, DNRC or Marcus Jackson, MFO.

COMMON AND SCIENTIFIC NAMES

Pathogens

Annosus 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 2007

Gibson, Ken. 2007. Bark Beetles and Root Disease, Libby Ranger District, June 6, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-12. June 6, 2007.

Gibson, Ken. 2007. Bark Beetles on Northern Cheyenne Indian Reservations, July 17, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-16. July 23, 2007.

Gibson, Ken. 2007. Insects Damaging Douglas-fir Cones, Bigfork Tree Improvement Area, July 24, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-18. July 24, 2007.

Gibson, Ken. 2007. Bark Beetle Potential in Brush Creek Fire, Tally Lake Ranger District, Flathead National Forest. September 20, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-23. October 9, 2007.

Gibson, Ken. 2007. Prevention/Suppression/Restoration Project Reviews, Custer, Bitterroot, and Gallatin National Forests, October 2-19, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-26. November 1, 2007.

Gibson, Ken. 2007. Bark beetles in the Brush Creek Fire Area-Follow-up, Tally Lake Ranger District, Flathead National Forest. October 29, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-28. November 5, 2007.

Jackson, Marcus. 2007. Diseases in Stand 449010285, Three Rivers Ranger District, January 25, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-02. March 13, 2007.

Jackson, Marcus. 2007. Rocky Pine Fuel Reduction Watershed Boundary, Three Rivers Ranger District, March 2, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-03. March 13, 2007.

Jackson, Marcus. 2007. 2007 Bark Beetle Suppression Project Reviews, Flathead National Forest, September 12, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-22. September 27, 2007.

Jackson, Marcus. 2007. Root Disease Evaluation - Firefighter Douglas-fir Tree Improvement Test Plantation. October 4, 2007. Flathead National Forest. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-24. November 21, 2007.

Jackson, Marcus; Aquino, Leah. 2007. Tree Failures and Douglas-fir Beetle in Battle Ridge Campground, March 12, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-05. March 23, 2007.

Lockman, Blakey. 2007. Root Disease and Commercial Thinning in Marten Creek, Cabinet Ranger District, Kootenai NF, October 30-31, 2006. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-01. February 9, 2007.

Lockman, Blakey. 2007. Ponderosa Pine Needleminer, Flathead Indian Reservation, July 25, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-17. July 31, 2007.

Lockman, Blakey. 2007. Root Disease in Clearwater Crossing CG, Missoula RD, Lolo NF. December 4, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-33. December 7, 2007.

Lockman, Blakey; Sturdevant, Nancy. 2007. Root Disease in Big Eddy and Marten Creek Campgrounds, Cabinet RD. November 13, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-07-32. December 6, 2007.

Lockman, Blakey; Gibson, Ken. 2007. Campground Evaluations, Superior Ranger District, Lolo National Forest, May 9, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-08. May 16, 2007.

Montana Department of Natural Resources and Conservation; USDA Forest Service. 2007. Montana Forest Insect and Disease Conditions and Program Highlights – 2006. USDA Forest Service, Forest Health Protection, Northern Region. Numbered Report 07-01. 73p.

Steed, Brytten E. 2007. Cooperative Bark Beetle Management, Fort Belknap Reservation, July 20, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-19. August 24, 2007.

Steed, Brytten E. 2007. Beaverhead-Deerlodge project proposal review, Wise River/Wisdom and Madison Districts, 24 August 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-20. September 20, 2007.

Steed, Brytten E.; DeNitto, Gregg. 2007. Tree Improvement Area Pine Mortality, Plains RD, Lolo National Forest, June 28, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-14. June 29, 2007.

Steed, Brytten E.; Jackson, Marcus. 2007. Charles Waters CG (Bass Creek Area), Stevensville, RD, Bitterroot National Forest, 6 July, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-15. July 27, 2007.

Steed, Brytten E.; Sturdevant, Nancy. 2007. Pine Engraver, Fort Belknap Reservation, 12 June, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-13. June 22, 2007.

Steed, Brytten; Sturdevant, Nancy; Gibson, Ken. 2007. Establishment Report: Permanent Plots to Monitor Douglas-fir Mortality Due to Western Spruce Budworm and Douglas-fir Beetle Interactions. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. Numbered Report 07-09. 7p.

Sturdevant, Nancy. 2007. Ips Beetles Attack on Pine Trees in Billings, March 12, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-04. March 16, 2007.

Sturdevant, Nancy. 2007. Mountain Pine Beetle Activity at the Anaconda Job Corps Fuel Reduction Project, Pintler Rd., B-D National Forest, 5/19/07 USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-07. March 15, 2007.

Sturdevant, Nancy. 2007. Elliston Face - Unit 2, Mountain Pine Beetle Strategy. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-11. June 4, 2007.

Sturdevant, Nancy. 2007. PSR Review and Evaluation of Potential Insect and Disease Projects on the Cabinet RD, Kootenai NF, August 29, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-21.September 7, 2007.

Sturdevant, Nancy. 2007. Western Bark Beetles Projects and other Insect and Disease Conditions, Fortine RD, Kootenai NF. October 15, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-25. November 13, 2007.

Sturdevant, Nancy J. Evaluation of Bark Beetle Activity Following the Meriwether Fire, Helena NF. September 5, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-27. November 15, 2007.

Sturdevant, Nancy. 2007. Insect and Disease Activity on the Kootenai NF, Rexford RD, Campgrounds and General Forested Areas, October 2, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-29. November 9, 2007.

Sturdevant, Nancy. 2007. Evaluation of Inland Meadows Pine Beetle Project. November 14, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-30. December 10, 2007.

Sturdevant, Nancy. 2007. Spruce Budworm and Mountain Pine Beetle Activity in the Wise River Project, BLM. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-34. December 26, 2007.

Sturdevant, Nancy; Cramer, William. 2007. Monitoring New and Established Releases of *Mecinus janthinus*, a Biological Control Agent of Dalmatian Toadflax. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. Numbered Report 07-03. 6p.

Sturdevant, Nancy; Gibson, Ken. 2007. Mountain Pine Beetle in Butte Lookout Timber Sale Area, Missoula Ranger District, Lolo National Forest, May 14, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-09. May 16, 2007.

Sturdevant, Nancy; Steed, Brytten E. 2007. Treatment Options for Reducing Losses from Mountain Pine Beetle at the Cromwell-Dixon Campground, Helena National Forest, May 16, 2007. USDA Forest Service, Forest Health Protection, Northern Region, Missoula, MT. MFO-TR-07-10. May 25, 2007.

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Table 1. Acres of Host Type Infested by Bark Beetles In Montana, From 2005 Through 2007

	2005[3]		2006[2,3]		2007[2,3]	
Insect	**Acres**	**Trees**	**Acres**	**Trees**	**Acres**	**Trees**
DFB[1]	168,514	340,946	60,620	113,117	22,285	58,773
ESB[1]	109	210	119	143	403	572
FE[1]	38,489	56,958	2,417	4,338	1,657	1,634
IPS[1]	12,569	30,240	1,302	2,891	1,187	2,299
MPB[1]	793,337	2,784,061	805,595	2,167,382	807,334	2,559,859
WBBB[1]	198,870	353,952	129,784	182,451	115,250	286,757
WPB[1]	1,714	249	452	336	401	243
TOTAL	1,213,602	3,566,616	1,000,289	2,470,658	948,517	2,910,137

[1]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.

[2]Not all areas were flown due to fires, inclement weather or seasonal limitations.

[3]Yellowstone NP includes MT, ID and WY acres.

Table 2. Acres with Douglas-fir Beetle-Caused Mortality on All Ownerships In Montana, From 2005 Through 2007

	2005		2006		2007	
Reporting Area	**Acres**	**Trees**	**Acres**	**Trees**	**Acres**	**Trees**
Beaverhead	23,492	34,928	8,929*	2,488*	4,197*	11,138*
Bitterroot	69,342	142,708	27,071	49,444	1,835*	5,430*
Custer	4,314*	3,872*	0	0	1,086	4,302
Deerlodge	20,409	43,591	2,088	6,775	107*	386*
Flathead	13,457	27,719	8,006	18,316	5,450	9,020
Gallatin	9,520	21,200	1,088*	1,107*	2,058*	9,803*
Garnets	3,158	7,755	1,196	2,365	47*	154*
Helena	5,553	8,670	5,279	13,779	419*	1442*
Kootenai	5,403	11,891	701*	949*	724*	805*
Lewis & Clark	2,573*	5,770*	959*	1,162*	203*	630*
Lolo	10,439	30,915	5,114	16,356	1,261*	3,029*
Blackfeet IR	★	★	★	★	★	★
Crow IR	49	113	0	0	348	1,371
Flathead IR	200	414	177	346	552	1,102
Fort Belknap IR	0	0	0	0	13	57
No. Cheyenne IR	0	0	0	0	0	0
Rocky Boy's IR	256	538	0	0	2	25
Glacier NP	★	★	★	★	3,604*	8,814*
Yellowstone NP	349	862	12*	30*	379	1,265
TOTAL	168,514	340,946	60,620	113,117	22,285	58,773

★ = Not surveyed * = Partially surveyed

Yellowstone NP includes acres in MT, ID and WY

Table 3. Acres with Mountain Pine Beetle-Caused Mortality on State and Private Lands In Montana, From 2005 Through 2007

	2005				2006				2007			
Reporting Area	**LPP**	**PP**	**WBP**	**WWP**	**LPP**	**PP**	**WBP**	**WWP**	**LPP**	**PP**	**WBP**	**WWP**
Beaverhead	2,682	8	1,250	0	1,641*	2*	852*	0*	6,074*	4*	918*	0*
Bitterroot	596	87	0	0	113	123	0	0	6*	45*	0*	0*
Custer	9*	63*	0*	0*	0	10	0	0	217	145	6	0
Deerlodge	25,903	618	68	9	33,933	138	402	0	16,529*	21*	302*	0*
Flathead	9,804	190	0	0	5,262	241	0	0	2,971	1,009	0	0
Gallatin	42	0	1,354	0	4,612*	14*	8,203*	0*	9,641*	56*	7,971*	0*
Garnets	7,527	454	0	0	5,424	814	2	0	1,430*	84*	0*	0*
Helena	2,099	1,237	1,000	0	2,720	2,544	111	0	14,886*	6,312*	0*	0*
Kootenai	164	0	12	0	359*	30*	0*	0*	4*	4*	0*	0*
Lewis & Clark	895*	2,678*	2*	0*	1,260*	1,252*	41*	0*	735*	2,922*	55*	0*
Lolo	13,761	1,593	75	0	18,909	2,403	0	0	5,309*	608*	0*	0*
Blackfeet IR	★	★	★	★	★	★	★	★	★	★	★	★
Crow IR	0	28	14	0	0	0	0	0	2	36	0	0
Flathead IR	6,127	3,055	2	17	2,117	244	0	0	1,399	109	0	0
Fort Belknap IR	★	★	★	★	★	★	★	★	0	2	0	0
No. Cheyenne IR	0	4	0	0	0	0	0	0	0	8	0	0
Rocky Boy's IR	387	191	0	0	★	★	★	★	593	62	0	0
Glacier NP	★	★	★	★	★	★	★	★	4*	0*	0*	0*
Yellowstone NP	0	0	0	0	0*	0*	0*	0*	0*	0*	0*	0*
TOTAL	69,996	10,206	3,777	26	76,350	7,815	9,611	0	59,800	11,427	9,252	0

[1]LPP = Lodgpole pine; PP = ponderosa pine; WBP = whitebark pine; WWP = western white pine

★ = Not surveyed; * = Partially surveyed; Yellowstone NP includes MT, ID, and WY acres

Table 4. Acres with Mountain Pine Beetle-Caused Mortality on All Federal Ownerships In Montana, From 2005 Through 2007

	2005				2006				2007			
Reporting Area	**LPP**	**PP**	**WBP**	**WWP**	**LPP**	**PP**	**WBP**	**WWP**	**LPP**	**PP**	**WBP**	**WWP**
Beaverhead	47,786	60	41,191	11	26,178*	0*	59,240	0*	55,673*	6*	43,257*	0*
Bitterroot	12,118	415	7,199	2	2,591	204	3,005	0	2,491*	334*	180*	0*
Custer	728*	545*	1,087	0*	0	85	265	0	1,151	476	3,334	0
Deerlodge	156,312	1,208	2,007	0	212,195	186	2,083	0	160,671*	78*	2,800*	0*
Flathead	51,766	108	612	0	37,610	181	632	2	40,148	62	16	0
Gallatin	109	0	18,962	0	13,523	16*	23,029	0*	20,659*	42*	44,989*	0*
Garnets	4,417	124	0	0	8,525	10	0	0	3,830*	21*	0*	0*
Helena	11,207	793	7,607	0	19,340	2,598	6,943	0	91,317*	5,235*	526*	0*
Kootenai	11,604	2	7,102	1,700	13,134*	320*	2*	6*	3,405*	48*	14*	4*
Lewis & Clark	4,404*	5,648*	6,539*	0	10,932	7,222	12,736	0*	9,766*	3,331*	2,529*	0*
Lolo	190,601	3,839	7,710	15	190,890	12,743	726	0	123,274*	2,562*	58*	2*
Blackfeet IR	★	★	★	★	★	★	★	★	★	★	★	★
Crow IR	104	115	0	0	0	12	38	0	286	127	26	0
Flathead IR	84,461	12,075	1,293	0	42,563	1,948	19	0	26,413	929	16	0
Fort Belknap IR	★	★	★	★	★	★	★	★	28	104	0	0
No. Cheyenne IR	0	171	0	0	0	16	0	0	0	302	0	0
Rocky Boy's IR	548	141	0	0	★	★	★	★	1,281	75	0	0
Glacier NP	★	★	★	★	★	★	★	★	10,028*	4*	24*	0*
Yellowstone NP	1,316	0	29,214	0	6,908*	0*	286*	0*	28,085	0	36,838	0
TOTAL	577,481	25,244	130,523	1,728	584,389	25,541	109,004	8	578,506	13,736	134,607	6

[1]LPP = Lodgepole pine; PP = Ponderosa pine; WBP = Whitebark pine; WWP = Western white pine

★ = Not surveyed; * = Partially surveyed; Yellowstone NP includes MT, ID, and WY acres

Table 5. Acres with Additional Bark Beetle-Mortality on All Ownerships In Montana, From 2005-2007

	Engelmann Spruce Beetle			Fir Engraver Beetle			Pine Engraver Beetle			Western Balsam Bark Beetle			Western Pine Beetle		
Reporting Area	**2005**	**2006**	**2007**	**2005**	**2006**	**2007**	**2005**	**2006**	**2007**	**2005**	**2006**	**2007**	**2005**	**2006**	**2007**
Beaverhead	0	0*	0*	58	0*	0*	0	0*	0*	81,899	54,085*	21862*	0	0*	10*
Bitterroot	55	6	0*	0	0	10*	2,336	4	0*	26,088	4,141	9547*	0	6	0*
Custer	0*	0	0	0*	0	0	6,168*	0	10	4,216*	1,123	5,485	0*	0	0
Deerlodge	0	0	0*	0	0	0*	364	0	0*	6,276	692	120*	1,532	12	0*
Flathead	31	30	12	22,439	1,496	1,559	790	20	0	22,222	4,986	6,987	0	84	124
Gallatin	6	0*	0*	0	2*	0*	0	2*	5*	26,567	46,054*	33350*	0	0*	0*
Garnets	0	0	0*	0	2	0*	108	203	33*	444	144	334*	2	12	0*
Helena	0	18	0*	0	0	0*	470	311	0*	3,387	1,316	6*	0	24	0*
Kootenai	8	4*	5*	7,702	195*	66*	9	0*	0*	124,366	381*	6732*	45	0*	0*
Lewis & Clark	0*	0*	0*	0*	70*	0*	0*	0*	40*	4,518*	11,372*	1022*	0*	0*	2*
Lolo	9	58	8*	2,688	215	18*	19	749	470*	2,559	1,177	457*	135	302	265*
Blackfeet IR	★	★	★	★	★	★	★	★	★	★	★	★	★	★	★
Crow IR	0	0	0	0	0	0	393	0	0	331	4,091	4,736	0	0	0
Flathead IR	0	0	0	5,602	436	2	0	13	610	5,933	276	1,045	0	12	124
Fort Belknap IR	★	★	0	★	★	0	★	★	19	★	★	0	★	★	0
No. Cheyenne IR	0	0	0	0	0	0	2,186	0	0	0	0	0	0	0	0
Rocky Boy's IR	0	★	0	0	★	0	0	★	0	2	★	0	0	★	0
Glacier NP	★	★	4*	★	★	2*	★	★	0*	★	★	1580*	★	★	0*
Yellowstone NP	1802*	0*	374	0	0*	0	0	0*	0	11,678	451*	21,987	0	0*	0
TOTAL	1,911	116	403	38,489	2,416	1,657	12,843	1,302	1,187	320,486	130,289	115,250	1,714	452	401

★ = Not surveyed * = Partially surveyed

Yellowstone NP includes both MT, ID and WY acres

Figure 20. Reporting Area Boundaries in Montana

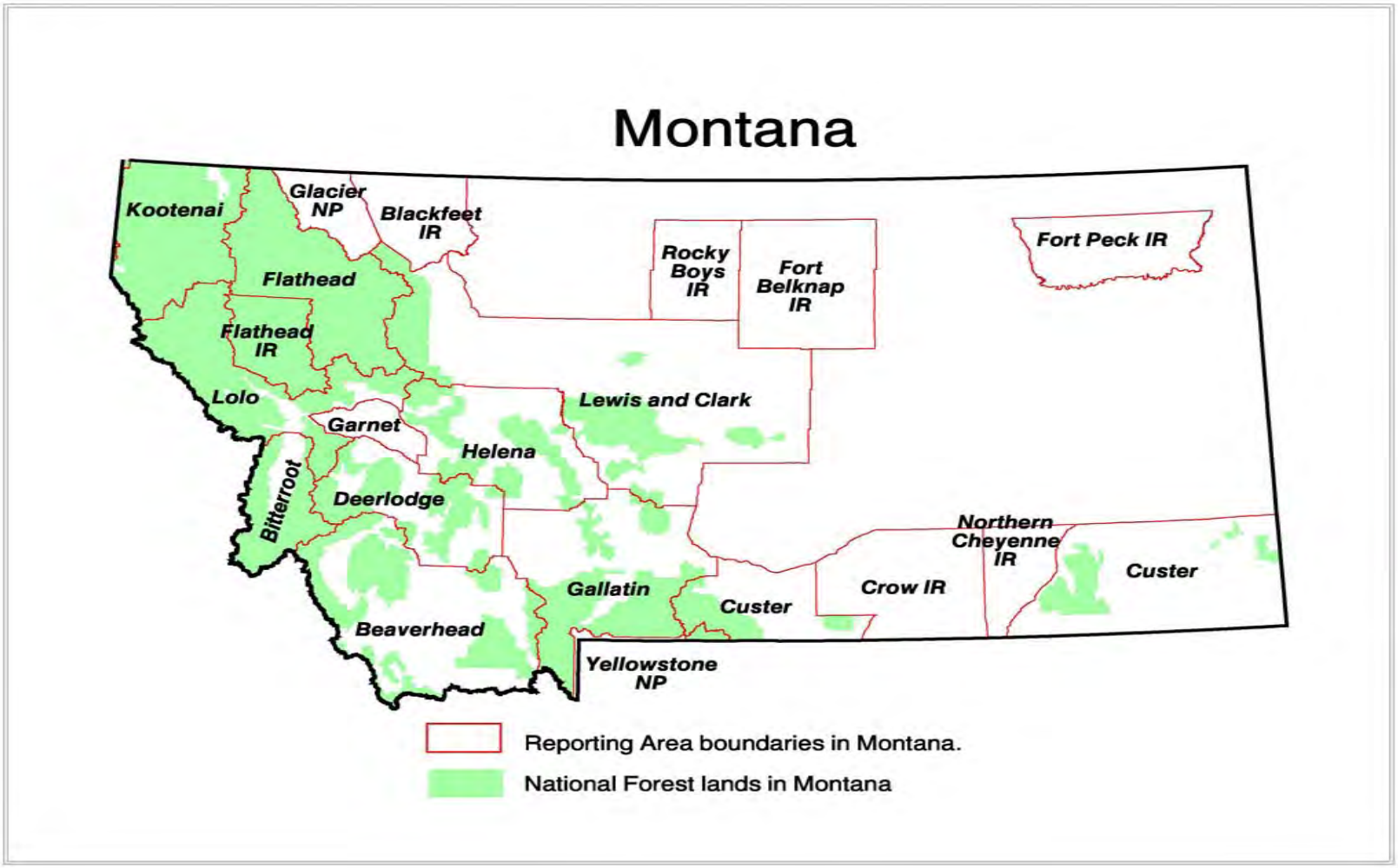

Figure 21. Area Surveyed During the Forest Health Protection Aerial Detection Survey in Montana, 2007

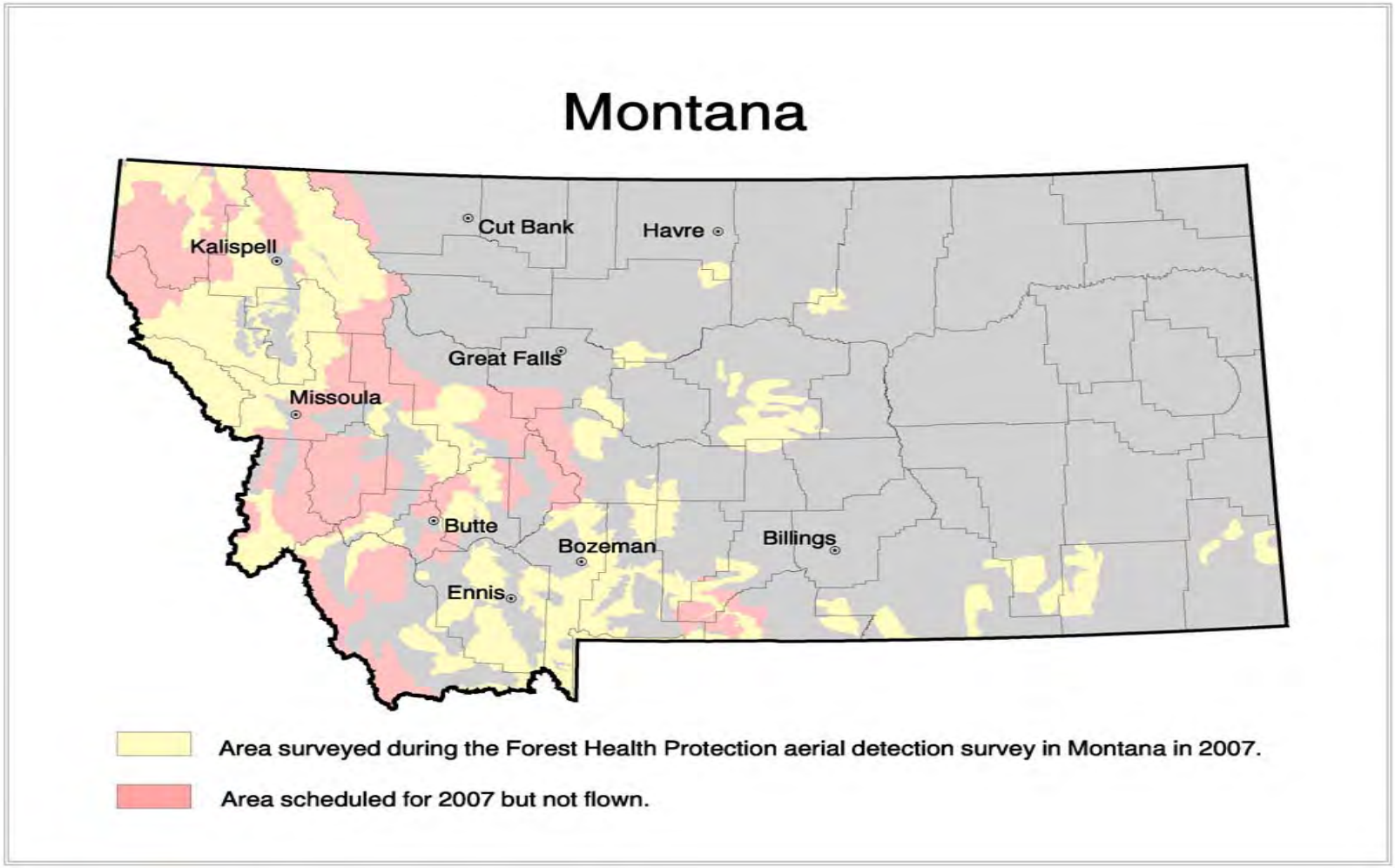

Figure 22. Mountain Pine Beetle Infestations in Montana, 2007

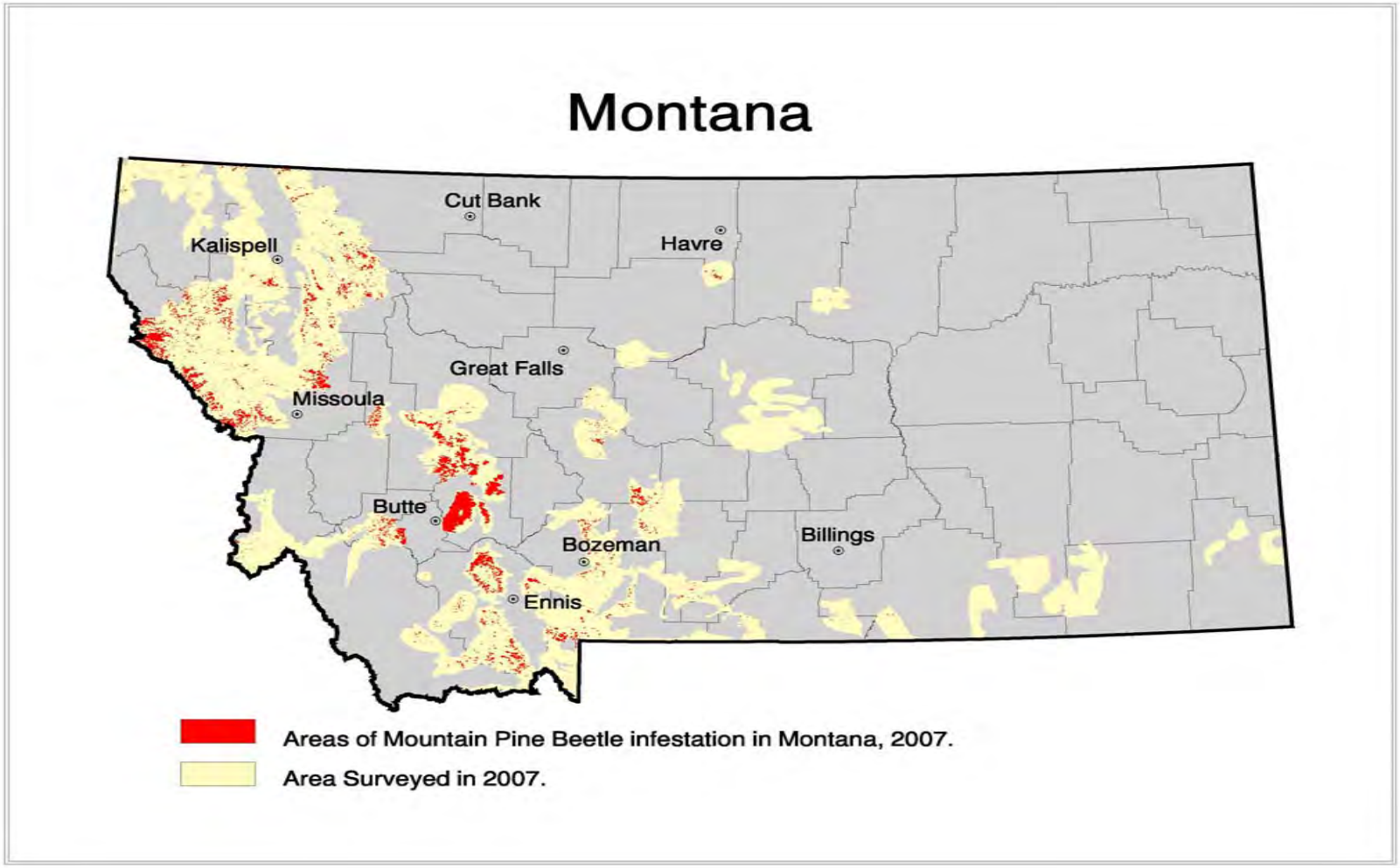

Figure 23. Douglas-fir Beetle Infestations in Montana, 2007

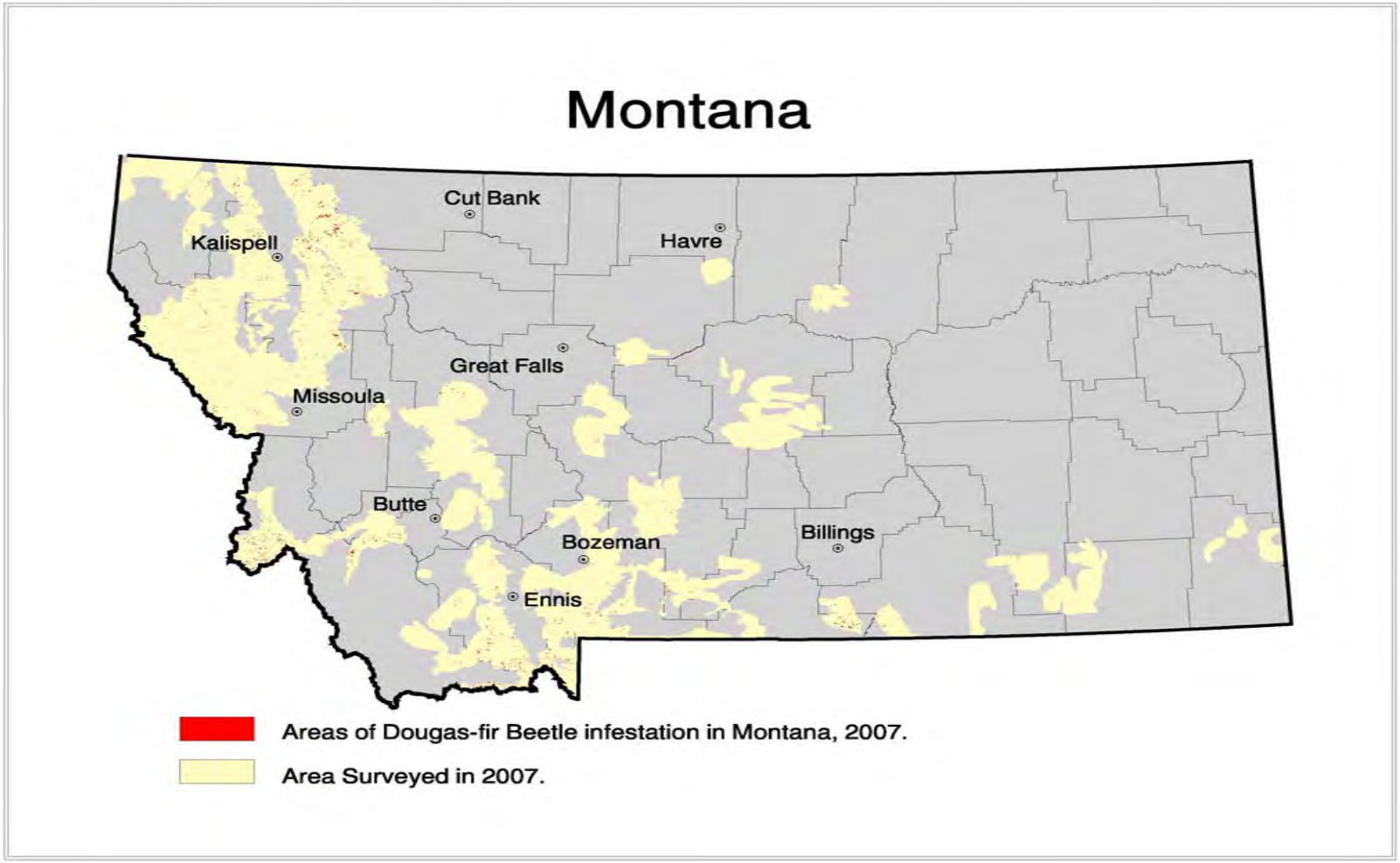

Figure 24. Fir Engraver Beetle Infestations in Montana, 2007

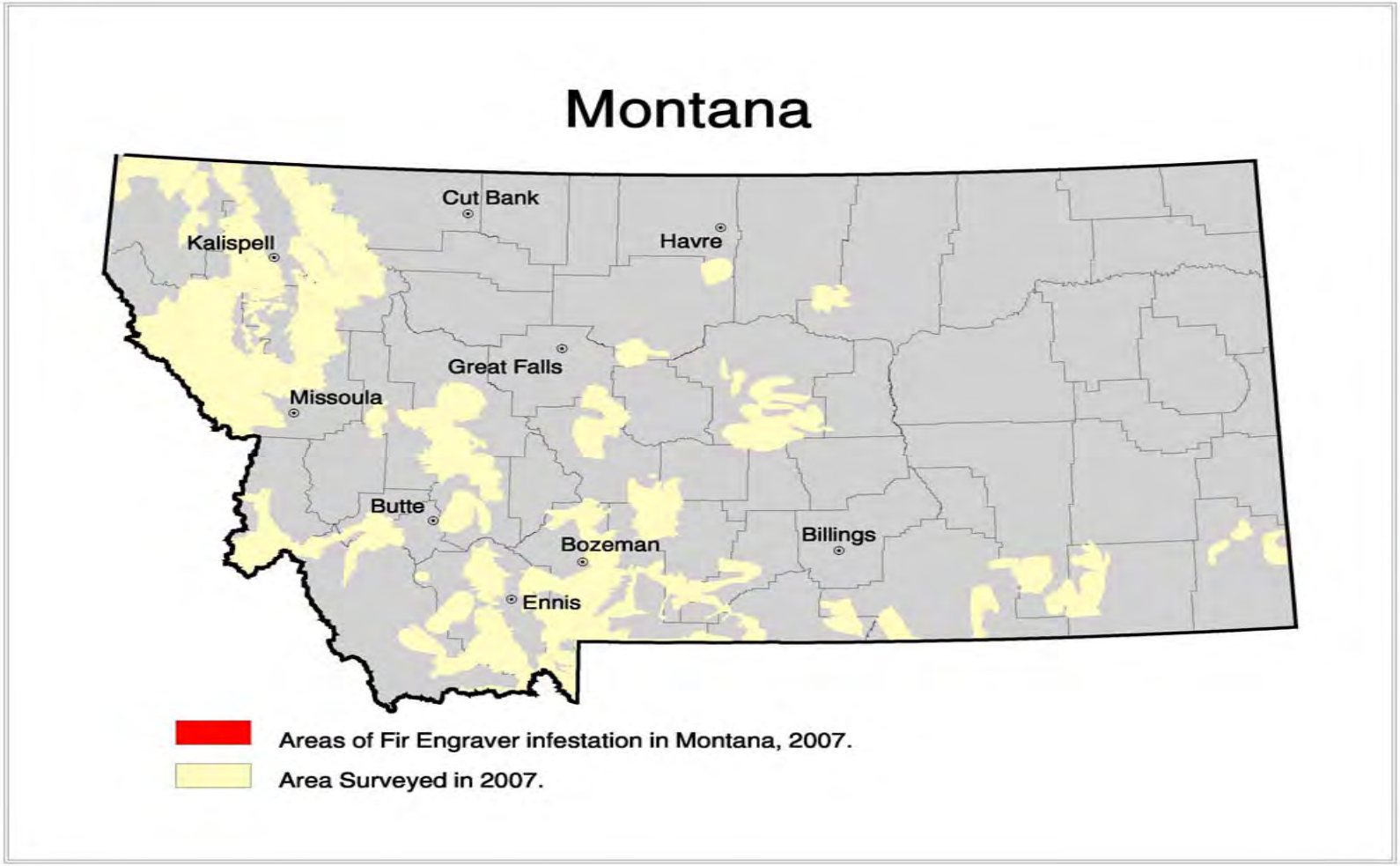

Figure 25. Western Balsam Bark Beetle Infestations in Montana, 2007

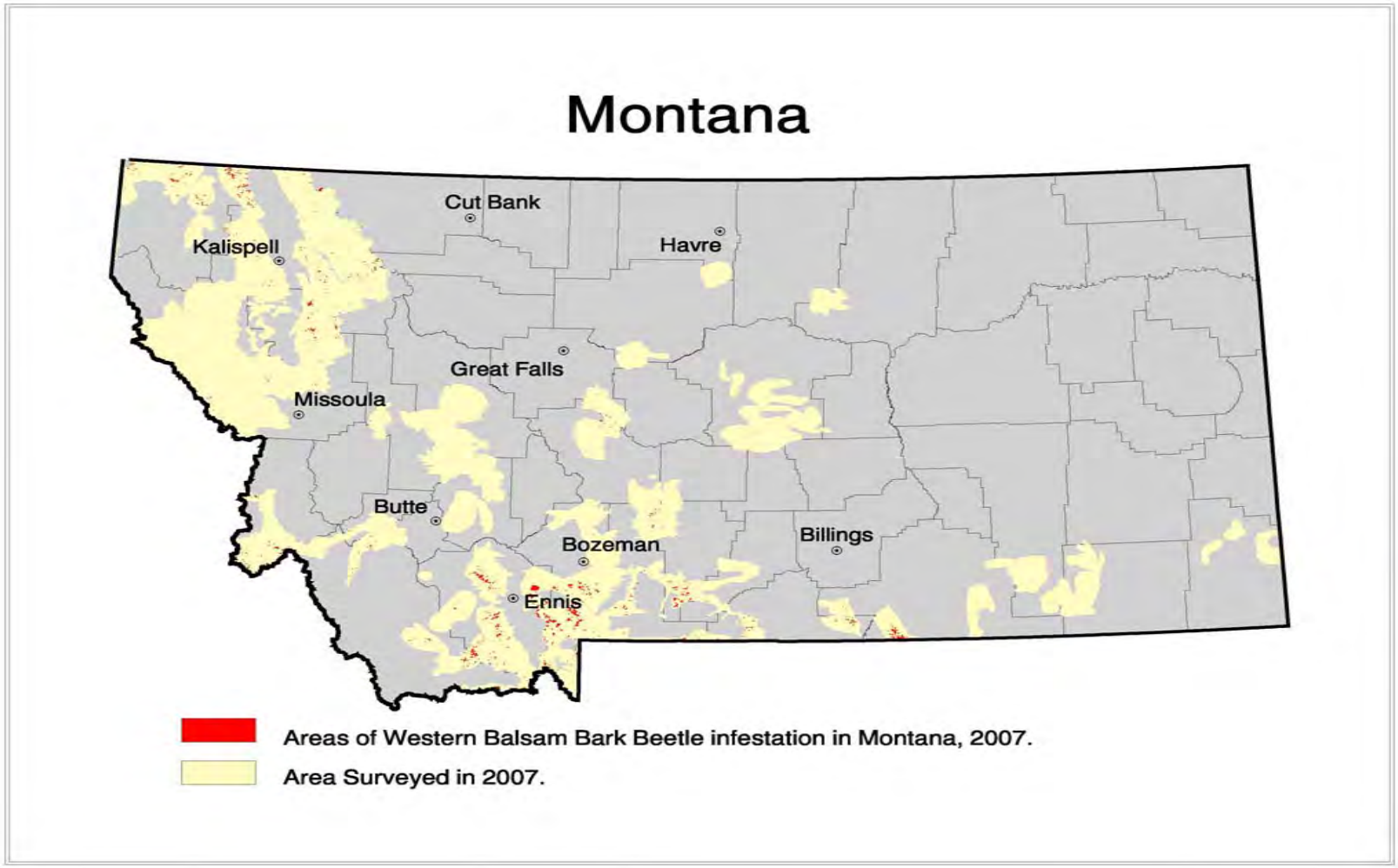
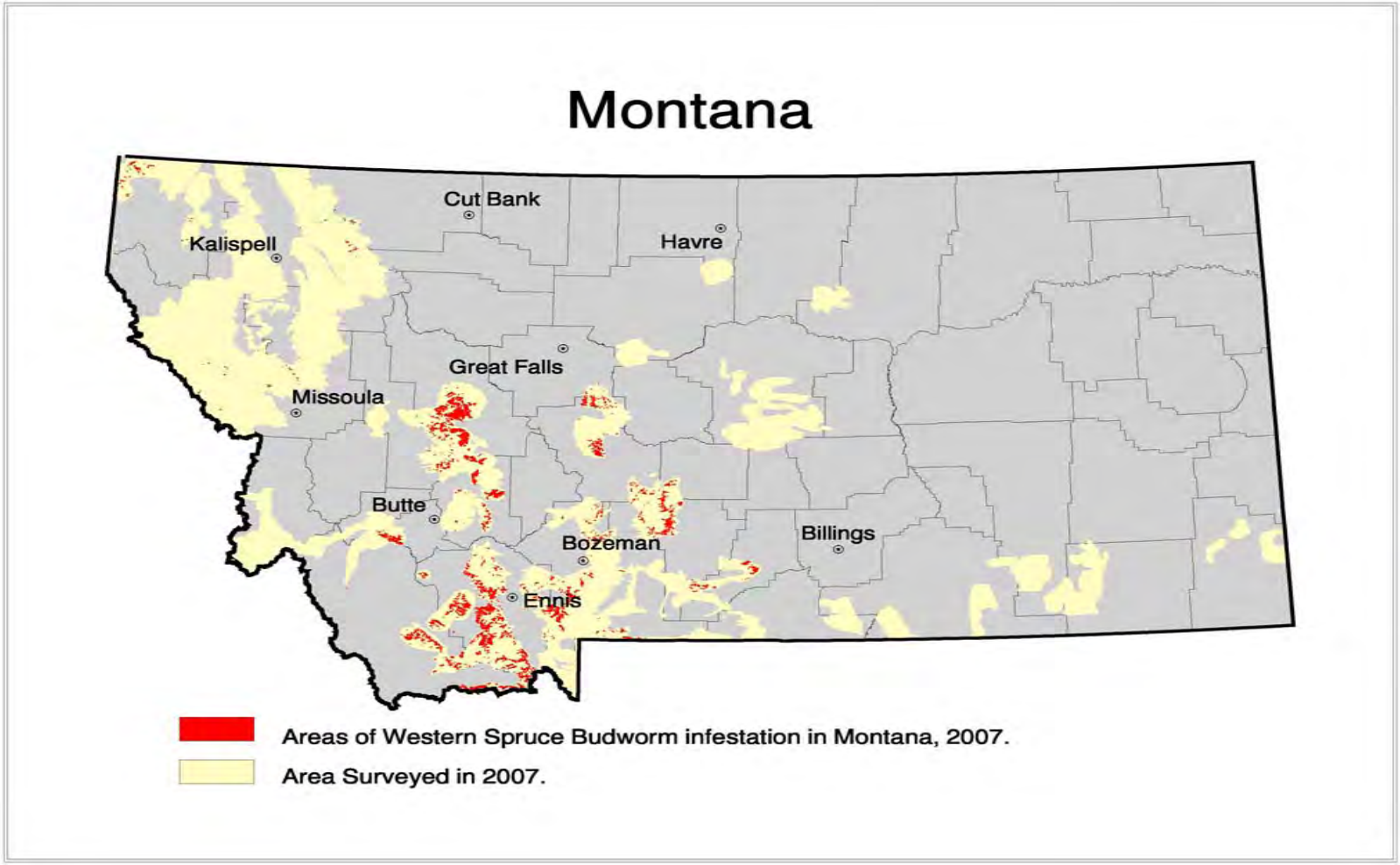
Figure 26. Western Spruce Budworm Infestations in Montana, 2007