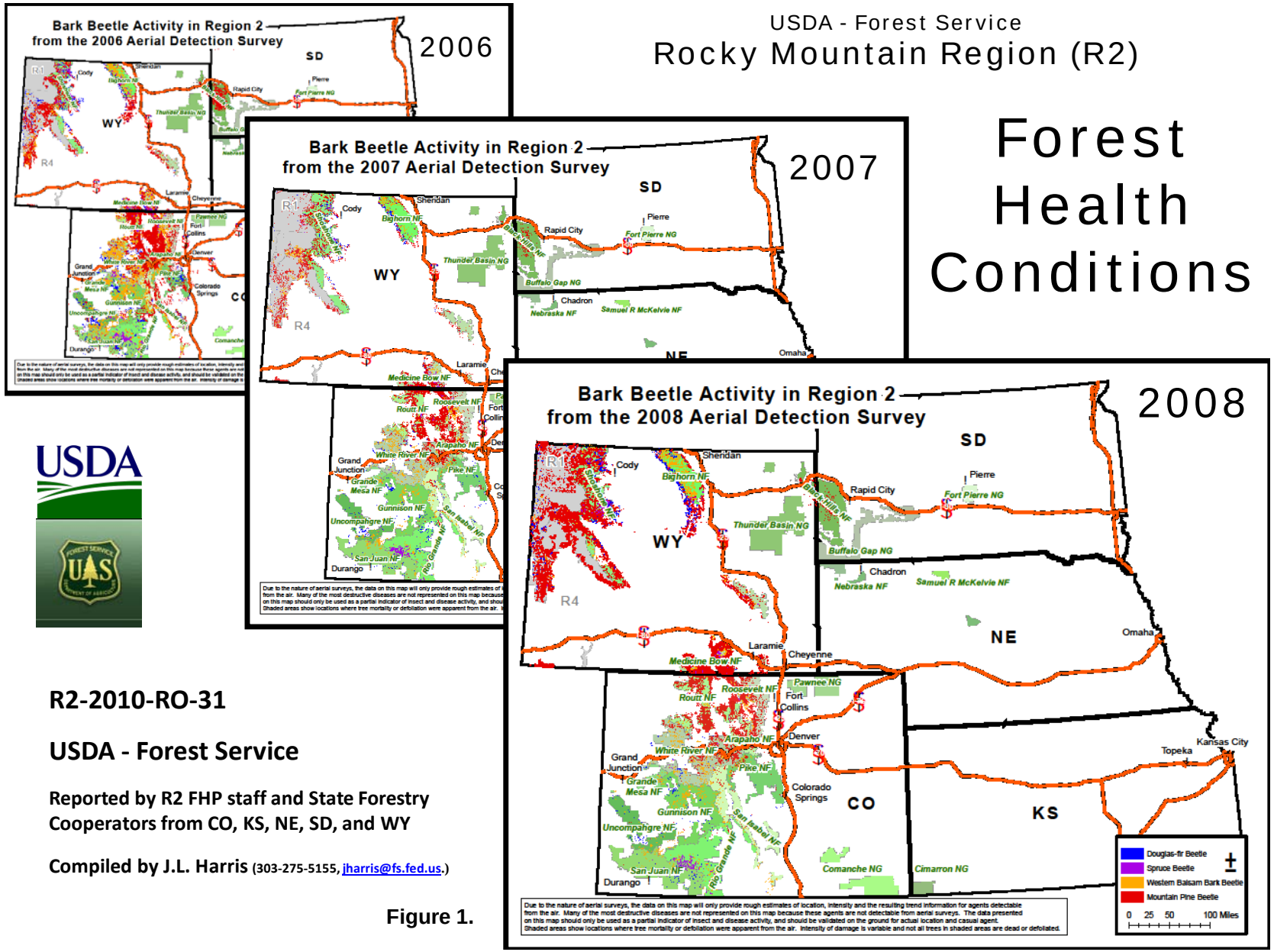
USDA - Forest Service

Rocky Mountain Region (R2)

Forest Health Conditions



R2-2010-RO-31

USDA - Forest Service

Reported by R2 FHP staff and State Forestry Cooperators from CO, KS, NE, SD, and WY

Compiled by J.L. Harris (303-275-5155, jharris@fs.fed.us.)

Figure 1.

Rocky Mountain Region
Forest Health Conditions
2006 – 2008

Table of Contents

Figure 2.. Rocky Mountain Region (R2), Forest Health Protection (FHP) Service Center Areas

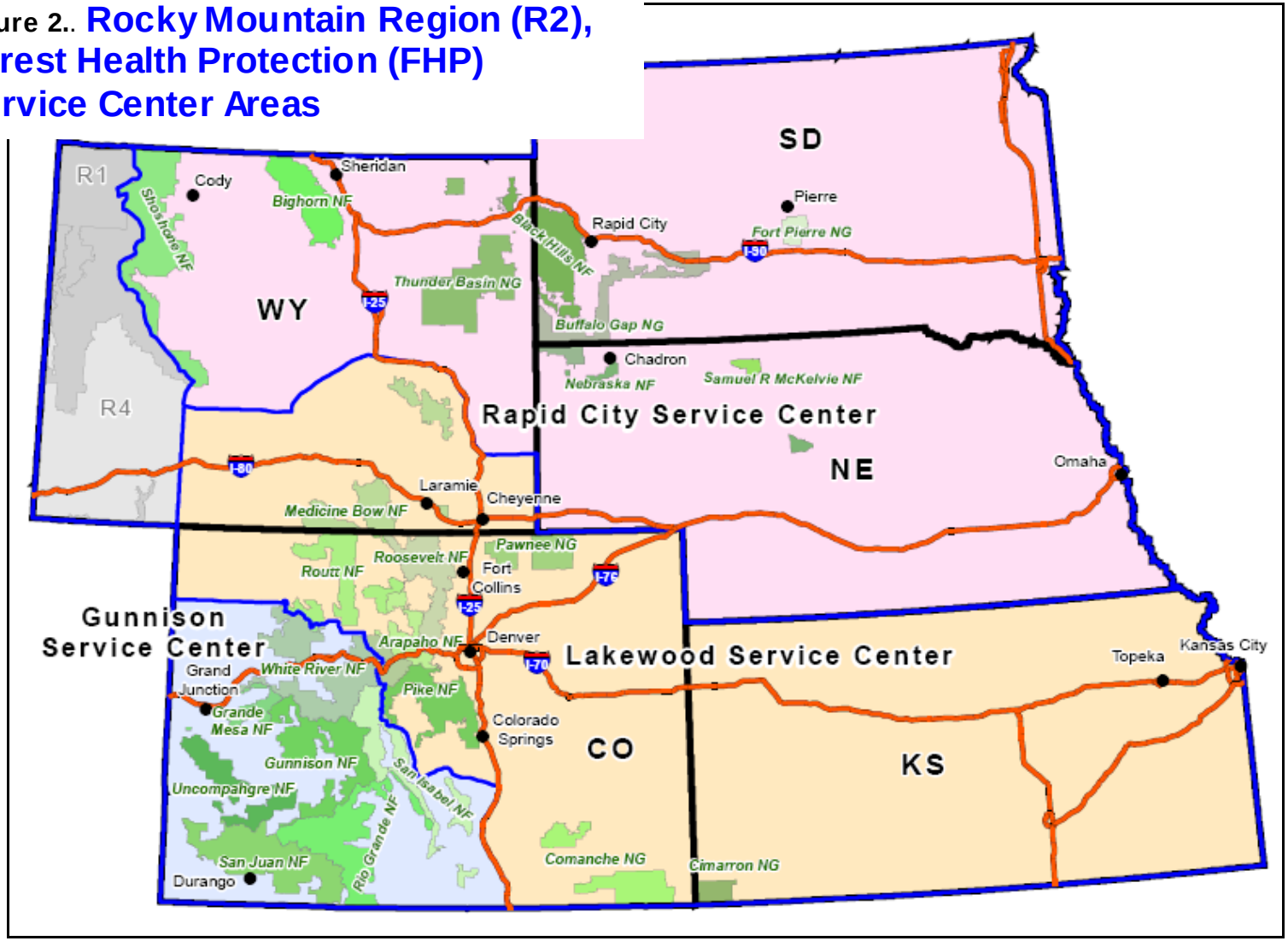


Figure 3.

Major Forest Health Issues

The Major Forest Health (FH) issues in FH work were reported for the Rocky Mountain Region (R2) on forest lands in Colorado, Kansas, Nebraska, South Dakota, and central to eastern Wyoming. FH work projects on forest lands in Wyoming are performed by private landowners, by Wyoming State Forestry Division, and by 3 USDA Forest Service Regions: R1, 2, & 4. Consequently, in this report "**Wyoming-R2 only"** refers to the Shoshone, Bighorn, and Medicine Bow National Forests (NF); the eastern forests in Wyoming are State and Private, with part of the Black Hills NF. This report covers the forest damages by year, state, national forest areas, and damaging agents. Estimated acres of impacted forests by Major Damaging Agents are listed in Appendix A.

Mountain Pine Beetle (MPB)

Dendroctonus ponderosae

Large MPB outbreaks and epidemics occurred in the pines of **Colorado, South Dakota, and Wyoming.** Lodgepole pine was damaged in large outbreaks; then ponderosa, whitebark, limber, and bristlecone pines experienced large population MPB as well. An R2 entomologist often refers to this time period of intensive and extensive beetle damage as "Beetlegeddon." The beginnings of the outbreaks (reported in 2004 – 2005) intensified and expanded through 2006 – 2008 in the Region. These outbreaks developed into epidemics in the lodgepole pines of northern and central Colorado.

Beetle outbreaks, turning into epidemics, were also observed in the Shoshone, Bighorn, and Medicine Bow National Forests in Wyoming. Also in R2, the Black Hills forests of South Dakota had large epidemics of MPB which killed thousands of ponderosa pine and limber pines.

Figure 4 shows a general overview of how MPB infestations increased in R2 from 2005 to 2008. The Aerial Detection Survey maps on the report cover (Figure 1) also indicate the expanding beetle-caused tree mortality during 2006, 2007, and 2008. These maps may be seen at http://www.fs.fed.us/r2/fhm/ or by request to R2 FHP. Estimated acreage counts of MPB damaged trees by NF and year are listed in Appendix B

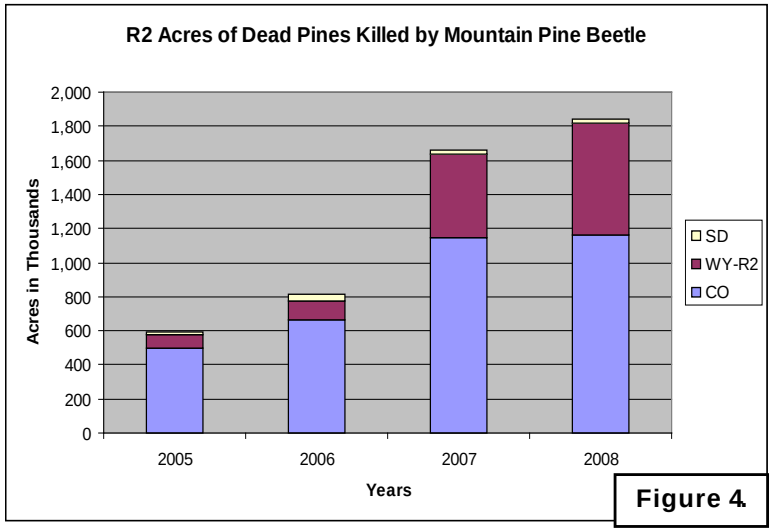


Figure 4.

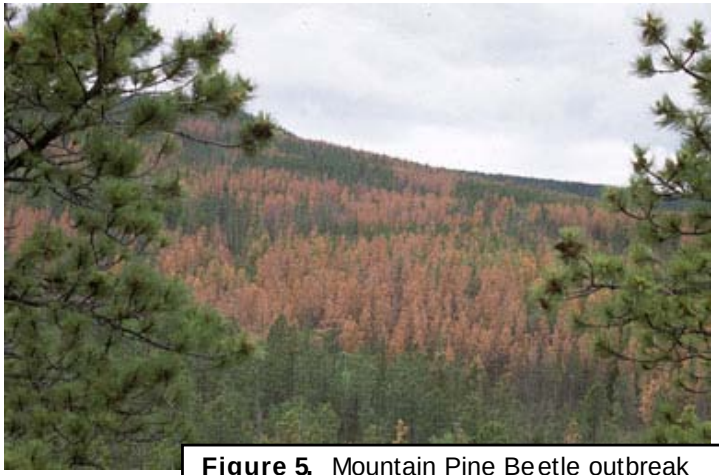


Figure 5. Mountain Pine Beetle outbreak in ponderosa pine in the Black Hills NF

Black Hills National Forest (SD & Eastern WY):

2006: MPB caused ponderosa pine mortality on over 40 thousand acres throughout the Black Hills area. Most of this was in localized areas of the northern and central Black Hills. A multi-stand, landscape-level episode of the tree mortality continued across the Deerfield Reservoir area.

This reservoir area experienced the largest outbreak and has been ongoing for about 4 years with intense tree mortality. Suppression efforts were used to treat and reduce beetle spread.

Another MPB outbreak expanded around the Harney Peak and Black Elk Wilderness Areas.

2007: MPB epidemics continued expanding and intensifying to even higher levels of damage in 2007. An estimated 41 thousand acres were impacted. Pine mortality cased by MPB continued across areas of Deerfield Reservoir, Harney Peak, and the Black Elk Wilderness.

2008: MPB infestations were treated aggressively in the central Black Hills. New areas of tree mortality occurred in Custer State Park and around the Black Elk Wilderness. A variety of treatments, including thinning, and non-commercial sanitation were undertaken. Some treatments were less successful than others because of the large populations of beetles attacking from the wilderness area.

Bighorn and Shoshone National Forests:

2006: Mountain pine beetle activities were at elevated levels in ponderosa pine along the eastern slope of the Bighorn Mountains. Much of this activity occurred on lands that are difficult to treat due to topography. It was expected that the increasing trend in tree mortality will continue over the next few years.

There was significant MPB-caused limber pine mortality occurring throughout the Bighorns, especially on the western side of the mountains. Many of the limber pine stands have been heavily impacted, with the larger-diameter trees killed

On the Shoshone NF, there was a large and increasing outbreak of MPB in the Wind River area. Whitebark and limber pines were killed in large numbers, and landscape-level mortality occurred throughout lodgepole pine forests in the area. Whitebark pine, mortality exceeded 50% in some stands, and the outbreak continued to grow.

In lodepole pine, whole hillsides and river drainages were killed in a relatively short amount of time. On the

northern end of the Shoshone NF, there were rapidly increasing levels of MPB in lodgepole pine stands. Throughout the Clark's Fork Basin, small groups of beetle-killed lodepole pine are appearing at regular intervals. Also, along the North Fork corridor, the number of MPB-killed lodgepole pines increased. In some areas, most or all the larger-diameter pine trees were dead and many of the remaining ones were attacked by MPB in 2006.

2007: Mountain pine beetle populations continued to increase and expand on the Bighorn National Forest and the Shoshone National Forest.

2008: On the Bighorn NF, thousands of lodgepole, ponderosa, and limber pines were killed by MPB on both the east and west sides of the Bighorn Mountains. On the Shoshone National Forest large mountain pine beetle outbreaks continued in several mountain ranges.

Medicine Bow and Routt National Forests:

2006: In southern Wyoming on the Medicine Bow NF, limber pine mortality attributed to MPB in concert with white pine blister rust disease killed thousands of trees. The dead limber pines were mapped within the Snowy Mountain and Sierra Madre Mountain ranges of the Medicine Bow National Forest in 2006. An estimated 14,000 limber pine trees on 6500 acres in Carbon County area were killed.

Lodgepole pine forests across both the Sierra Madre and Snowy Range mountains were also impacted by MPB. Much of the larger infestations occurred near the Wyoming-Colorado border. Overall observations from aerial surveys showed that MPB killed roughly 780,000 lodgepole pine trees.

On the Routt NF, MPB populations remained at epidemic levels in lodgepole pine stands throughout northern CO. Jackson and Routt Counties of Colorado were severely impacted by MPB Infestations in lodgepole and limber pines.

2007: Mountain pine beetle infestations in lodgepole pine forests across both the Sierra Madre and Snowy Range Mountains of the Medicine Bow National Forest continued to intensify and expand. Some of the larger infestations occurred near the Wyoming/Colorado border. Overall observations from aerial survey showed that mountain pine beetle killed lodgepole pine trees on over 180,000 on the Medicine Bow National Forest. In some areas of the forest this was a 10-fold increase from the previous year.

Mountain pine beetle infested thousands of trees in Colorado on the Routt NF on over 350,000 acres. This infestation was occurring mainly in lodgepole pine and limber pine at higher elevations. The populations of mountain pine beetle continued to increase in Northern Colorado, especially in Routt and Jackson Counties.

2008: A landscape-level epidemic of mountain pine beetle was evident across the lodgepole pine forest cover type on the Medicine Bow - Routt NF's. Mountain pine beetle populations increased and expanded in the mountain ranges throughout south-central Wyoming. Entomologists forecasted that if this current rate continues, most of the mature, large diameter lodgepole pine forests in this area will be killed within 3-5 years.

Anomalies of mountain pine beetle behavior were seen with the ongoing outbreak in the Routt, Jackson, Eagle, Summit, and Grand counties of Colorado. Some infestations were observed in small diameter (<3 inches) trees; and occasional beetle attacks in the smaller branches above the spray line of chemically treated trees. There were even a few incidences of finding MPB in Englemann spruce and subalpine fir trees. Possible host tree depletion in an area caused MPB to "spill over" into the non-pine trees.

Roosevelt, Arapaho, and White River National Forests:

2006: MPB populations remained at epidemic levels in lodgepole pine stands throughout northern CO, west of the Continental Divide. The following counties were severely impacted: Eagle, Grand, Jackson, Routt, and Summit. Large amounts of dead and dying lodgepole pines adjacent to towns prompted efforts by Federal, State, and local landowners to manage beetle impacts and fire risk in the wildland-urban interface. These communities included Breckenridge, Silverthorne, Dillon, Frisco, Grand Lake, Granby, Winter Park, Steamboat Springs, Avon, and Vail.

As living lodgepole pine trees have been depleted from this area, MPB has concentrated on the few remaining pines that are intermingled with Englemann spruce in riparian areas. Along these riparian areas, MPB was attacking and infesting Engelmann spruce trees along with lodgepole pine trees. MPB larvae are developing in these trees and are reaching late larval instars. Whether these beetles will survive to emerge as adults has not been determined.

In an unusual twist, mountain pine beetle-infested Engelmann spruce are being attacked at their base by the spruce beetle, *Dendroctonus rufipennis*. This interaction between these two beetles may lead to an increasing problem as spruce beetle populations build while MPB populations collapse due to a depletion of the lodgepole pine resources; however this has not been seen yet.

In Colorado, MPB successfully completes their lifecycle in a single year at elevations in excess of 9500 feet, where they were expected to take two years to complete development. As a result, we saw very high levels of lodgepole pine morality in these high elevation forests. Single trees and small groups of fading lodgepole pines, indicative of MPB attack, were detected throughout high-elevation forests near Rocky Mountain National Park and along the east side of the Continental Divide along the northern Front Range. This suggested that a major outbreak could be imminent in this area within the next 3-5 years.

2007: The MPB populations in areas of the northern Front Range are on the rise, specifically in Boulder, Clear Creek, Gilpin, and Larimer Counties. The main hosts affected in these areas are lodgepole, limber and Rocky Mountain bristlecone pine.

Mountain pine beetle infestations intensified throughout lodgepole and limber pine stands on the eastern slopes of the Front Range in 2007. Affected areas include the eastern slopes of the Medicine Bow (Rawah) Range, Bull Mountain, Rocky Mountain National Park, and areas from Estes Park to Blackhawk and Central City. In many areas, the number of new fading trees averaged 5-10

trees/acre and spots of 10 – 100 trees were common both in lodgepole and limber pines. Largest spots occurred in creek bottoms or at the lower elevation limits of forest cover where large diameter, thick barked, lodgepole pines, favored by mountain pine beetle were found in greatest abundance. Areas with high levels of damage during 2005-6, including the South Boulder Creek drainage west of Rollinsville. The infestation along the I-70 Corridor and along U.S. 40 near Berthoud Pass also intensified in 2007. In some areas, nearly 100% of the large lodgepole pines have been killed.
Mountain pine beetle was also detected in urban areas east of the Continental Divide (commonly referred to as the Front Range); it was highly likely that the beetle was transported in infested firewood. Trees affected were exotic ornamental pines, but were unsuccessfully attacked because of tree defenses "pitching out" the beetles.

2008: In northern Colorado, lodgepole, ponderosa, limber, and Rocky Mountain bristlecone pines continued to be killed by the mountain pine beetle. The current epidemic was occurring in lodgepole pine in Eagle, Grand, Jackson, Routt, and Summit Counties, west of the Continental Divide. Mountain pine beetle populations are at epidemic levels in high elevation lodgepole pine forests in Boulder, Clear Creek, Gilpin, and Larimer Counties along the northern Front Range. Losses of lodgepole pines are likely to be similar to those observed west of the Continental Divide. In addition to this lodgepole pine mortality, the ponderosa pines intermixed with lodgepole pines along the northern Front Range showed increasing levels of infestation, especially in Boulder, Clear Creek, and Larimer Counties.
In lower elevation ponderosa pine forests, mountain pine beetle-killed trees increased in number in Boulder and Larimer Counties in 2008. Because of greater variability in the age, size, density and species diversity in the ponderosa pine dominated forests of the northern Front Range, the course of the mountain pine beetle epidemic and the severity of losses are difficult to predict with any degree of confidence. We suspected that tree mortality in ponderosa pine will be more variable than the losses observed in lodgepole pine forests west of the Continental Divide.
Limber and bristlecone pines are also being attacked at high elevations in Boulder, Clear Creek, and Larimer Counties.

National Forests in Central to Southern Colorado (Pike, San Isabel, Grand Mesa, Uncompahgre, Grand Mesa, Rio Grande, and San Juan):

2006: Beetle activity in lodgepole pine continued to intensify near Vail, CO. MPB populations in ponderosa pine were at epidemic levels surrounding the Woodland Park community in El Paso and Teller Counties.
The beetles also caused high levels of tree mortality in stands of ponderosa pine in the South Park area, near Fairplay, in Park County, Colorado.
A massive outbreak of MPB in ponderosa pine on the Pike NF continued to 2006. In some areas much of the susceptible host types were depleted.
The outbreak of MPB along the eastern slopes of the Sangre de Cristo Range continued during 2006.

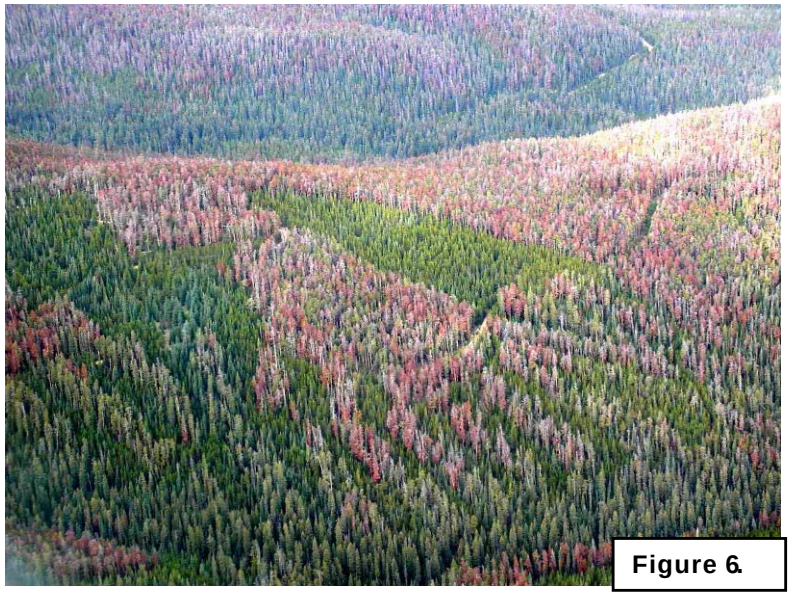


Figure 6.

Photo titled, "The Red Hand of Death", by researchers at the Rocky Mountain Research station. This area of the Frazer Experimental Forest on the Arapaho NF shows some of the landscape level damage caused by MPB and their preference for larger trees, as seen in these lodgepole pines in an experimental, watershed treatment. (See Appendix B)

2007: In Colorado, mountain pine beetles successfully completed their lifecycle in a single year at elevations in excess of 9,500 feet, where they were expected to take two years to complete development. As a result, we saw unprecedented high levels of lodgepole pine mortality in these high elevation forests.
A localized outbreak of mountain pine beetle continued in urban ponderosa pine forests in the communities of Woodland Park, Crystola, Chipita Park and Cascade along US Highway 24 on the Pike National Forest. This outbreak has been underway for at least four years. Extensive mortality of limber/bristlecone pine was detected in the Wolf Creek and Big Cottonwood Creek drainages of the eastern slope of the Sangre de Cristo Range for the second straight year. The damage has been classified as being caused by mountain pine beetle.

2008: Mountain pine beetle activity increased in 2008 on the Pike and San Isabel National Forests in lodgepole pine in northern Lake County, south of Leadville, and western Park County, north of Fairplay. These infestations occurred in areas near Summit County, where a mountain pine beetle epidemic has been ongoing for a number of years.
Suppression efforts are occurring on most of these National Forests. These include sanitation, single tree preventive insecticide treatments and the use of verbenone, a repellent pheromone for mountain pine beetle.

Spruce Beetle

Dendroctonus rufipennis in Colorado and Wyoming on Engelmann spruce

Bighorn and Shoshone National Forests:
2006: Spruce beetle has been at relatively low levels on the Bighorn NF; however, there have been a few spots of elevated activity. There continued to be a large number of spruce killed along highway 14A, a main highway in Bighorn Mountain area.

Spruce beetle expanded through the spruce type on the northern end of the Shoshone NF. Almost all spruce trees from pole-size to larger were killed in the Carter Mountain area. The beetle caused similar widespread mortality in spruce stands in Sunlight Basin. It appeared that much of the spruce type on the northern end of the Shoshone NF would be affected before this major landscape-level event subsides. Anywhere spruce was found along the North Fork corridor, most of the larger trees were killed and many of the smaller ones were also attacked.

2007 - 2008:
The Shoshone National Forest experienced the largest impact from spruce beetle with 24,000 acres of Engelmann spruce affected by the beetle. Spruce beetle killed extensive areas of Engelmann spruce on Carter Mountain west of Cody and throughout the central Shoshone NF.

Southern Wyoming and Northern Colorado National Forests (Medicine Bow, Routt, Roosevelt, and Arapaho):

2006: Spruce beetle populations in northern Colorado remained at epidemic levels in Jackson and Routt Counties on the Routt NF. Spruce beetle activity was also increasing on the Arapaho-Roosevelt National Forests from Rocky Mountain National Park north to the Wyoming border, in western Larimer County and eastern Jackson County (Jackson County – 12,800 acres; Larimer County – 6,600 acres), along the Medicine Bow Mountains (Rawah Range) and in small stands of mature spruce east of the Laramie River.

In southern Wyoming, spruce beetle populations were at epidemic levels (Albany County – 4,800 acres; Carbon County – 33,700 acres). The spruce beetle was active along the main drainages of North Platte Creek and Savage Run Creek on the Medicine Bow NF. Much of this spruce mortality occurs within mixed Engelmann spruce-lodgepole pine stands affected by mountain pine beetle. Spruce beetle-caused mortality was prominent south of Snowy Range Pass. Spruce mortality due to spruce beetle was also common within mixed Engelmann spruce-lodgepole pine stands affected by mountain pine beetle in Carbon County. Spruce beetle also was very active along the Roaring Fork of the Little Snake River and the West Branch of the Little Snake River. Within the Snowy Range and the Sierra Madre, spruce beetle caused tree mortality on approximately 37,000 acres.

2007: In northern Colorado, large areas of older spruce have been killed on the Routt National Forest. Spruce beetle activity increased on the Arapaho-Roosevelt National Forests from Rocky Mountain National Park north to the Wyoming border, in western Larimer County and eastern Jackson County along the Medicine Bow Mountains (Rawah Range) and in small stands of mature spruce east of the Laramie River. Levels of spruce mortality declined in 2007 (Jackson County – 13,000 acres; Larimer County – 2,400 acres), relative to acres impacted in 2005 and 2006. This was largely due to the severe mortality of the susceptible host type, where large areas of spruce in this area suffered nearly 100% mortality of the overstory spruce.
In southern Wyoming on the Medicine Bow National Forest, spruce beetle populations continued at epidemic,

but declining levels (Albany County – 6,900 acres; Carbon County – 12,000 acres). Spruce beetle populations continued at epidemic levels along the main drainages of North Platte Creek and Savage Run Creek. Much of this spruce mortality occurred within mixed Engelmann spruce-lodgepole pine stands affected by mountain pine beetle. Spruce beetle-caused mortality was prominent south of Snowy Range Pass. Spruce beetle-caused mortality also was common within mixed Engelmann spruce-lodgepole pine stands affected by mountain pine beetle in Carbon County.

2008: Spruce beetle was in outbreak status in high elevation, old growth Engelmann spruce forests in Northern Colorado, in the Jackson and Larimer Counties, along the Medicine Bow Mountains (Rawah Range) and in small stands of mature spruce east of the Laramie River, during 2008, but at lower levels lower than in 2007 (Jackson County – 1,600 acres; Larimer County – 1,300 acres). This was largely due to the loss of a majority of the susceptible host type in previous years. Large areas of spruce forests in this area have suffered nearly 100% mortality.
In southern Wyoming on the Medicine Bow National Forest, spruce beetle populations continued at epidemic, but declining levels (Albany County – 1,200 acres; Carbon County – 2,900 acres) Spruce beetle was active along the main drainages of North Platte Creek and Savage Run Creek. Much of this spruce mortality occurs within mixed Engelmann spruce-lodgepole pine stands affected by mountain pine beetle. Spruce beetle also remains active in some stands of the Snowy Range and the Sierra Madre.

National Forests in Central and Southern Colorado (Pike&San Isabel (PSI), White River(WR), Grand Mesa-Uncompahgre-Gunnison (GMUG), Rio Grande (RG), and San Juan (SJ):

2006: Spruce beetle activity intensified on the White River NF - Of particular management concern were expanding outbreaks such as one near Baylor Park on the White River NF.
Spruce beetle activity increased on the Grand Mesa-Uncompahgre-Gunnison, Rio Grande, San Juan, and White River NFs. One near the Colorado-New Mexico state line on the Rio Grande NF was a massive outbreak extending throughout high-elevation spruce trees from Wolf Creek Pass to west of Telluride. Recreational values are currently at grave risk as spruce beetles impact stands near the Wolf Creek and Telluride ski areas. A large number of trees over 90,000 acres were killed in the San Juan Mountains.

2007: Active spruce beetle outbreaks were occurring on the Rio Grande, San Juan, and White River National Forests in southern and central Colorado. A large spruce beetle outbreak in the Weminuche Wilderness expanded into the Wolf Creek Pass area and another outbreak continued in the Baylor Park area southwest of Glenwood Springs. Recent wind-throw events on the Grand Mesa and in the Wet Mountains, on the San Isabel NF, set the stage for developing spruce beetle populations. Spruce beetle was in all of the wind-throw dead trees. Spruce beetle activity intensified on the Grand Mesa-Uncompahgre-Gunnison, Rio Grande, San Juan, and White River National Forests.

2008: Spruce beetle was killed extensive forests of high elevation old Englemann spruce. The most active infestations were occurring in southern Colorado. In 2008, 64,000 acres of spruce killed by spruce beetle were detected by aerial surveys. The largest outbreak spread from the Weminuche Wilderness on the San Juan National Forest with Hinsdale, Mineral counties most dramatically impacted. Notable spruce beetle outbreaks also occurred on the Rio Grande NF in Conejos and Rio Grande Counties and on the San Juan National Forest in Archuleta County.

Spruce beetle populations typically build up in old spruce forests where scattered windthrown trees provide habitat for outbreak populations to develop. Windthrown trees led to a building epidemic on the Grand Mesa in Mesa and Delta Counties and more recently in the Wet Mountains in Custer County.

Another area of potential spruce beetle activity was the higher elevations of the Wet Mountains near Greenhorn Peak (San Isabel NF). This area suffered some extensive windthrow in June 2007. Salvage logging was initiated with the objective of alleviating the problem.

Douglas-fir Beetle (DFB)

Bighorn and Shoshone National Forests:

2006: Douglas-fir beetle continued to cause high levels of mortality throughout the national forests in northern Wyoming. On the Bighorn NF, Douglas-fir beetle was very active on the west side of the forest. Shell Canyon, which was predominantly Douglas-fir lost well over 80% of their trees to the beetle. Management activities occurred in this area to reduce the amount of fuels left by the beetles and to provide some level of protection for any remaining undamaged or moderately impacted stands. Other parts of the western Bighorn Mountains didn't reach this level of mortality, but mortality was increasing. Areas such as Battle Park and Ten Sleep Canyon experienced increased beetle outbreaks the past few years.

On the Shoshone NF, Douglas-fir beetle killed a large numbers of trees in the North Fork corridor of the Yellowstone River. This outbreak was going strong for at least eight years, and much of the mature overstory had been killed. Beetles were noted to be newly attacking small (3-4" diameter) trees along the North Fork. Douglas-fir beetle activity also picked up in intensity in the Sunlight Basin area of the northern Shoshone NF during the previous two years. There were large expanses of almost pure Douglas-fir forest type in this area, so it seemed that this outbreak had considerable room to expand in the coming years. In the southern part of the Shoshone NF, Douglas-fir on the Wind River area are being attacked and killed. Over the last several years, many of the larger stands experienced almost complete mortality. In general, much of the Douglas-fir resource was rapidly being depleted.

2007: In Wyoming, drainages of the North Platte River have considerable Douglas-fir mortality caused by Douglas-fir beetle. The beetle continued to cause high levels of mortality throughout the national forests in northern Wyoming. Douglas-fir beetle populations increased on sites of the Bighorn and Shoshone National

Forests where there were still living, large-diameter Douglas-fir trees.

2008: The Douglas-fir beetle was still infesting large parts of the western side of the Bighorn Mountains. Any place Douglas-fir occurs on that side of the forest was in outbreak scenario, except for areas such as Shell Canyon which had no remaining DF due to beetle-kill or harvesting.
Most of the DFB activity subsided along the North Fork of the Shoshone, where most of the host type had been killed. The Gunbarrel fire in 2008 burned through this area and scorched a large amount of the remaining live Douglas-fir on the north side of the river. As of September, the scorched trees had not been infested with Douglas-fir beetle, but it was a late fire so there may be increased activity in 2009. Douglas-fir beetle increased again in the Clark's Fork area of the Shoshone. This area didn't have active Douglas-fir beetle activity since the early 1990's after the Yellowstone fires of 1988. Douglas-fir beetle was declining outside Dubois, as most of the cover type sustained mortality rates of 75%.

National Forests in Southern Wyoming and Colorado:
2006: In Wyoming, large pockets of Douglas-fir beetle caused mortality were observed (Albany County – 3,800 acres; Carbon County – 6,500 acres). Drainages of the North Platte River had considerable Douglas-fir mortality. In CO, DFB declined from about 35,000 acres in 2005 to about 23,400 acres in 2006. Some Douglas-fir beetle activity was in direct association with prescribed burns and wildfires, while some had no association with fire injury from tree scorch.
Douglas-fir beetle activity was observed on the Gunnison, Rio Grande, San Isabel, San Juan, and White River National Forests and surrounding lands of mixed ownership. Chronic Douglas-fir beetle activity continued in some stands previously defoliated by western spruce budworm of the Rio Grande NF. In 2006, the anti-aggregation pheromone MCH was successfully deployed to protect specific Douglas-fir stands on Rio Grande, White River, and San Isabel NFs

2007: In Colorado, the impact of Douglas-fir beetle increased in 2007 to 47,000 acres. Some Douglas-fir beetle activity was in direct association with prior prescribed burns and wildfires, while some had no association with fire injury from tree scorch. New faders were often in close proximity to trees killed during previous years.
Infestations were detected in mature Douglas-fir growing on steep slopes from Denver south to the New Mexico border. Populations were still increasing in different areas throughout Colorado, such as Saguache, San Juan, Rio Grande, La Plata, Montrose, Ouray, Mesa, and Pitkin Counties. Douglas-fir beetle activity was observed on the Gunnison, Pike, Rio Grande, San Isabel, San Juan, and White River National Forests and surrounding lands of mixed ownership. The rest of Colorado seems to be at endemic levels, or decreasing from high populations. Some chronic Douglas-fir beetle activity continues in stands previously defoliated by western spruce budworm of the Rio Grande National Forest.

2008: Douglas-fir beetle activity continued to expand on north-facing slopes dominated by dense, large diameter Douglas-firs. Large outbreaks were present along the Dolores River in the San Juan Mountains, the San Miguel River and the North Fork of the Gunnison River (Grand Mesa- Uncompahgre-Gunnison NF). Smaller outbreaks were scattered across southwestern Colorado, several in association with areas that were repeatedly defoliated by western spruce budworm. MCH was being successfully deployed against Douglas-fir beetle in campgrounds on both the San Isabel and San Juan NF's.
With the increase in the amount of prescribed burning in low elevation mixed conifer, many managers experienced higher levels of Douglas-fir beetle activity due to fire injury from scorch of these trees. Removing slash concentrations from beneath certain residual trees (e.g. seed trees) prior to burning reduced the amount of beetle activity following the fire. Prior to 2008, Douglas-fir pole beetle was often found in association with Douglas-fir beetle activity, but the former bark beetle seemed less evident in 2008.

Pine Engraver beetle

Ips sp.
Colorado, Nebraska, South Dakota, and Wyoming
Jack, lodgepole, piñon, and ponderosa pines, and Colorado blue spruce

2006: *Ips* activity in jack and ponderosa pines continued at elevated levels on the Neb. NF in central Nebraska. There was an increased level of concern over *Ips* activity around Chadron, where a number of large wildfires burned and scorched large acreages of ponderosa pine. Forest areas affected by these fires were highly susceptible to attack by increasing Ips populations.
Ips activity in ponderosa pine continued to be a problem in South Dakota. Less pine engraver activity was detected relative to 2005. This was the second consecutive year of large reductions in killed trees and affected acres attributed to pine engraver. Pine engravers acted in concert with mountain pine beetle, so significant pine engraver populations existed in the mountain pine beetle epidemic areas.
Ips infestations continued to decline in the Black Hills from their historically high levels in 2000-03. There were still some areas with drought-stressed trees in the wildland-urban interface and/or fire-damaged trees, which were becoming infested and killed by the pine engraver beetle.
In contrast to mpb in the central and northern Black Hills, activity by pine engraver beetles was concentrated around the periphery of the forest or associated with recent fires. Another significant source of tree mortality by *Ips* was infestations on pines weakened by hail damage and *Sphaeropsis* blight.
Ips activity was reduced in 2006 in much of Wyoming. As the drought continued, these beetles continued to be a concern. *Ips* activity was also a concern in areas being infested by other *Dendroctonus* beetles, which killed much of the larger-diameter stems of pines and spruce.
Ips activity in piñon pine subsided along with the drought in southern CO. The final tally from the 2003-05 comprehensive piñon *Ips* aerial detection survey was over 5.5 million piñon trees killed across 1.5 million acres throughout Colorado.

While piñon *Ips* and piñon twig beetle activity were much reduced from the large mortality event that occurred in 2003-05, there were still some areas of notable mortality: specifically, throughout the southern portion of Colorado on the Uncompahgre Plateau.
In virtually all areas affected by piñon *Ips* from prior years, remnant populations of the bark beetles had survived. Coupled with low moisture levels recorded during the winter of 2006, this caused these populations to rebound and increased piñon mortality. The close correlation between beetle activity and moisture availability made additional large mortality events possible. While many stands of piñon were virtually wiped out during the last mortality event, there were still several areas in Colorado containing mature, susceptible piñon.

2007: *Ips* beetle (*Ips* spp.) populations in ponderosa and lodgepole pine appeared to be stable in most of Colorado. However, when fuel mitigation/salvage activities were performed, populations of this beetle increased.
Piñon *Ips* beetle (*Ips confusus*) populations in southern Colorado were stable or decreasing due to either lack of host or the wet season occurring in 2007. This enabled piñon trees to recover and be more resistant to beetle activity. Branch injury caused by piñon twig beetles, *Pityophthorus* spp., was decreased this year.

2008: Ips activity tapered off in the Black Hills; rain that fell in Spring (2008) improved soil moisture conditions for trees. In urban areas and new developments, *Ips* beetle caused most of the pine mortality.

There continued to be a lot of *Ips* activity on the Nebraska NF following recent wildfire. In the Pine Ridge area, pine engravers were emerging from fire-damaged trees and killing remaining green trees. In Halsey, NE, *Ips* were still killing jack pine, but moving into ponderosa to some extent.
Ips beetle (*Ips* spp.) populations in ponderosa and lodgepole pines appeared to be increasing in all parts of Colorado again. Especially in areas where there was a mountain pine beetle outbreak, fuel mitigation/salvage activity, trees with dwarf mistletoe, and in areas that had been severely affected by drought. *Ips* suppression activity has increased by landowners.
Piñon *Ips* beetle, *Ips confusus,* populations in most parts of Colorado were stable or decreasing due to either lack of host or the wet season that enabled piñon trees to recover and be more resistant to beetle activity. In the past epidemic, over 60% of piñon pines were killed. Lower than average rainfalls for the last couple of years caused a large outbreak of Piñon *Ips* beetle south of Colorado Springs on the Fort Carson Army Base.

Western Balsam Bark Beetle – Subalpine Fir Decline

2006: Sublpine fir decline caused by root diseases and western balsam bark beetle was a widespread, damaging condition in R2 affecting over 1.8 million trees across 500,000 acres of the spruce-fir forest type. The decline was present everywhere across the range of subalpine fir in R2; *Armillaria* root disease was the most common root pathogen found at these sites. Western balsam bark beetle, *Dryocoetes confusus*, and its associated

pathogenic fungus, *Ceratocystis dryocoetidis*, caused most of the mortality of subalpine fir.
Subalpine fir mortality continued to increase and caused larger pockets of dead trees throughout the Bighorn NF. Much of the morality was concentrated in the northern half of the forest, where most of the cover type was located, but there also were some larger areas of mortality occurring in the southern end of the forest. There was concern over the mortality that occurred at relatively high levels in the Krumholz fir stands in the wilderness areas of the forest.
On the Medicine Bow NF, subalpine fir mortality was the second-leading damage agent after MPB. Subapine fir decline was recorded over 43,000 acres.
In Southern Colorado, mortality levels were lower than those seen during recent years. This mortality was closely associated with low moisture availability.

2007 - 08: In the area of Telluride, CO, there were concerns of wildfires due to the large area affected with tree mortality on the steep slopes surrounding the town. The organisms found affecting subalpine fir are a combination of insects and diseases, such as western balsam bark beetle. (*Dryocoetes confusus*), root diseases (*Armillaria* spp., *Hetobasidium annosum*), and other unknown factors. Large patches of subalpine fir/corkbark fir mortality, ranging from 1-10 trees/acre were mapped throughout the high elevation spruce-fir forests

Sudden Aspen Decline (SAD) & Other Aspen Damages

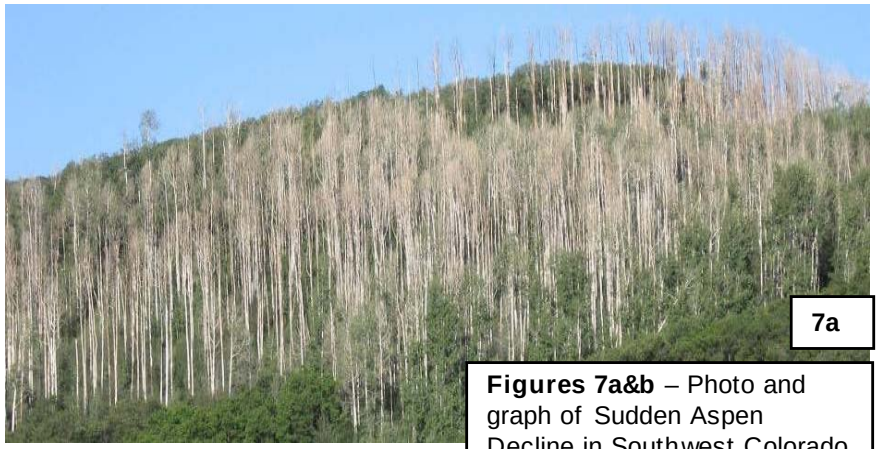
Colorado, South Dakota, Wyoming – Aspen

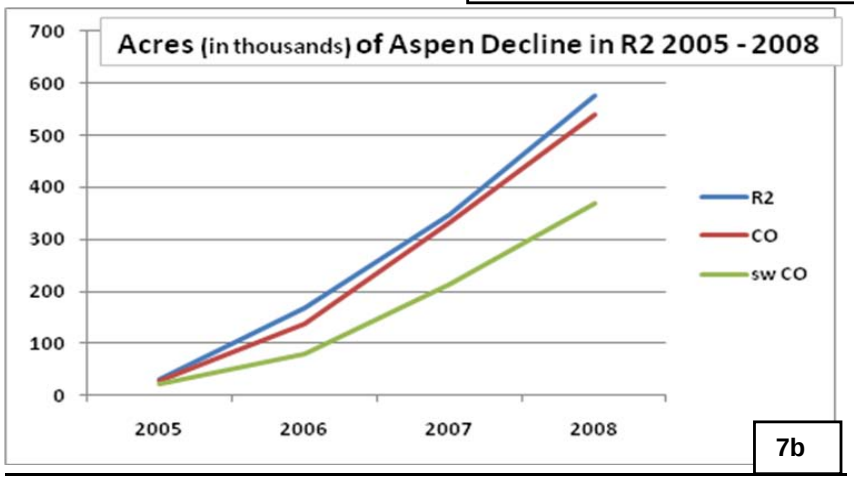
Aspen decline and severe mortality were noticed by foresters in 2005 and R2 Forest Health started extensive surveys throughout the region to address this problem.

2006: aerial surveyors especially focused on recording aspen damages; they estimated that 170,000 acres had dead or severely damaged aspen throughout the Region with about 90,000 acres of dieback and mortality in southwest Colorado.
The primary detection signature for declining aspens during aerial survey work was the appearance of significantly more white stems and branches than green canopy color when compared with nearby (healthy) aspen. This "sparse crown look" has the general appearance of defoliation, often intermixed with leafless aspens that appeared to be dead. The moderate size of the aerial survey sketch-map polygons and the aggregated nature of the signature suggest a clonal association with the agents responsible.
Intensive ground surveys were started and a unique phenomena appeared to be occurring in southwest Colorado that was later documented in the literature as Sudden Aspen Decline (SAD)

Sudden Aspen Decline (SAD)
About 90,000 acres of aspen dieback and mortality, primarily located in southwest Colorado, were observed from the aerial survey flights in 2006. This more than tripled the number of acres affected since the problem was first reported. Despite many site inspections, experts were baffled about the reason.

A systematic investigation by foresters, researchers, and other scientists attempted to determine specific symptoms and causes. Verifying the geographic extent of the dieback, determining the percentage of trees dying, and what factors or damaging agents contributed to the decline. The root systems were also closely examined to identify the percentage root systems affected; noting which attacked trees produce new aspen suckers, and what factors were contributed to root death. Assessments indicated many different causal agents, from canker fungi to aspen bark beetles, in different areas. In some cases, the decline was occurring on low-elevation, marginal aspen sites. Aspen dieback was occurring in less than 5% of the aspen cover type in southern Colorado, but the visual impact was very striking. There was a strong demarcation between areas affected and unaffected indicating a possible dieback of clones. The dieback was more conspicuous at lower elevations, in drier sites near sagebrush. At higher elevations, dieback appears to be occurring on the west-southern-facing slopes, again on drier sites. *Cytospora* canker, bronze poplar borer, poplar borer, and aspen bark beetles, all of which are stress-related agents, and often associated with SAD,





Figures 7a&b – Photo and graph of Sudden Aspen Decline in Southwest Colorado

Other Aspen Damages

2006: Aerial surveys were conducted region-wide, especially over the SAD stands in southwestern Colorado Surveyors estimated that 170,000 acres have dead or severely damaged aspen.

A Forest Health systematic survey documenting common diseases, insects, and damage agents associated with aspen stress and mortality in Wyoming was completed in 2006. The survey included state, federal, and tribal lands. For each causal agent, significant impacts were

recorded. Results indicate that the most common causal agents of stress and mortality among aspen were cankers 67% (mainly *Cytospora* spp., *Encomia* spp., and *Cryptosphaeria* spp.), 60% root diseases (*Ganoderma* spp. and *Armillaria* spp.). Animals damaged 10% and 6% were damaged by other foliar diseases and insects. Significant impacts were observed in 90% of the stands. However, in most cases mortality appeared to be low.

2007: Aspen dieback and mortality intensified in low-elevation aspen "climax" forests in most areas of the eastern slopes of the Rawah Range in the Laramie River Basin and in a north-south band west of Red Feather Lakes in Northern Colorado. Occurrence of SAD significantly in South Park and virtually all of the low elevation aspen climax type was now affected. Areas of heavy aspen mortality occurred in the vicinity of Little Baldy Mountain. Areas of SAD were mapped on the slopes of Waugh Mountain. High mortality occurred again in southwestern Colorado.
In general, the decline and mortality was more conspicuous at lower elevations, in drier sites near sagebrush. At higher elevations, decline appears to be occurring on the west and south facing slopes, on drier sites.
Pockets of aspen defoliation were detected in high elevation aspen forests throughout the Front Range Mountains of Colorado. The cause of the damage was believed to be late spring frost but this was not confirmed by ground checks. Extensive defoliation of aspen forests was mapped throughout the Wet Mountains especially on the west facing slopes.

2008: Aerial surveys indicated aspen mortality on 542,000 acres in Colorado, 32,000 acres in Wyoming, and on 900 acres in western South Dakota. Ground surveys still remain the best method for assessing aspen problems.
Over 300 permanent plots were established in South Dakota and Wyoming. Results indicated that most of these aspen stands are healthy and regenerating, although a few stands have significant mortality. Many causal agents were observed, but only 8 agents were observed on more than 2% of the trees and regeneration. Animal browsing was by far the most common damage on regeneration. In addition, other competing tree species and shading from overstory trees were the main factors affecting regeneration.

White Pine Blister Rust Disease (WPBR)
(Non-native)

2006 - 2008: White pine blister rust, caused by *Cronatium ribicola*, continued to spread and intensify on limber, bristlecone, and whitebark pines. Often this disease promotes mountain pine beetle attack of these five-needle, white pines.

In Colorado, the disease front has moved to approximately 23 miles north of Rocky Mountain National Park, raising concerns about sustaining white pines in one of our national treasures.
The disease also was discovered in isolated locations of the Sangre de Cristo and Wet Mountain Ranges of southern Colorado, more than 200 miles from any other known infection zone. The closest outbreak area to the

south was on Gallinas Peak in central New Mexico. The Sangre de Cristo outbreak was observed on the San Carlos RD of the San Isabel NF, the Great Sand Dunes NP, and other state and federal lands nearby. In the Wet Mountains, the disease was distributed throughout the eastern side of the range, just west of Rye and Beulah, Colorado. Infections in southern Colorado were found primarily on limber pine, but infected Rocky Mountain bristlecone pines were also observed for the first time in their native range.

In Nebraska and South Dakota, white pine blister rust was not found in a 2006 ground survey of limber pine in Kimball County, Nebraska (near the Wyoming border). White pines at a number of locations in southwestern Nebraska have died suddenly in recent years without any clear indication of the cause. Possible poor soil conditions for white pine, in combination with root diseases, were responsible.
White pine blister rust continued to intensify in limber pine sites in western South Dakota. On the Black Hills, the only existing stand of limber pine was now limited to a few hundred trees. The two primary stressors of this relict stand are white pine blister rust and intense competition with other trees. Ponderosa pine and Black Hills spruce were encroaching into this widely dispersed stand of relatively competition-intolerant limber pine. While noted for its ability to survive on dry sites, the persisting regional drought was a contributing factor in the decline and mortality of the limber pines. Mountain pine beetle had not become a mortality factor despite the outbreak in the Norbeck-Mt. Rushmore area. However, the South Dakota Division of Resource Conservation and Forestry were utilizing anti-aggregation pheromones (verbenone) in this stand to protect the trees from the beetle.

In Wyoming, limber pine mortality was widespread throughout the Bighorn Mountains and Crooks, Green, Ferris, and Shirley Mountain Ranges. Virtually all of the northern Shirley Mountains had declining limber pine populations due to infection by white pine blister rust. Intensities ranged from 4 - 15 infected trees per acre. According to results from a 2-year limber pine aerial survey (2004-2005), white pine blister rust and mountain pine beetle affected over one million trees across 200,000 acres. Most of the mortality was attributed to mountain pine beetle. A recent forest health survey of limber pine in the Bighorn NF showed that mountain pine beetle incidence positively correlated with white pine blister rust branch canker severity and stem canker incidence. Mountain pine beetle-infested trees had higher incidences of branch cankers and stem cankers than non-infested trees.
White pine blister rust was discovered in several new locations in south-central Wyoming, including the Snowy Range and the Sierra Madre, where the incidence was low. In the Sierra Madre, the disease was observed on only a few trees on private land along Highway 70, just east of the Medicine Bow NF boundary.

See appendix A for *Estimated Forest Acres Impacted by the above damage agents for* 2006 – 2008

Other Damaging Agents of Concern

Dwarf Mistletoe, root diseases, stem rusts, decays, and other disease agents caused significant tree damages in forests of the Rocky Mountain Region. Adding to these damages were defoliating and sucking types of insects. Weather damage, caused by drought, ice, snow, and strong winds increased the stress to trees in CO, KS, NE, SD, and WY. Because of the increased attention and focus of the bark beetle outbreaks, only a few observations were reported regarding these damage agents.

Annosus Root Disease *Heterobasidion annosum*	**Nebraska - 2006** Jack pine, ponderosa pine, eastern redcedar	Annosum root disease was found recently on ponderosa pine and eastern redcedar in the Bessey Ranger District of the Nebraska National Forest. This root disease had previously been identified there on jack pine. Heterobasidion occurred on both jack pine and eastern redcedar in the same stand. In another stand, this root disease appeared to be killing the ponderosa pine. Now the incidence levels of this root disease are low.
Armillaria Root Disease *Armillaria* spp.	**Colorado, South Dakota, Wyoming - 2006** Aspen, Douglas-fir, Colorado blue, Engelmann, and white spruces, lodgepole and ponderosa pines, subalpine and white firs	Armillaria was the most common root disease in the Region and occurred on many different tree species. Often this disease contributes to beetle-caused tree mortality. Armillaria root disease was seen on oaks along floodplains and in grazed areas in South Dakota and Wyoming. The combination of stresses between flooding in the 1990's and drought in more recent years promoted its growth in these areas.
Banded Elm Bark Beetle (non-native) *Scolytus schevyrewi*	**Colorado, Nebraska, South Dakota - 2006, 2007** American elm, rock elm, Siberian elm	Banded elm bark beetle was found nearly everywhere that elms were found in the Region. **In 2006**, the beetle was associated with declining Siberian elms in communities in western **South Dakota**. These trees were often a dominant tree species and were stressed due to the long-term drought The insect also appeared in dying American elms within many of the riparian stands in the western and central areas of South Dakota. The population appeared high, based upon the number of emergence holes found on these trees, and the expanding elm mortality was due to the possibility of the banded elm bark beetle serving as a vector for Dutch elm disease. **In 2007,** beetle traps were deployed at 8 sites in **Colorado** to monitor for the banded elm bark beetle. The beetle seemed to be abundant in the areas trapped. Trap catches of 2,500 beetles were recorded for the city of Montrose.

Diplodia Blight *Diplodia pinea*	**Kansas, Nebraska, South Dakota – 2006** Ponderosa, Austrian, and Scotch pines	Diplodia Blight increased in importance in the Great Plains and was one of the most important diseases affecting pines in this area. There were few reports of this disease in the 1900's. This shoot blight pathogen was considered a nonnative, invasive, forest pathogen in Nebraska and South Dakota. In 2006, stress from drought allowed the disease to cause greater damage in planted areas and native forest. Diplodia seems to continue to be a problem, and might be getting worse. Ips beetle-caused pine mortality was associated with Diplodia-infected trees. At times, this disease was associated with hail damage in the Black Hills and Nebraska.
Douglas-fir Tussock Moth *Orgyia pseudotrsugata*	**Colorado - 2006-2008** Douglas-fir	In 2006, populations of Douglas-fir tussock moth increased in the Rampart Range, Jefferson County, Colorado, since its last outbreak in 2005. Much of the damage occurred on private forest lands, west of Denver, Colorado. Early-warning traps were used to sample moth populations. Only 29 moths were caught in the traps in 2005; but in 2007, 211 moths were caught. During 2006, a moth population along Highway 285 collapsed, near Windy Point/Doubleheader Mountain. However, a new outbreak area was detected along the South Platte area with most of the infested trees 100% defoliated. Heaviest defoliation occurred in the creek bottoms. Defoliation by this moth was reported again in 2007 in the Rampart Range area. The damage was intermixed with further defoliation from western spruce budworm. An outbreak previously detected along the South Platte area increased in size; and Douglas-fir beetles were attacking the defoliated, weakened trees. By the end of summer 2008, most of the insect populations in these areas collapsed.
Dutch Elm Disease *Ophiostoma ulmi* **(non-native)**	**Colorado, Kansas, Nebraska, South Dakota - 2006-2008** American elm	The incidence of Dutch elm disease in the Great Plains did not increase beyond 2005 reports, though the mortality was higher than experienced during the 1990's. This disease was still a concern, especially in trees that escaped the first wave of the disease and were about 5-6" diameter, or about 20 years of age. Larger trees were succumbing as well. The disease continued to be a problem in riparian areas and cities in the region.
Dwarf Mistletoe *Arceuthobium* spp.	**Colorado, Wyoming - 2006-2008** Douglas-fir, limber; lodgepole, piñon, and ponderosa pines	In the Front Range of **Colorado**, the number of infested pines with dwarf mistletoes has increased since the 1990's.
Fir engraver beetle	**Colorado, Wyoming - 2006-2008**	Populations of fir engraver beetles expanded each year from **2006 – 2008** in dense white fir stands on the San Juan and Pike/San Isabel National Forest. In some of the

<table>
<tr><td>Fir engraver beetle
Scolytus ventralis and Scolytus spp.
(continued)</td><td>Douglas-fir, subalpine and white firs</td><td>southern portions of Colorado, corkbark fir (A. lasiocarpa arizonica) was also a favored host of the fir engraver.
Fir engraver beetles caused scattered mortality of white fir around Manitou Springs, the eastern slope of Cheyenne Mountain and the lower portions of Beaver Creek and Phantom Canyon. Extensive mortality of white fir by the fir engraver was detected in low elevation mixed conifer forests on the eastern slopes of the Wet Mountains.</td></tr>
<tr><td>Flat headed wood borer
Agrilus spp., or other Buprestidae</td><td>South Dakota - 2006
Bur. English, and Gambel Oaks, Birch, Eastern redcedar</td><td>In 2006, Two-lined chestnut borer (A. bilineatus) was associated with dying bur oaks located in native stands in western South Dakota. These infestations appeared to be concentrated along the White River, though they occurred in oak stands in the northwest part of the state.
Bronze birch borer (A. anxius) infested trees in the central areas of South Dakota, even in communities that had experienced very little birch tree dieback. This increase in activity and tree decline was related to the high summer temperatures that extremely stress birches.
The hackberry borer (A. celti) was found infesting hackberries throughout the central South Dakota and this increased activity was probably related to the lack of host vitality due to the drought and high summer temperatures.</td></tr>
<tr><td>Gypsy Moth
Lymantria dispar
(non-native)</td><td>Colorado, Kansas, Nebraska, South Dakota, Wyoming - 2006-2008
Hardwood tree species</td><td>Annual detection trapping for gypsy moth was conducted every year in each state of the Region. Traps were placed among potential hosts at popular developed recreation sites.

<table>
<tr><td>2006</td><td>Kansas</td><td>One moth trapped near Kansas City at a race track</td></tr>
<tr><td>2006</td><td>Nebraska</td><td>3 moths trapped near Omaha, Papillion, and Gretna</td></tr>
<tr><td>2006</td><td>South Dakota</td><td>4 moths trapped in Black Hills area campgrounds and 4 moths trapped on eastern edge of the state</td></tr>
<tr><td>2007</td><td>Colorado</td><td>1 moth trapped near Rocky Mountain National Park and 1 moth trapped in the Boulder area</td></tr>
<tr><td>2008</td><td>South Dakota</td><td>8 moths trapped in Black Hills area campgrounds</td></tr>
</table></td></tr>
<tr><td>Oak Decline
Multi-agents</td><td>Kansas, Nebraska - 2007
Bur and other Oaks</td><td>In Kansas, the forest health impacts to oaks were complex dealing with many biological, environmental, and agricultural factors that combine into situations unfavorable to oaks.
Hypoxylon and Botryosphaeria cankers were noted in decline situations. Incidence of both canker diseases were recorded in moderate to high levels in select sites.
Weather and extremes of flooding and drought were important as were animal husbandry practices such as cattle lots in oak stands and related soil compaction and erosion issues.
Oak decline was long term and appeared to be brought on by a combination of</td></tr>
</table>

Oak Decline (continued)		weather and man-made stresses which gradually caused decline of the trees, This allowed opportunistic diseases to establish themselves in a stand. Each decline site situation was different but the combination of these factors was common to all situations and absent when undisturbed native stands were observed. Bur oaks in eastern and north-central **Nebraska** over the past several years had shown symptoms that often looked like oak wilt disease. The symptoms included foliage that dies completely or had large necrotic areas, branch dieback, general tree decline, and occasionally some streaking in the wood. It appeared the trees were declining from changes in site conditions from human activities combined with oak wilt along the eastern edge and north-central areas of Nebraska.
Pine Tussock Moth *Dasychira grisefacta*	**Colorado, Nebraska - 2006** Ponderosa pine	An outbreak in an area of a few hundred acres of ponderosa pine on private land near Kimball, **Nebraska**, occurred in 2006. This was near, but separate from, an area that had an outbreak in 2003 and 2004. Heavy defoliation of old needles occurred locally.
Pine wilt / Pinewood Nematode *Bursaphelenchus xylophilus*	**Colorado, Kansas, Nebraska, South Dakota - 2006** Austrian, ponderosa, and Scotch pines	Pine wilt caused by the pinewood nematode was an increasing problem in Great Plains windbreaks. About 1,000 trees, mostly Scotch pine, were killed by pine wilt in **Nebraska** in 2006. Southeastern **Nebraska** was the area most heavily affected by the disease, but it continues to spread north and west. Pine wilt caused significant Scotch pine mortality in southwestern and central **South Dakota**. Windbreak and ornamental trees were killed at an alarming rate. Austrian pines, though few in number within this Region, were also killed. These species are no longer recommended for planting due to the prevalence of the disease. Despite the presences of the nematode in southwestern **South Dakota** for decades, this disease was not a serious problem until recently. This was due to the long-term drought stressing the trees and the warmer winters perhaps increasing nematode survival. The nematode associated with pine wilt had not been found north of I-90 in South Dakota. In 2006, pine wilt was detected for the first time in Larimer and Weld Counties in **Colorado**.
Sawflies *Neurotoma fasciata*	**South Dakota - 2006** Cherry and plum trees	The feeding by this sawfly resulted in the defoliation of plums and cherries throughout the south-central areas of **South Dakota**. The sawfly had left most plum thickets completely defoliated by early summer, resulting in a poor fruit crop during 2006.
Spruce Needle Miner *Endothenia aibiuneana*	**Colorado, South Dakota - 2006** Spruces: Colorado Blue, Engelmann, and Black Hills	The number of spruce found infested by this insect continued to grow. The needleminer was confined to only a few counties in **Colorado** in the 1980s, but now can be found defoliating spruce throughout eastern **South Dakota** and the Black Hills. The defoliation was usually confined to the lower branches but this premature loss of foliage reduces the value of the trees in windbreaks and urban plantings.

Weather Damages: *1. Drought*	**Colorado, Kansas, Nebraska, South Dakota, and Wyoming - 2006-2008** All tree species affected	Moisture conditions improved periodically each year for a few months in localized sites of each state during 2006 – 2008. However, most of the region had severe drought conditions. All tree species were vulnerable to secondary stressors of damaging insects and diseases. In **Colorado and Wyoming**, tree defenses were reduced and trees had difficulties in preventing bark beetle infestations. Warm and dry conditions were responsible for some of the declining aspens. Heat appeared to be a common factor affecting much of the leaf scorch in urban and some forested areas of **Colorado**. In **Kansas**, desiccation from hot southern winds caused severe tree damage during this drought cycle. Drought stress in **Nebraska** caused many conifers and broadleaf trees to die from secondary and stress-related insect pests and diseases, such as bark beetles, Sphaeropsis blight, and root diseases. Reduced growth and poor color were seen in many tree species, especially conifers, Trees particularly stressed from the drought were those in windbreaks and in riparian areas where water tables around them dropped. In **South Dakota**, drought was responsible for the decline and mortality of spruces that were planted on the western short-grass prairie where the precipitation was inadequate to support them. Reduced growth and poor color were seen in many tree species, especially conifers. Windbreak trees were particularly stressed by drought conditions.
Weather Damages: *2. Ice and Snow*	**Kansas, Nebraska, South Dakota - 2006-2007** All tree species	Ice storms often occur in the Great Plains and severely damage many species of trees. South-central **Kansas** had severe ice storms in 2006, with the worst damage occurring in communities and urban areas. An ice storm in late December 2006 caused some limb breakage to trees in central **Nebraska**. An ice storm that stretched across eastern **SD** in January 2006 was responsible for damaging thousands of trees. A buildup of ice resulted in branch breakage in silver maples, green ash, and a number of other deciduous species.
Weather Damages: *3. Wind*	**Colorado - 2007** **Aspen, Englemann spruce, and other conifer tree species**	A severe weather event occurred in the Wet Mountains of the Pike and San Isabel National Forests with wind velocities measured at 90-100 MPH. The winds caused extensive windthrow of Engelmann spruce and other conifers. Areas of windthrow, ranging in size from 5–50 acres were mapped during aerial surveys of the Wet Mountains. Windthrow was also detected in aspen forests, especially on the west facing slopes of the Wet Mountains, where extensive aspen forests occur.

<table>
<tr>
<td>Western Spruce Budworm
Choristoneaura occidentalis</td>
<td>Colorado and Wyoming - 2006-2008
Douglas-fir, Engelmann spruce, subalpine, and white firs
Colorado and Wyoming - 2006-2008
Douglas-fir, Engelmann spruce, subalpine, and white firs</td>
<td>Several consecutive years of defoliation decimated understory spruce and firs, and top-kill was readily evident in overstory and mid-story trees. Ground checks indicated that the primary host was white fir but a stand of Engelmann spruce on the north side of Cuchara Pass also suffered defoliation. The defoliation was affecting all hosts: spruce, fir, and Douglas-fir in Colorado. Some of these outbreaks also had Douglas-fir tussock moth causing further defoliation on the same Douglas-fir trees. Some chronic infestations appear to be increasing on the Shoshone and Medicine Bow National Forests in Wyoming.
<u>2006 Infestations</u>:
• In Colorado, Douglas-fir along the North Platte River on the Routt NF; Eldorado Mountains southwest of Boulder; In spruce-fir forests on the southern Uncompahgre Plateau and in the area around the Cimarron Ridge; budworm activity continued in another high elevation spruce-fir forest on the RG NF. Significant impact was evident in understory spruce and fir.
• In Wyoming, there was some light budworm defoliation noted both in the northern and southern ends of the Shoshone National Forest. This was certainly as increase from what has been seen over the past few years. Also chronic populations of the budworm continued to defoliate subalpine fir on the Medicine Bow National Forest.
<u>2007 Infestations:</u>
• Colorado - This insect caused light defoliation on the Routt National Forest adjacent to the Wyoming border. Heavy defoliation was found in the Rampart Range and on the eastern and western ranges of Sangre de Cristo; North of Durango. defoliation continued on the eastern slopes of the Culebra Range from North La Veta Pass to the New Mexico border. Defoliation was most severe in the southern Culebra Range.
<u>2008 Infestations:</u>
• Colorado - Western spruce budworm was detected again causing heavy defoliation in localized areas of Southern Colorado forests. The Rampart Range, north of Durango; around the Telluride area, in the San Juan Mountains, and in the Sangre de Cristo Mountains.

Western Spruce Budworm Damage in Thousands of Acres in the Rocky Mountain Region 2005 - 2008
<table>
<tr><th></th><th>2005</th><th>2006</th><th>2007</th><th>2008</th></tr>
<tr><td>Colorado</td><td>71.4</td><td>93.7</td><td>391</td><td>154</td></tr>
<tr><td>Wyoming (R2 only)</td><td>6.4</td><td>4.4</td><td>7.1</td><td>8.2</td></tr>
</table>
</td>
</tr>
</table>

Western Tent Caterpillar *Malacosoma californicum*	**Colorado - 2006-2008** Aspen	In 2006, this defoliator affected the southern and western parts of **Colorado**. Defoliation had increased from 2005. Populations of this insect were high in Telluride. Western tent caterpillar damaged aspens on 265 acres during 2006 along the northwestern rim of the San Luis Valley of **Colorado**. Another outbreak continued in the area near LaVeta, **Colorado**. This outbreak was ongoing for over 4 years, and mortality of some repeated damaged aspen was evident by late summer 2006. In the Durango area, **Colorado**, western tent caterpillar caused heavy defoliation of aspen along Highway 550. In the Cuchara area, this was the fourth year of defoliation affecting public and private lands; aspens were rapidly dying in these areas. A low but noticeable population was observed in aspen forests in the Wet Mountains, **Colorado**. Extensive defoliation of quaking aspen was seen on both the eastern and western slopes of the Sangre de Cristo Range and the Culebra Range
Zimmerman Moth *Dioryctria spp.*	**South Dakota - 2006** Austrian, Ponderosa, and Scotch pines, Colorado Blue Spruce	Zimmerman pine moth continued to be a problem in windbreaks and ornamental plantings of **South Dakota**. Austrian pine was the primary species affected, though ponderosa pine windbreaks in drought-stricken areas were also experiencing significant branch injury.

Appendix A – Estimated Forest Acres Impacted by Major Damaging Agents

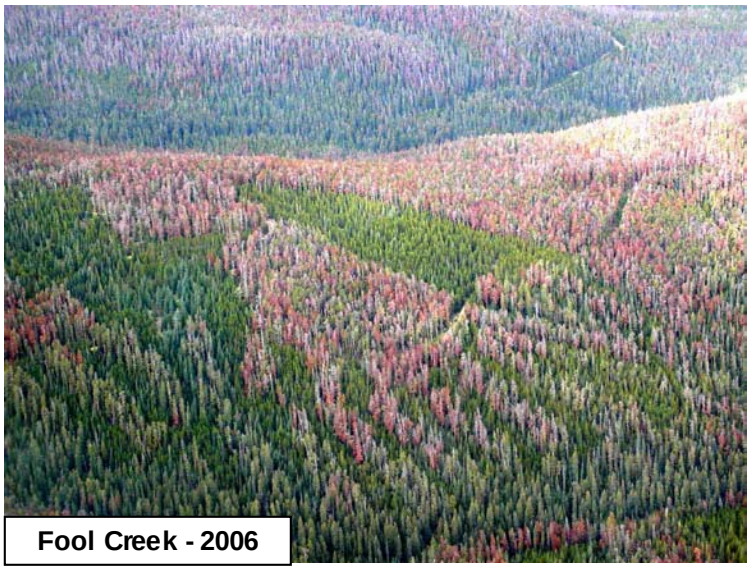
(acres in thousands)	2006					2007					2008			
	CO	NE	SD	WY - R2 only		CO	NE	SD	WY - R2 only		CO	NE	SD	WY - R2 only
MPB	664.5		349.4	111		980.1		25.6	237.6		1,161		25	656
SB	68.1			628		97.7			40.5		27			21
DFB	23.4			26.7		47.1			57.6		64			30
PEB	13.9	3.5	1.2	0.3		4	0.7	1.9	0.8		2.8	7.2	1.2	1
WBBB	372.1			101.9		350.5			81		344.2			46.4
Damaged Aspen	138.6		0.5	30.2		134.2		0.4	14.8		541.6		0.8	32.3
Limber Pine Decline	0.8		0	88.1		168.8		0	206.3		26			280.2

MPB – mountain pine beetle,
SB – spruce beetle,
DFB – Douglas-fir beetle,
PEB – pine engraver beetle,
WBBB – western balsam bark beetle,
Damaged Aspen includes SAD and other Aspen defoliation,
Limber Pine Decline (Other 5-Needle Pines, sometimes only white pine blister rust disease was seen).

MPB Damaged Acres (in thousands) by R2 National Forests	2006	2007	2008		MPB Damaged Acres (in thousands) by R2 National Forests	2006	2007	2008
Arapaho	148.1	163.4	150.8		Roosevelt	6.3	128.9	205.9
Bighorn	0.7	4.5	1.7		Routt	228.5	349.7	427
Black Hills	40.1	26.4	25		Rio Grande	3.9	1.8	1.9
Grand Mesa	0	0.5	0		San Isabel	8.8	6.6	4.6
Gunnison	0.7	0.1	0		San Juan	0.1	0.6	0.1
Medicine Bow	75.5	178.2	347.7		Shoshone	16.2	106.5	214
Nebraska	0	0	0		Uncompahgre	0.2	0.4	0.2
Pike	4.9	3.9	9.7		White River	100	99.7	157.9

Appendix B: Brief Summary by Rocky Mountain Research Station

The Red Hand of Death - Fraser Experimental Forest



Fool Creek - 2006

This photograph is a 2006 snapshot of the mountain pine beetle infestation in the Fool Creek watershed of the Fraser Experimental Forest. Red crowns are old-growth lodgepole pine that has succumbed to bark beetle attack and green stands are 50-year-old lodgepole pine forest regenerating within clear cuts. Fool Creek is the managed portion of a paired-watershed study designed to evaluate how harvesting affects water yield and water quality. East St Louis, the unmanipulated control basin, appears in the background. Heavy overstory mortality in these basins and other study watersheds at Fraser allows RMRS researchers to evaluate how managed and unmanaged watersheds respond to this extensive canopy disturbance.

The "Red Hand of Death" signals the beginning of a new era of research at the Fraser Experimental Forest. For the past 70 years, RMRS researchers have studied how harvesting alters snow accumulation, streamflow, forest regeneration, water chemistry and channel processes. Since 2003 when the outbreak was first noted at Fraser, RMRS scientists, collaborators and management partners have begun to assess the consequences of this natural forest disturbance and associated management activities.

The Chief of the USFS recently awarded RMRS researchers emergency funds to assist in assessing the consequences of bark beetle outbreak on subalpine forest watersheds at the Fraser Experimental Forest. Sustained commitment to Fraser's long-term records allows RMRS scientists and collaborators an unprecedented opportunity to detect changes in snow accumulation, stream flow, water chemistry, stream channel and large wood dynamics and riparian and upland forest communities as catchments respond to pine mortality. Measurement of hillslope and basin-scale processes will allow us to improve predictions regarding the supply of clean water following bark beetle outbreaks over a range of scales throughout the West.

Fool Creek - 1958

Active collaboration between RMRS researchers and NFS managers during beetle mitigation operations allows rapid delivery of research findings and implementation of adaptive management strategies. Planned research at Fraser will address concerns identified by local and regional resource specialists and public stakeholders regarding the response to beetle outbreak.

Clean Water - Insect Outbreaks and Watersheds

Mountain pine bark beetle outbreaks are causing rapid changes in the headwater forests of Western North America. Infestation and mortality currently threaten more than 80% of the basal area of many lodgepole pine dominated stands across the West. In Colorado, bark beetle mortality now exceeds 1.5 million acres and the outbreak is projected to ravage 85 to 90% of the mature lodgepole ecosystems in Colorado and Wyoming within the next five years. The consequences of this extensive canopy disturbance and subsequent management activities will characterize western watersheds and forest landscapes for decades to come.

For additional information on how RMRS research is responding to the bark beetle outbreak at the Fraser Experimental Forest contact: Kelly Elder, Team Leader and Hydrologist: (970-498-1233; kelder@fs.fed.us)
Kate Dwire, Riparian Ecologist (970-498-1206; kadwire@fs.fed.us)
Rob Hubbard, Ecophysiologist (970-498-1260; rmhubbard@fs.fed.us)
Chuck Rhoades, Biogeochemist (970-498-1250; crhoades@fs.fed.us)
Sandra Ryan, Fluvial Geomorphologist (970-498-1015; sryanburkett@fs.fed.us)

Appendix C: The 2008 Aerial Detection Survey Summary (page numbers as recorded in the original report)

The 2008 Aerial Detection Survey Summary for Colorado, Wyoming, South Dakota and Nebraska

Spruce Beetle on Cooper Mountain, Rio Grande National Forest

For more information or additional data requests, please contact:

Brian Howell, Aerial Survey Program Manager
303-236-1020 behowell@fs.fed.us
Jennifer Ross, GIS Specialist
719-488-1242 jross@fs.fed.us

Last updated: 1/19/2011

Table of Contents

Introduction

Acreage figures are rounded as follows:

X < 10 acres- to the nearest acre
10 < X < 1,000 acres- to the nearest 10 acres
1,000< X < 10,000 acres- to the nearest 100 acres
X > 10,000 acres- to the nearest 1,000 acres

These tables provide summaries for the major damage agents detected in the 2008 aerial detection survey for Wyoming including Forest Service Regions 1, 2, and 4.

Counties or National Forests that have zero mapped acres for all categories in the tables are omitted.

Acres for Yellowstone/Teton National Parks, Caribou-Targhee NF, and Wasatch-Cache NF include only the Wyoming portion of the Park or Forest.

Certain calculations using these data should be avoided. Adding numbers from different categories in an attempt to produce a total of acres impacted by multiple agents, for example will produce inaccurate, inflated results because acres experiencing multiple damages are double-counted. Producing totals for multiple agents is a separate GIS exercise.

Caution should be exercised when making year to year comparisons using these data, the survey area is not identical from year to year and extent flown each year may not equal 100 % of the forested acres in a given area. A GIS dataset of area flown is available and provides information on the spatial extent of the aerial survey for a particular year.

The county summaries include all ownerships within the county boundary. National Forest summaries are based on the Forest's proclamation boundary and include inholdings of all ownership types.

Interpreting the 2008 Aerial Detection Survey Summary Tables

The 2008 aerial detection survey summary tables for the Rocky Mountain Region of the USDA Forest Service have been prepared to answer the majority of questions concerning the aerial survey data and to provide consistent answers to questions from our clients. Raw GIS files are available for analysis; however minor differences in query structure can result in multiple "correct" answers to the same question. Therefore the numbers provided in these tables are to be considered final. The numbers reported here are the results of GIS queries that remain consistent from year to year. In these tables, the major forest pests that were detected in the region's forests are summarized by state, county, and national forest. County totals include all ownerships within a counties' boundary. Forest totals include all acres within the forest's proclamation boundary.

For bark beetles including mountain pine beetle, spruce beetle and Douglas-fir beetle the aerial survey tables provide the number of acres where some level of trees were detected that were currently dying (fading) from bark beetle attack. Fading occurs one year after initial attack so trees mapped in a given year were killed by bark beetles the previous year. Information from the prior year (2007 Acres Affected) is also provided to assess the trend of the epidemic over the last year in a given area. Because bark beetles may be active in an area for multiple years there is considerable overlap of acres from year to year. Cumulative acres affected since 1996 through the current and through the prior year are provided to determine the area affected by the ongoing epidemic. By subtracting the current cumulative acres (1996-2008 Cumulative Acres Affected) for a given area from the prior year's cumulative acres (1996-2007 Cumulative Acres Affected) for that area, the expansion of the beetle epidemic onto new (not previously mapped) acres can be determined.

For western balsam bark beetle and associated subalpine fir disease problems, western spruce budworm, aspen defoliation, and aspen dieback and mortality caused by a combination of insects and diseases only the current and prior years acres detected are provided. For these pests, general trend information about the population of the insect or disease affects can be determined by comparing acres affected with the prior year

2008 Mountain Pine Beetle Activity

	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Colorado			
Lodgepole Pine	1,139,000	1,527,000	1,964,000
Ponderosa Pine	8,600	547,000	553,000
5-Needle Pines	13,000	65,000	74,000
Wyoming			
Lodgepole Pine	851,000	data unavailable	1,452,000
Ponderosa Pine	10,000	data unavailable	86,000
5-Needle Pines	335,000	data unavailable	986,000
South Dakota			
Lodgepole Pine	0	0	0
Ponderosa Pine	25,000	349,000	354,000
5-Needle Pines	0	1	1

Colorado County	Host Tree	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Alamosa	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	0	0	430	430
	5-Needle Pines	0	0	10	10
Archuleta	Lodgepole Pine	0	1	0	1
	Ponderosa Pine	280	30	16,000	16,000
	5-Needle Pines	0	0	0	0
Boulder	Lodgepole Pine	26,000	42,000	27,000	55,000
	Ponderosa Pine	380	1,600	19,000	20,000
	5-Needle Pines	6,000	2,500	6,600	8,100
Chaffee	Lodgepole Pine	2,100	1,100	4,700	5,100
	Ponderosa Pine	660	40	77,000	77,000
	5-Needle Pines	100	20	1700	1700
Clear Creek	Lodgepole Pine	30,000	17,000	34,000	39,000
	Ponderosa Pine	20	110	3,900	4,000
	5-Needle Pines	7,600	230	8,000	8,200

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

Colorado County	Host Tree	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Conejos	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	0	0	4,800	4,800
	5-Needle Pines	0	0	0	0
Costilla	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	0	0	4,600	4,600
	5-Needle Pines	0	0	7	7
Custer	Lodgepole Pine	0	1	160	160
	Ponderosa Pine	3	10	34,000	34,000
	5-Needle Pines	230	30	770	780
Delta	Lodgepole Pine	0	0	2	2
	Ponderosa Pine	0	0	6	6
	5-Needle Pines	0	0	0	0
Dolores	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	0	40	510	550
	5-Needle Pines	0	0	0	0
Douglas	Lodgepole Pine	0	260	10	270
	Ponderosa Pine	40	110	33,000	33,000
	5-Needle Pines	0	0	0	0
Eagle	Lodgepole Pine	48,000	75,000	120,000	158,000
	Ponderosa Pine	80	650	3,500	3,700
	5-Needle Pines	0	30	130	160
El Paso	Lodgepole Pine	2	0	2	2
	Ponderosa Pine	400	90	13,000	13,000
	5-Needle Pines	0	0	0	0
Elbert	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	0	0	390	390
	5-Needle Pines	0	0	0	0
Fremont	Lodgepole Pine	0	4	170	170
	Ponderosa Pine	390	130	31,000	31,000
	5-Needle Pines	240	500	1,400	1,800
Garfield	Lodgepole Pine	1,600	5,200	2,700	7,300
	Ponderosa Pine	0	0	60	60
	5-Needle Pines	30	10	390	400
Gilpin	Lodgepole Pine	16,000	12,000	17,000	24,000
	Ponderosa Pine	30	90	2,500	2,600
	5-Needle Pines	11,000	1,100	13,000	14,000

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

Colorado County	Host Tree	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Grand	Lodgepole Pine	274,000	208,000	522,000	561,000
	Ponderosa Pine	80	0	470	470
	5-Needle Pines	140	210	2,900	3,100
Gunnison	Lodgepole Pine	6	0	2,500	2,500
	Ponderosa Pine	70	70	1,200	1,300
	5-Needle Pines	0	0	0	0
Hinsdale	Lodgepole Pine	0	0	3	3
	Ponderosa Pine	20	10	3,200	3,200
	5-Needle Pines	0	0	0	0
Huerfano	Lodgepole Pine	0	0	50	50
	Ponderosa Pine	9	2	26,000	26,000
	5-Needle Pines	60	0	220	220
Jackson	Lodgepole Pine	251,000	233,000	320,000	354,000
	Ponderosa Pine	200	420	360	740
	5-Needle Pines	280	1,200	5,200	6,400
Jefferson	Lodgepole Pine	170	80	1,700	1,800
	Ponderosa Pine	140	250	27,000	27,000
	5-Needle Pines	1	0	5	5
La Plata	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	140	2	12,000	12,000
	5-Needle Pines	0	0	0	0
Lake	Lodgepole Pine	3,600	3,800	7,000	9,300
	Ponderosa Pine	8	1	300	300
	5-Needle Pines	100	30	530	560
Larimer	Lodgepole Pine	122,000	187,000	124,000	229,000
	Ponderosa Pine	890	1,900	49,000	50,000
	5-Needle Pines	22,000	6,600	23,000	27,000
Las Animas	Lodgepole Pine	10	0	10	10
	Ponderosa Pine	40	0	12,000	12,000
	5-Needle Pines	6	0	6	6
Mesa	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	5	60	5,200	5,200
	5-Needle Pines	0	0	0	0
Mineral	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	30	0	710	710
	5-Needle Pines	7	0	3	3

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

Colorado County	Host Tree	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Moffat	Lodgepole Pine	1,600	9,700	3,200	12,000
	Ponderosa Pine	0	0	0	0
	5-Needle Pines	0	90	7	100
Montezuma	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	30	40	630	670
	5-Needle Pines	0	0	0	0
Montrose	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	140	160	1,800	1,900
	5-Needle Pines	0	0	0	0
Ouray	Lodgepole Pine	0	0	5	5
	Ponderosa Pine	70	50	170	210
	5-Needle Pines	0	0	0	0
Park	Lodgepole Pine	2,800	9,400	3,500	12,000
	Ponderosa Pine	160	260	89,000	89,000
	5-Needle Pines	30	30	240	270
Pitkin	Lodgepole Pine	1,200	5,200	6,500	11,000
	Ponderosa Pine	0	20	60	80
	5-Needle Pines	0	0	0	0
Pueblo	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	0	10	21,000	21,000
	5-Needle Pines	0	0	0	0
Rio Blanco	Lodgepole Pine	6,400	18,000	13,000	26,000
	Ponderosa Pine	9	0	30	30
	5-Needle Pines	0	0	100	100
Rio Grande	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	140	0	3,300	3,300
	5-Needle Pines	0	0	0	0
Routt	Lodgepole Pine	134,000	245,000	214,000	331,000
	Ponderosa Pine	0	80	90	170
	5-Needle Pines	110	210	220	420
Saguache	Lodgepole Pine	0	3	780	780
	Ponderosa Pine	2,200	2,300	38,000	38,000
	5-Needle Pines	60	30	300	330
San Miguel	Lodgepole Pine	10	0	10	10
	Ponderosa Pine	490	40	2,700	2,700
	5-Needle Pines	10	0	10	10

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

Colorado County	Host Tree	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Summit	Lodgepole Pine	51,000	65,000	101,000	125,000
	Ponderosa Pine	0	0	20	20
	5-Needle Pines	0	260	190	440
Teller	Lodgepole Pine	0	0	10	10
	Ponderosa Pine	680	90	9,600	9,600
	5-Needle Pines	0	0	20	20

Wyoming County	Host Tree	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Albany	Lodgepole Pine	19,000	92,000	23,000	100,000
	Ponderosa Pine	1,200	1,500	3,400	4,900
	5-Needle Pines	5,700	6,900	25,000	31,000
Big Horn	Lodgepole Pine	240	140	1,200	1,300
	Ponderosa Pine	410	0	1,200	1,200
	5-Needle Pines	8,100	810	20,000	21,000
Campbell	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	0	0	180	180
	5-Needle Pines	0	0	0	0
Carbon	Lodgepole Pine	168,000	273,000	223,000	361,000
	Ponderosa Pine	550	1,600	2,000	3,600
	5-Needle Pines	970	2,700	13,000	15,000
Converse	Lodgepole Pine	150	230	370	600
	Ponderosa Pine	350	190	2,400	2,600
	5-Needle Pines	600	580	2,200	2,700
Crook	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	800	320	31,000	31,000
	5-Needle Pines	0	0	0	0
Fremont	Lodgepole Pine	data unavailable	59,000	data unavailable	136,000
	Ponderosa Pine	data unavailable	0	data unavailable	110
	5-Needle Pines	data unavailable	108,000	data unavailable	212,000

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

Wyoming County	Host Tree	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Goshen	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	0	0	20	20
	5-Needle Pines	0	0	0	0
Hot Springs	Lodgepole Pine	80	470	260	720
	Ponderosa Pine	0	0	770	770
	5-Needle Pines	4,400	2,500	32,000	34,000
Johnson	Lodgepole Pine	520	1,100	2,200	3,300
	Ponderosa Pine	2,600	5,200	18,000	22,000
	5-Needle Pines	3,100	19,000	19,000	34,000
Laramie	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	10	210	20	230
	5-Needle Pines	0	70	0	70
Lincoln	Lodgepole Pine	data unavailable	46,000	data unavailable	114,000
	Ponderosa Pine	data unavailable	0	data unavailable	30
	5-Needle Pines	data unavailable	19,000	data unavailable	40,000
Natrona	Lodgepole Pine	70	130	690	810
	Ponderosa Pine	1,000	60	3,500	3,600
	5-Needle Pines	4,000	7,000	25,000	31,000
Niobrara	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	0	0	90	90
	5-Needle Pines	0	0	0	0
Park	Lodgepole Pine	data unavailable	59,000	data unavailable	106,000
	Ponderosa Pine	data unavailable	0	data unavailable	30
	5-Needle Pines	data unavailable	89,000	data unavailable	341,000
Platte	Lodgepole Pine	0	0	9	9
	Ponderosa Pine	9	2	70	70
	5-Needle Pines	8	0	10	10
Sheridan	Lodgepole Pine	1,800	40	1,900	2,000
	Ponderosa Pine	2,500	550	5,800	6,100
	5-Needle Pines	1,400	120	2,100	2,200
Sublette	Lodgepole Pine	data unavailable	138,000	data unavailable	256,000
	Ponderosa Pine	data unavailable	0	data unavailable	40
	5-Needle Pines	data unavailable	23,000	data unavailable	75,000
Teton	Lodgepole Pine	data unavailable	128,000	data unavailable	287,000
	Ponderosa Pine	data unavailable	0	data unavailable	4
	5-Needle Pines	data unavailable	46,000	data unavailable	117,000

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

Wyoming County	Host Tree	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Uinta	Lodgepole Pine	data unavailable	54,000	data unavailable	82,000
	Ponderosa Pine	data unavailable	0	data unavailable	0
	5-Needle Pines	data unavailable	0	data unavailable	0
Washakie	Lodgepole Pine	270	250	1,900	2,100
	Ponderosa Pine	180	160	1,700	1,800
	5-Needle Pines	2,400	10,000	23,000	31,000
Weston	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	340	140	7,800	7,900
	5-Needle Pines	0	0	0	0

South Dakota County	Host Tree	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Butte	Ponderosa Pine	0	0	120	120
Custer	Ponderosa Pine	2,800	3,800	40,000	42,000
Fall River	Ponderosa Pine	0	0	1,400	1,400
Lawrence	Ponderosa Pine	5,400	3,100	129,000	130,000
Meade	Ponderosa Pine	90	2	26,000	26,000
Pennington	Ponderosa Pine	17,000	18,000	152,000	155,000

Nebraska County	Host Tree	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Sheridan	5-Needle Pines	1	0	1	1

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

National Forest	Host Tree	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Arapaho National Forest	Lodgepole Pine	211,000	150,000	379,000	410,000
	Ponderosa Pine	10	70	1,500	1,600
	5-Needle Pines	8,100	710	9,400	10,000
Bighorn National Forest	Lodgepole Pine	2,600	920	4,100	5,000
	Ponderosa Pine	1,900	410	5,700	5,800
	5-Needle Pines	5,800	1,500	13,000	14,000
Black Hills National Forest	Lodgepole Pine	0	0	0	0
	Ponderosa Pine	26,000	25,000	363,000	369,000
	5-Needle Pines	0	0	0	0
Bridger-Teton National Forest	Lodgepole Pine	data unavailable	295,000	data unavailable	619,000
	Ponderosa Pine	data unavailable	0	data unavailable	40
	5-Needle Pines	data unavailable	88,000	data unavailable	231,000
Grand Mesa National Forest	Lodgepole Pine	0	0	2	2
	Ponderosa Pine	0	0	8	8
	5-Needle Pines	0	0	0	0
Gunnison National Forest	Lodgepole Pine	6	3	3,100	3,100
	Ponderosa Pine	100	60	1,900	2,000
	5-Needle Pines	0	0	0	0
Medicine Bow National Forest	Lodgepole Pine	177,000	345,000	233,000	432,000
	Ponderosa Pine	1,200	2,300	4,100	6,300
	5-Needle Pines	2,900	4,200	19,000	22,000
Pike National Forest	Lodgepole Pine	3,000	9,200	3,700	12,000
	Ponderosa Pine	960	440	100,000	100,000
	5-Needle Pines	20	30	150	180
Rio Grande National Forest	Lodgepole Pine	0	0	90	90
	Ponderosa Pine	1,800	1,900	34,000	35,000
	5-Needle Pines	60	30	270	300
Roosevelt National Forest	Lodgepole Pine	127,000	195,000	130,000	242,000
	Ponderosa Pine	950	2,600	55,000	57,000
	5-Needle Pines	27,000	8,300	29,000	33,000
Routt National Forest	Lodgepole Pine	346,000	426,000	458,000	594,000
	Ponderosa Pine	170	50	270	310
	5-Needle Pines	320	970	3,400	4,400
San Isabel National Forest	Lodgepole Pine	4,500	3,900	9,500	12,000
	Ponderosa Pine	910	100	134,000	134,000
	5-Needle Pines	720	570	4,500	4,900

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

National Forest	Host Tree	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
San Juan National Forest	Lodgepole Pine	0	1	0	1
	Ponderosa Pine	380	110	27,000	27,000
	5-Needle Pines	0	0	3	3
Shoshone National Forest	Lodgepole Pine	31,000	65,000	72,000	122,000
	Ponderosa Pine	0	0	20	20
	5-Needle Pines	113,000	150,000	287,000	385,000
Targhee National Forest	Lodgepole Pine	data unavailable	1,300	data unavailable	8,300
	Ponderosa Pine	data unavailable	0	data unavailable	30
	5-Needle Pines	data unavailable	680	data unavailable	2,900
Uncompahgre National Forest	Lodgepole Pine	10	0	20	20
	Ponderosa Pine	450	210	6,900	7,100
	5-Needle Pines	0	0	0	0
Wasatch-Cache National Forest	Lodgepole Pine	data unavailable	33,000	data unavailable	44,000
	Ponderosa Pine	data unavailable	0	data unavailable	0
	5-Needle Pines	data unavailable	0	data unavailable	0
White River National Forest	Lodgepole Pine	100,000	157,000	227,000	304,000
	Ponderosa Pine	40	640	2,500	2,700
	5-Needle Pines	30	300	800	1,100
Yellowstone/ Grand Teton NP	Lodgepole Pine	data unavailable	30,000	data unavailable	data unavailable
	Ponderosa Pine	data unavailable	0	data unavailable	data unavailable
	5-Needle Pines	data unavailable	25,000	data unavailable	data unavailable

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and causal agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

2008 Spruce Beetle Activity

	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Colorado	64,000	341,000	374,000
Wyoming	30,000	data unavailable	364,000
South Dakota	0	100	100

Colorado County	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Archuleta	2,300	1,200	3,300	4,500
Boulder	2	40	4	40
Chaffee	7	3	10	10
Clear Creek	0	1	30	30
Conejos	4,600	1,300	11,000	11,000
Costilla	8	2	1,400	1,400
Custer	0	30	820	820
Delta	450	430	2,600	3,000
Dolores	300	20	1,800	1,800
Douglas	0	1	10	20
Eagle	110	2,200	1,900	4,100
El Paso	0	0	10	10
Fremont	0	2	40	40
Garfield	540	510	3,700	4,100
Gilpin	0	2	5	7
Grand	380	780	1,300	2,100
Gunnison	370	160	4,800	4,900
Hinsdale	25,000	12,000	49,000	52,000
Huefano	0	0	900	900
Jackson	13,000	1,600	62,000	63,000
Jefferson	2	3	4	6
La Plata	30	140	4,300	4,400
Lake	0	3	30	40
Larimer	2,400	1,300	10,000	11,000
Las Animas	2	0	650	650
Mesa	660	400	9,500	9,800
Mineral	33,000	34,000	65,000	79,000

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

Colorado County	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Moffat	0	0	600	600
Montezuma	10	0	290	290
Montrose	10	0	500	500
Ouray	900	40	1,400	1,400
Park	0	8	6	10
Pitkin	1,200	1,200	6,600	7,300
Pueblo	0	110	2,100	2,100
Rio Blanco	20	0	3,600	3,600
Rio Grande	4,800	5,200	7,500	11,000
Routt	7,200	1,100	80,000	81,000
Saguache	450	70	2,800	2,800
San Juan	60	4	1,600	1,600
San Miguel	160	20	870	890
Summit	0	300	40	330

Wyoming County	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Albany	6,900	1,200	13,000	14,000
Big Horn	2,200	850	9,600	10,000
Carbon	12,000	2,900	47,000	50,000
Converse	9	40	40	80
Fremont	data unavailable	4,500	data unavailable	15,000
Hot Springs	50	230	710	940
Johnson	580	570	1,600	2,200
Lincoln	data unavailable	10	data unavailable	330
Natrona	0	30	0	30
Park	data unavailable	19,000	228,000	242,000
Sheridan	1,300	130	4,900	5,000
Sublette	data unavailable	130	data unavailable	520
Teton	data unavailable	2	data unavailable	9,200
Washakie	70	480	180	650

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

South Dakota County	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Lawrence	0	0	100	100

National Forest	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Arapaho National Forest	90	710	180	900
Bighorn National Forest	4,000	1,500	16,000	17,000
Black Hills National Forest	0	0	100	100
Bridger-Teton National Forest	data unavailable	100	data unavailable	6,900
Grand Mesa National Forest	540	420	5,800	6,200
Gunnison National Forest	460	310	3,900	4,200
Medicine Bow National Forest	19,000	4,100	59,000	63,000
Pike National Forest	0	4	30	30
Rio Grande National Forest	50,000	39,000	89,000	108,000
Roosevelt National Forest	2,400	1,300	8,900	10,000
Routt National Forest	20,000	2,400	143,000	144,000
San Isabel National Forest	7	180	4,200	4,200
San Juan National Forest	20,000	14,000	51,000	56,000
Shoshone National Forest	17,000	24,000	208,000	224,000
Uncompahgre National Forest	1,300	100	7,500	7,600
White River National Forest	1,900	4,300	17,000	20,000
Yellowstone/Teton NP	data unavailable	4	data unavailable	data unavailable

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

2008 Douglas-fir Beetle Activity

	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Colorado	27,000	244,000	259,000
Wyoming	22,000	data unavailable	416,000

Colorado County	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Alamosa	0	0	20	20
Archuleta	5,800	3,500	24,000	27,000
Boulder	0	40	250	270
Chaffee	580	150	2,600	2,700
Clear Creek	1	0	820	820
Conejos	290	2,600	3,700	5,600
Costilla	30	4	1,500	1,500
Custer	110	30	6,200	6,200
Delta	970	450	2,400	2,700
Dolores	90	100	2,700	2,800
Douglas	1,600	20	23,000	23,000
Eagle	3,000	1,400	5,600	6,400
El Paso	160	100	4,100	4,100
Fremont	510	210	14,000	14,000
Garfield	4,000	2,500	25,000	25,000
Gilpin	0	4	60	60
Grand	210	350	770	770
Gunnison	4,400	3,700	14,000	15,000
Hinsdale	1,100	1,200	4,200	5,200
Huerfano	2	9	2,100	2,100
Jackson	160	60	180	240
Jefferson	600	110	5,000	5,000
La Plata	1,300	270	7,300	7,600
Lake	70	0	80	80

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

Colorado County	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Larimer	1,000	60	2,500	2,500
Las Animas	0	10	5,900	5,900
Mesa	320	1,500	3,600	4,700
Mineral	720	770	4,800	5,400
Moffat	0	0	50	50
Montezuma	640	240	6,500	6,700
Montrose	1,600	430	3,300	3,600
Ouray	420	120	1,100	1,200
Park	350	50	1,400	1,400
Pitkin	1,100	2,200	2,600	4,500
Pueblo	7	20	3,100	3,100
Rio Blanco	470	40	7,400	7,400
Rio Grande	2,200	400	7,000	7,300
Routt	1,600	40	4,000	4,000
Saguache	6,200	1,100	28,000	29,000
San Juan	0	0	120	120
San Miguel	5,400	3,600	12,000	12,000
Summit	6	0	300	300
Teller	110	0	1,600	1,600

Wyoming County	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Albany	810	620	4,800	5,300
Big Horn	21,000	3,300	31,000	32,000
Carbon	1,300	330	8,800	8,900
Converse	0	0	4	4
Fremont	data unavailable	5,200	data unavailable	54,000
Hot Springs	2,700	980	25,000	25,000
Johnson	140	1,100	1,200	1,200
Lincoln	data unavailable	420	data unavailable	32,000
Natrona	80	20	130	130
Park	data unavailable	5,400	data unavailable	191,000
Sheridan	40	240	390	600
Sublette	data unavailable	300	data unavailable	11,000
Teton	data unavailable	770	data unavailable	45,000
Uinta	data unavailable	0	data unavailable	950

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

Washakie	2,500	3,800	4,000	5,800

National Forest	2007 Acres Impacted	2008 Acres Impacted	1996-2007 Cumulative Acres Impacted	1996-2008 Cumulative Acres Impacted
Arapaho National Forest	1	0	490	490
Bighorn National Forest	14,000	4,000	22,000	25,000
Bridger-Teton National Forest	data unavailable	750	data unavailable	72,000
Grand Mesa National Forest	80	420	670	1,100
Gunnison National Forest	4,600	3,300	12,000	14,000
Medicine Bow National Forest	1,600	640	11,000	11,000
Pike National Forest	2,500	90	28,000	28,000
Rio Grande National Forest	6,200	3,200	33,000	35,000
Roosevelt National Forest	110	40	1,800	1,800
Routt National Forest	840	70	2,000	2,000
San Isabel National Forest	890	200	16,000	16,000
San Juan National Forest	8,600	5,900	39,000	44,000
Shoshone National Forest	21,000	7,200	193,000	199,000
Targhee National Forest	data unavailable	380	data unavailable	14,000
Uncompahgre National Forest	3,100	1,500	7,600	8,800
White River National Forest	4,500	4,400	12,000	15,000
Yellowstone/Grand Teton NP	data unavailable	620	data unavailable	data unavailable

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

2008 Western Balsam Bark Beetle Activity

	2007 Acres Impacted	2008 Acres Impacted
Colorado	data unavailable	346,000
Wyoming	data unavailable	69,000

Colorado County	2007 Acres Impacted	2008 Acres Impacted
Alamosa	300	20
Archuleta	7,000	550
Boulder	6,600	8,300
Chaffee	7,600	7,900
Clear Creek	4,400	3,500
Conejos	4,400	7,300
Costilla	2,000	3,700
Custer	3,400	5,200
Delta	5,200	8,000
Dolores	7,500	5,300
Eagle	17,000	24,000
El Paso	4	10
Fremont	2,100	1,300
Garfield	35,000	26,000
Gilpin	5,900	3,300
Grand	4,400	7,600
Gunnison	31,000	54,000
Hinsdale	4,700	9,100
Huerfano	880	3,100
Jackson	12,000	8,000
Jefferson	0	40
La Plata	650	230
Lake	4,100	3,400
Larimer	37,000	34,000
Las Animas	1,100	1,400
Mesa	11,000	14,000
Mineral	11,000	13,000
Moffat	2,400	630
Montezuma	2,900	1,200
Montrose	1,700	760
Ouray	1,500	2,100
Park	9,700	10,000
Pitkin	26,000	26,000
Pueblo	430	390
Rio Blanco	20,000	13,000
Rio Grande	9,200	8,700
Routt	17,000	5,500
Saguache	6,400	3,900
San Juan	17,000	7,700
San Miguel	5,800	6,700
Summit	6,200	5,400
Teller	3	0

Wyoming County	2007 Acres Impacted	2008 Acres Impacted
Albany	5,000	4,000
Big Horn	24,000	7,300
Carbon	12,000	8,400
Converse	120	690
Fremont	data unavailable	11,000
Hot Springs	150	260
Johnson	3,000	3,600
Lincoln	data unavailable	1,700
Natrona	600	1,200
Park	data unavailable	3,800
Sheridan	21,000	5,600
Sublette	data unavailable	11,000
Teton	data unavailable	10,000
Washakie	40	800

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

National Forest	2007 Acres Impacted	2008 Acres Impacted
Arapaho National Forest	8,000	9,600
Bighorn National Forest	47,000	17,000
Bridger-Teton National Forest	data unavailable	17,000
Grand Mesa National Forest	11,000	15,000
Gunnison National Forest	26,000	52,000
Medicine Bow National Forest	15,000	9,900
Pike National Forest	9,900	11,000
Rio Grande National Forest	27,000	32,000
Roosevelt National Forest	30,000	29,000
Routt National Forest	33,000	17,000
San Isabel National Forest	21,000	23,000
San Juan National Forest	26,000	13,000
Shoshone National Forest	14,000	14,000
Targhee National Forest	data unavailable	100
Uncompahgre National Forest	12,000	13,000
White River National Forest	93,000	87,000
Yellowstone/Grand Teton NP	data unavailable	1,400

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

2008 Western Spruce Budworm Activity

	2007 Acres Impacted	2008 Acres Impacted
Colorado	data unavailable	155,000
Wyoming	data unavailable	34,000

Colorado County	2007 Acres Impacted	2008 Acres Impacted
Alamosa	1,400	520
Archuleta	66,000	4,700
Conejos	22,000	16,000
Costilla	8,800	26,000
Custer	19,000	6,500
Dolores	14,000	3,300
Douglas	19,000	18,000
Eagle	0	150
El Paso	30	80
Fremont	1,800	1,300
Grand	230	130
Gunnison	0	20
Hinsdale	24,000	3,700
Huerfano	18,000	17,000
Jackson	410	1,700
Jefferson	1,500	0
La Plata	55,000	3,100
Las Animas	8,100	14,000
Mineral	40,000	6,100
Montezuma	32,000	3,000
Montrose	100	0
Ouray	40	2,300
Park	10	0
Pitkin	0	120
Rio Blanco	0	110
Rio Grande	36,000	11,000
Saguache	11,000	8,100
San Juan	13,000	3,900
San Miguel	0	2,600
Summit	0	200

Wyoming County	2007 Acres Impacted	2008 Acres Impacted
Albany	3,200	4,300
Carbon	1,300	1,600
Fremont	data unavailable	1,300
Hot Springs	630	0
Johnson	0	70
Lincoln	data unavailable	740
Park	data unavailable	25,000
Sheridan	0	920

National Forest	2007 Acres Impacted	2008 Acres Impacted
Bighorn National Forest	0	930
Bridger-Teton National Forest	data unavailable	40
Gunnison National Forest	0	40
Medicine Bow National Forest	3,900	5,800
Pike National Forest	18,000	14,000
Rio Grande National Forest	83,000	37,000
Routt National Forest	330	740
San Isabel National Forest	32,000	21,000
San Juan National Forest	211,000	18,000
Shoshone National Forest	2,100	0
Targhee National Forest	data unavailable	710
Uncompahgre National Forest	0	5,400
White River National Forest	0	490
Yellowstone/Grand Teton NP	data unavailable	26,000

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

2008 Aspen Decline

	Colorado	Wyoming	South Dakota
Acres Impacted Low	600	data unavailable	40
Acres Impacted Moderate	299,000	data unavailable	400
Acres Impacted High	242,000	data unavailable	400
Acres Impacted Total	**541,600**	**34,000**	**840**

Colorado County	2008 Acres Impacted Low	2008 Acres Impacted Moderate	2008 Acres Impacted High	2008 Acres Impacted Total
Archuleta	0	900	2,600	**3,500**
Boulder	0	80	30	**110**
Chaffee	50	3,600	850	**4,500**
Clear Creek	0	7	80	**90**
Conejos	0	150	2,000	**2,200**
Costilla	0	0	180	**180**
Custer	80	540	3,900	**4,500**
Delta	0	6,300	12,000	**18,000**
Dolores	0	3,000	8,800	**12,000**
Douglas	0	20	0	**20**
Eagle	0	18,000	2,700	**21,000**
El Paso	0	0	10	**10**
Fremont	10	700	1,900	**2,600**
Garfield	0	31,000	7,700	**39,000**
Gilpin	0	40	0	**40**
Grand	0	3,100	4,800	**7,900**
Gunnison	130	41,000	33,000	**74,000**
Hinsdale	40	5,100	920	**6,100**
Huerfano	0	130	1,900	**2,000**
Jackson	90	7,000	4,400	**11,000**
Jefferson	0	40	3	**40**
La Plata	0	730	3,900	**4,600**
Lake	0	590	120	**710**
Larimer	0	1,200	3,800	**5,000**
Las Animas	0	50	590	**640**

Colorado County	2008 Acres Impacted Low	2008 Acres Impacted Moderate	2008 Acres Impacted High	2008 Acres Impacted Total
Mesa	0	16,000	22,000	**38,000**
Mineral	0	7,500	770	**8,300**
Moffat	0	14,000	11,000	**25,000**
Montezuma	0	7,800	11,000	**19,000**
Montrose	0	11,000	15,000	**26,000**
Ouray	0	6,400	8,500	**15,000**
Park	20	4,200	17,000	**21,000**
Pitkin	0	13,000	730	**14,000**
Pueblo	0	220	590	**810**
Rio Blanco	0	22,000	7,700	**30,000**
Rio Grande	0	1,400	1,700	**3,100**
Routt	150	58,000	41,000	**99,000**
Saguache	20	12,000	1,800	**14,000**
San Juan	0	7	200	**210**
San Miguel	0	1,900	7,100	**9,000**
Summit	0	30	470	**500**
Teller	0	230	100	**330**

Wyoming County	2008 Acres Impacted Low	2008 Acres Impacted Moderate	2008 Acres Impacted High	2008 Acres Impacted Total
Albany	100	1,700	1,300	**3,100**
Bighorn	0	20	0	**20**
Carbon	70	12,000	8,600	**21,000**
Converse	0	3,600	320	**4,000**
Crook	40	700	950	**1,700**
Fremont	data unavailable	data unavailable	data unavailable	**260**
Johnson	0	140	20	**160**
Laramie	0	110	180	**290**
Natrona	0	1,600	320	**1,900**
Park	data unavailable	data unavailable	data unavailable	**40**
Sheridan	70	30	20	**120**
Sublette	data unavailable	data unavailable	data unavailable	**300**
Teton	data unavailable	data unavailable	data unavailable	**590**
Washakie	0	80	230	**310**
Weston	0	110	90	**210**

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.

South Dakota County	2008 Acres Impacted Low	2008 Acres Impacted Moderate	2008 Acres Impacted High	2008 Acres Impacted Total
Custer	0	0	2	**2**
Lawrence	40	190	220	**500**
Meade	0	0	40	**40**
Pennington	7	170	120	**300**

National Forest	2008 Acres Impacted Low	2008 Acres Impacted Moderate	2008 Acres Impacted High	2008 Acres Impacted Total
Arapaho National Forest	0	880	350	**1,200**
Bighorn National Forest	0	20	20	**40**
Black Hills National Forest	90	740	1,200	**2,000**
Bridger-Teton National Forest	data unavailable	data unavailable	data unavailable	**400**
Grand Mesa National Forest	0	7,500	11,000	**19,000**
Gunnison National Forest	80	35,000	30,000	**65,000**
Medicine Bow National Forest	170	9,400	2,500	**12,000**
Pike National Forest	7	2,500	8,000	**11,000**
Rio Grande National Forest	0	22,000	3,700	**26,000**
Roosevelt National Forest	0	890	1,600	**2,500**
Routt National Forest	140	39,000	16,000	**55,000**
San Isabel National Forest	130	5,400	6,000	**12,000**
San Juan National Forest	0	11,000	23,000	**34,000**
Shoshone National Forest	0	10	50	**60**
Uncompahgre National Forest	0	19,000	21,000	**40,000**
White River National Forest	0	55,000	14,000	**69,000**
Yellowstone/Grand Teton NP	data unavailable	data unavailable	data unavailable	**400**

Due to the nature of aerial surveys, this data will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented in the data because these agents are not detectable from aerial surveys. The data presented should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. The insect and disease data is available digitally from the USDA Forest Service, Region Two Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this data for purposes other than those for which it was intended may yield inaccurate or misleading results.