FOREST INSECT and DISEASE CONDITIONS in the ROCKY MOUNTAIN REGION

2000-2001

Looking south from Interstate 70, Vail, CO. Mountain pine beetle has been active here in mature lodgepole pine for several years, causing significant impacts in this wildland-urban interface.

United States Department of Agriculture

Renewable Resources Forest Health

Rocky Mountain Region

FOREST INSECT AND DISEASE CONDITIONS IN THE ROCKY MOUNTAIN REGION

2000-2001

USDA Forest Service
Rocky Mountain Region
Renewable Resources, Forest Health Management
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Visit our website at **www.fs.fed.us/r2/fhm**

by
The Forest Health Management Staff

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The Forest Health Management (FHM) Staff extends its appreciation to all cooperators who contributed to this report during 2000 - 2001.

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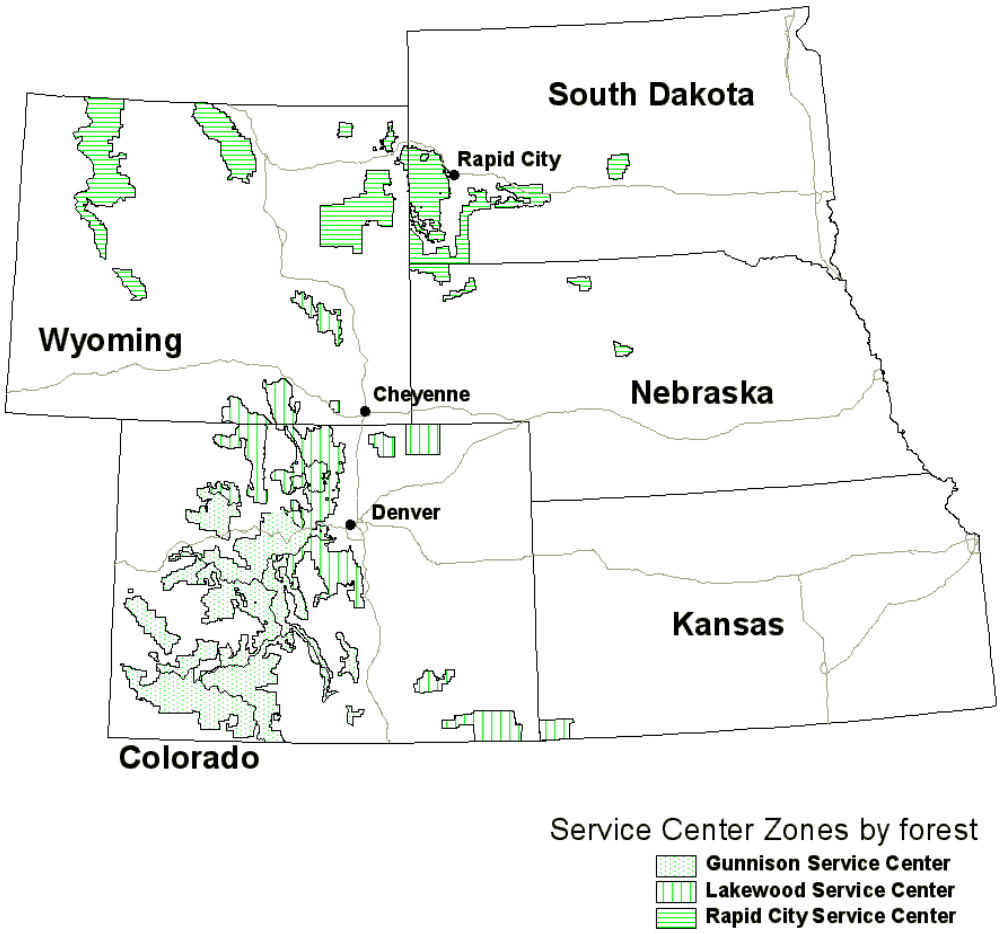
Forest Health Management (FHM) is responsible for the detection, evaluation, and suppression of insects and diseases on forested Federal lands. FHM also administers financial and technical assistance programs with the State Foresters of Colorado, Kansas, Nebraska, South Dakota, and Wyoming for insect and disease detection, evaluation, and suppression. In addition, the management of range pests and gypsy moth are a shared responsibilities with the Animal and Plant Health Inspection Service (APHIS). Close coordination and cooperation of the Federal and State agencies responsible for forest health management are necessary for effective program execution.

Three Service Centers and the Regional Office address forest health concerns for the Rocky Mountain Region. Questions concerning operations and requests for service can be directed to the Forest Health Management (FHM) Group Leader in the Regional Office or the respective Service Center Leaders.

SERVICE CENTERS and OFFICES	SERVICE AREAS	STAFF
Gunnison Service Center (GSC) 216 North Colorado, Gunnison, CO 81230 Ph: 970/641-0471 Fax: 970/641-1928	Assistance to National Forests and cooperators in southwestern and south-central Colorado: Rio Grande, San Juan, Grand Mesa, Uncompahgre, Gunnison, White River, and San Isabel.	**Roy Mask** – Service Center Leader, Entomologist **Tom Eager** - Entomologist **Jim Worrall**– Plant Pathologist **Kelly Sullivan –** Technician; moved to LSC in 2002 as a plant pathologist **Matt Cahir** – Technician (2001)
Lakewood Service Center (LSC) P.O. Box 25127 Lakewood, CO 80225 Ph: 303/236/9541 Fax: 303/236-9542	Assistance to Kansas, eastern and northwestern Colorado, and southern Wyoming; National Forests: Pike, Arapaho-Roosevelt, Medicine Bow-Routt, and White River (Dillon Ranger District), Comanche and Cimmarron National Grasslands	**Dave Johnson** Service Center Leader, Plant Pathologist (retired 2001) **Jeff Witcosky** Service Center Leader, Entomologist (2001) **Bill Schaupp** – Entomologist; moved to RCSC in 2002 as an entomologist **Jeri Lyn Harris –** Plant Pathologist (2000 - 2001); converted to R2 Forest Health Monitoring Coordinator in 2001 **Lee Pederson** – Technician (2000-2001), moved to Region 4, FHP, Ogden Field Office **Bernard Benton** - Computer Specialist **Christine Pontarolo** – Technician (2001)
Rapid City Service Center (RCSC) 1730 Samco Road, Rapid City, SD 57702 Ph: 605/343-1960 Fax: 605/394-6627	Assistance to National Forests, and cooperators east of the Continental Divide in northern Wyoming, South Dakota and Nebraska: Black Hills, Bighorn, Shoshone, and Nebraska, and National Grasslands in South Dakota, Wyoming, and Nebraska	**Kurt Allen** – Service Center Leader, Entomologist **Joel McMillin** – Entomologist (2000-2001); moved to Region 3, FHP, Arizona Field Office **Dan Long** –Technician
Regional Office – Forest Health Management (FHM) 740 Simms Street, Golden, CO 80401 Ph: 303/275-5061 Fax: 303/275-5075	Assistance to the three service centers; liaison to Washington D.C. offices and state forestry agencies.	**Frank Cross** – Group Leader **Michelle Frank -** Forest Health Monitoring Coordinator (2000-2001) Moved to R9, FHP, Pesticide Coordinator **Erik Johnson** – Aerial Survey Specialist **Tom McClure** – Noxious weeds, Invasive species (2001)
Regional Office – Renewable Resources	Oversight of Forest Health Management for R2	**Marisue Hilliard–** Director

Figure 1. **Rocky Mountain Region Forest Health Management Zones**



Rocky Mountain Region Insect, Disease, and Abiotic Damage

Status Report of 2000-2001

In 2000 – 2001, there were dramatic increases and continued tree mortality caused by bark beetles (Table 1, Figures 2 and 3). The most widespread forest damages were subalpine fir decline caused by western balsam bark beetle and root disease. Mountain pine beetle killed over 840,000 ponderosa, lodgepole, limber, whitebark, and bristlecone pines in CO, SD, and WY. Spruce beetle populations increased and killed over 250,000 Engelmann spruce in Wyoming and Colorado. These bark beetle epidemics continue to be a major forest health management concern.

Table 1. Summary Table of state totals for bark beetle-caused tree mortality detected in the 2001 aerial survey in Region 2.

State	Sub-alpine Fir Decline (W. Balsam Bark Beetle) (# of trees killed)	Mountain Pine Beetle (# of trees)	Spruce Beetle (# of trees)	Douglas- Fir Beetle (# of trees)
Colorado	712,400	457,892	16,460	6,400
South Dakota	-	273,310	-	-
Wyoming	249,700	111,025	234,948	16,085
TOTALS	**962,100**	**842,227**	**251,408**	**22,485**

Figure 2. 2001 aerial survey results depicting mountain pine beetle, spruce beetle, Ips beetles, and Douglas-fir beetle in the northern portion of the USDA Forest Service's Rocky Mountain Region.

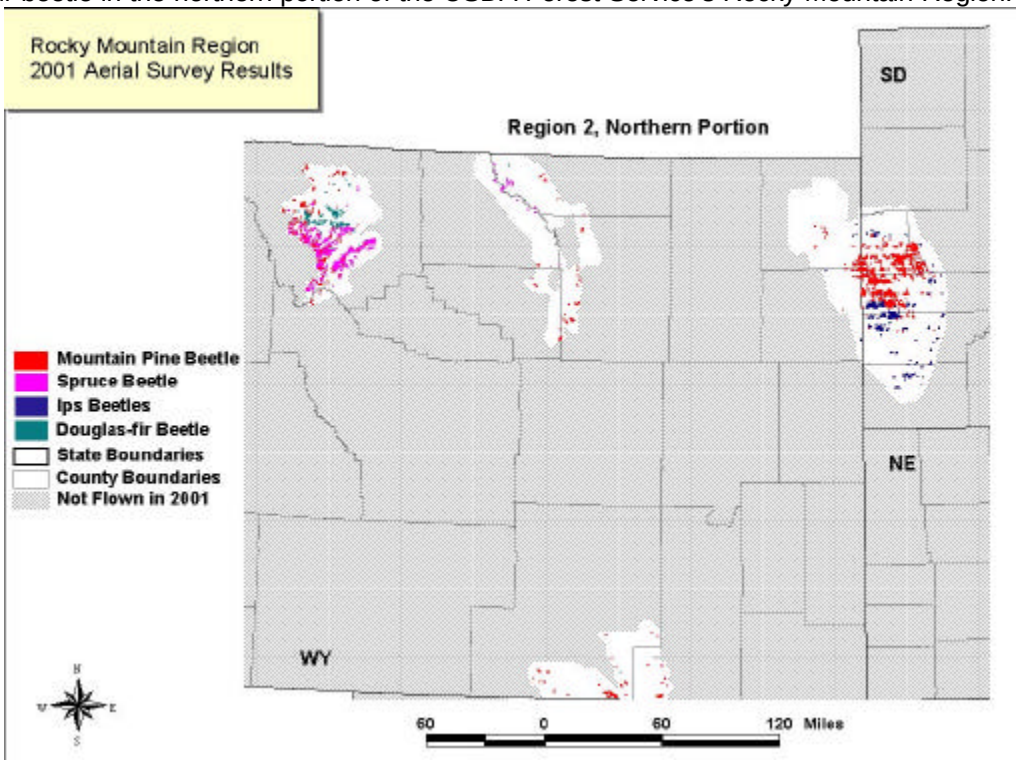
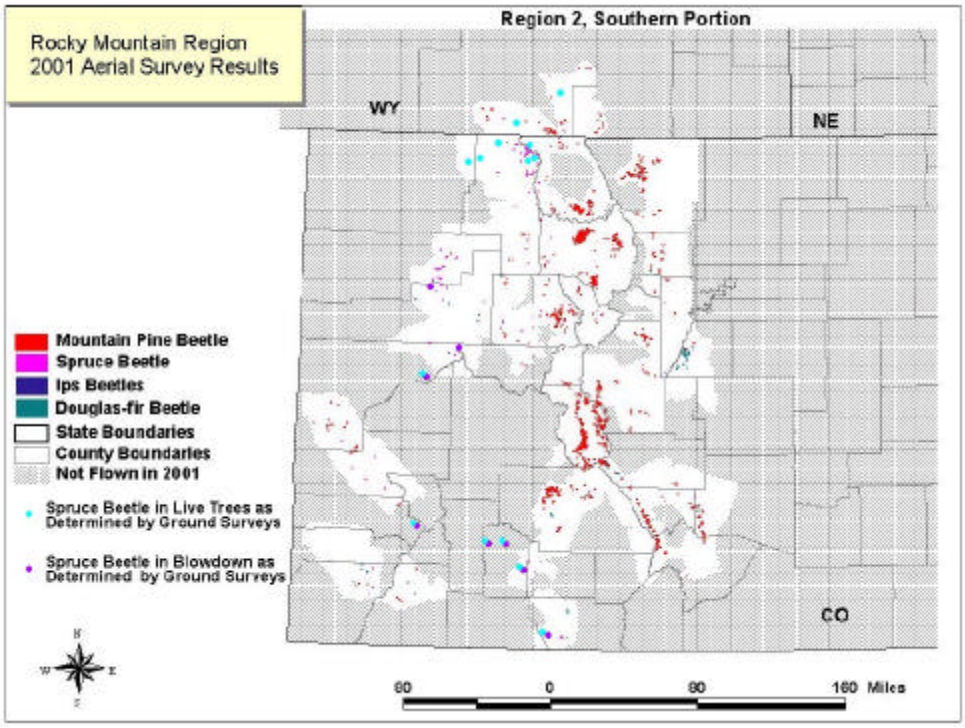


Figure 3. 2001 aerial survey results depicting mountain pine beetle, spruce beetle, Ips beetles, and Douglas-fir beetle in the southern portion of the USDA Forest Service's Rocky Mountain Region

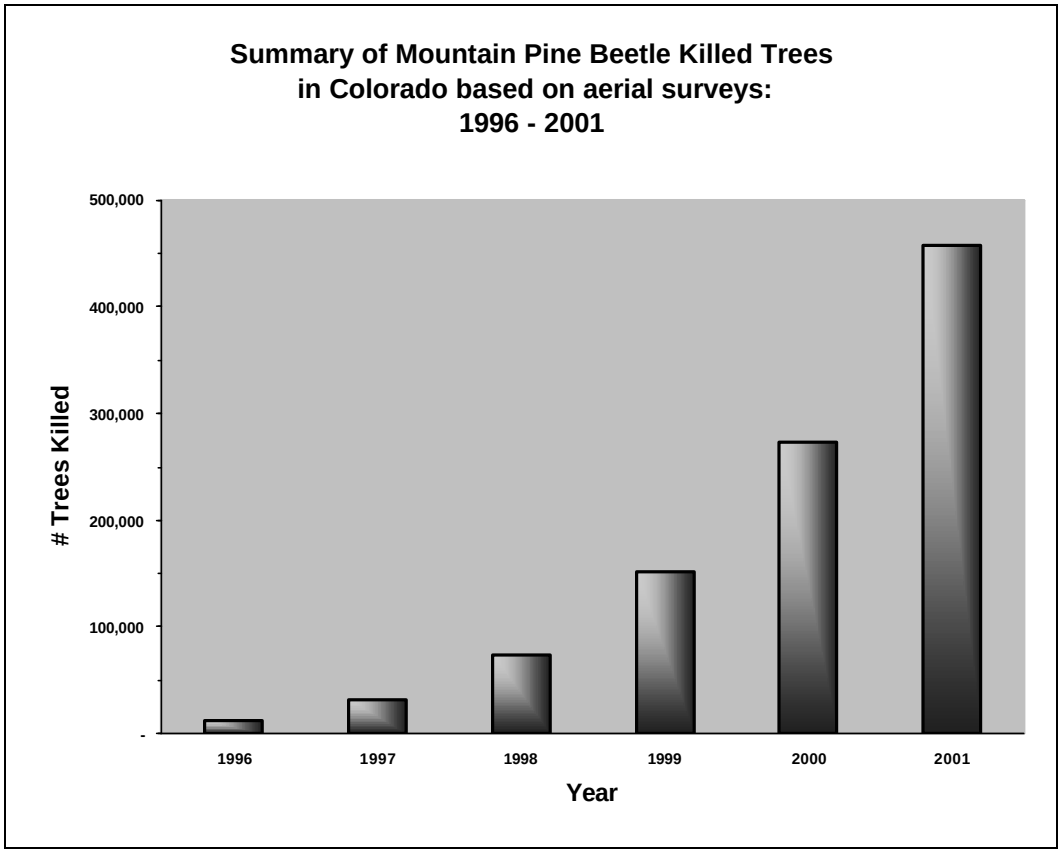


Mountain pine beetle,
Dendroctonus ponderosae

Colorado, South Dakota, Wyoming
Host (s): Ponderosa, Lodgepole, Whitebark, Limber, Bristlecone pines

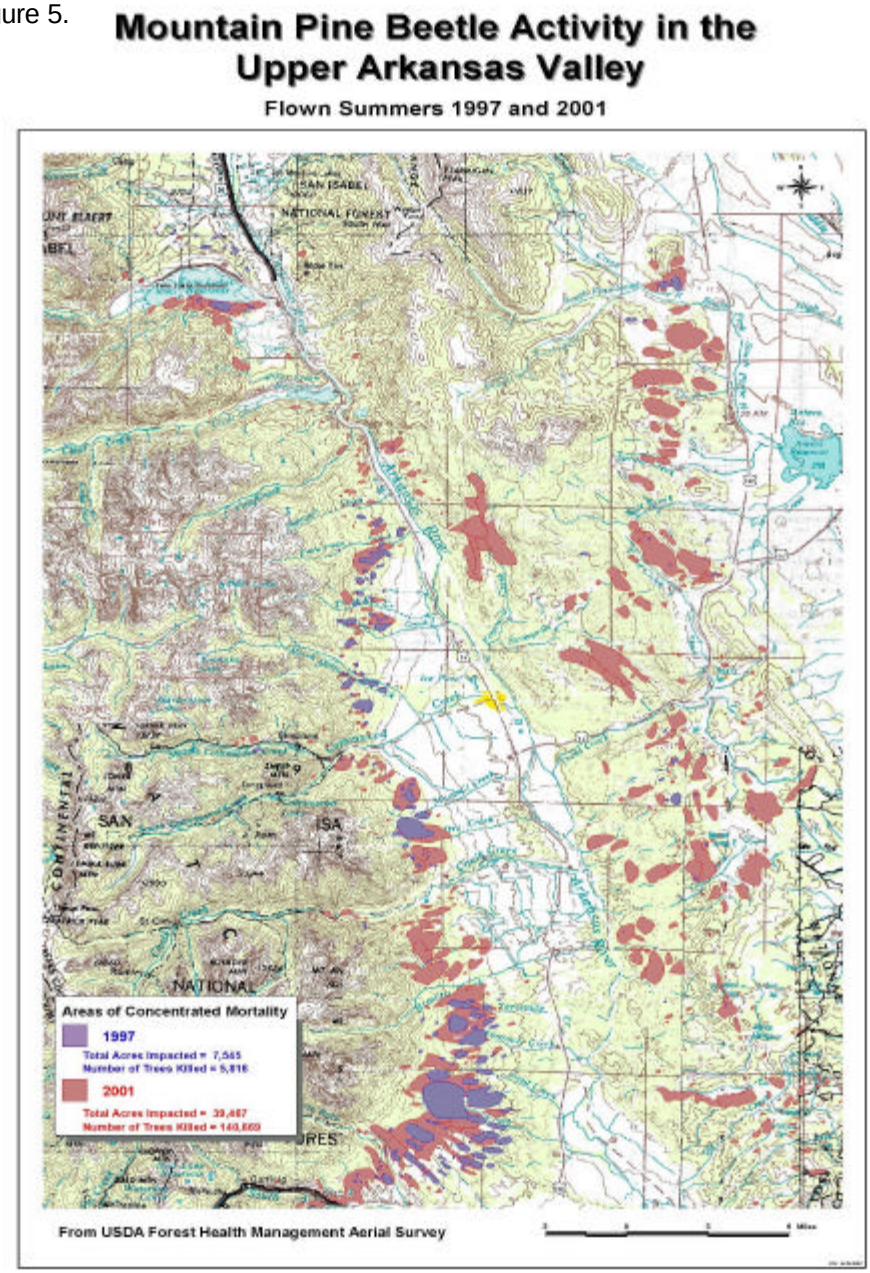
CO: This insect continues to be the primary pest of interest on public and private lands in CO (Figure 4). Grand County had the largest amount of tree mortality in Colorado with over 150,000 lodgepole pine killed by this beetle. This is more than double the survey numbers of 2000 with 65,000 trees detected. Areas around Lake Granby, along the William's Fork River near the Henderson Mine, and throughout the Troublesome Creek Watershed are under intense infestations. The mountain pine beetle affected area is spreading into ponderosa pines of the South Park area in Park County.

Figure 4. Increasing mountain pine beetle-caused tree mortality in Colorado



The second largest area of tree mortality caused by mountain pine beetle is located within ponderosa pine stands in the upper Arkansas Valley, between Salida and Buena Vista along the eastern foothills of the Saguache Range. Large portions of the wildland-urban interface between Buena Vista and Salida have been impacted with ponderosa pine mortality as high as 80% in some stands. By 2000, over 37,000 acres had been impacted by the current outbreak. Mountain pine beetle activity is evident in lodgepole pine stands of the Arkansas Valley (Chaffee County), including the Twin Lakes and Fooses Creek areas. Both federal and private lands are being impacted. The increasing trend of mountain pine beetle activity is well illustrated by the map of the Upper Arkansas Valley area (Figure 5) and compares 1997 and 2001 aerial survey results. The red polygons of the map indicate the increasing mountain pine beetle activity from 1997 to 2001.

Figure 5.



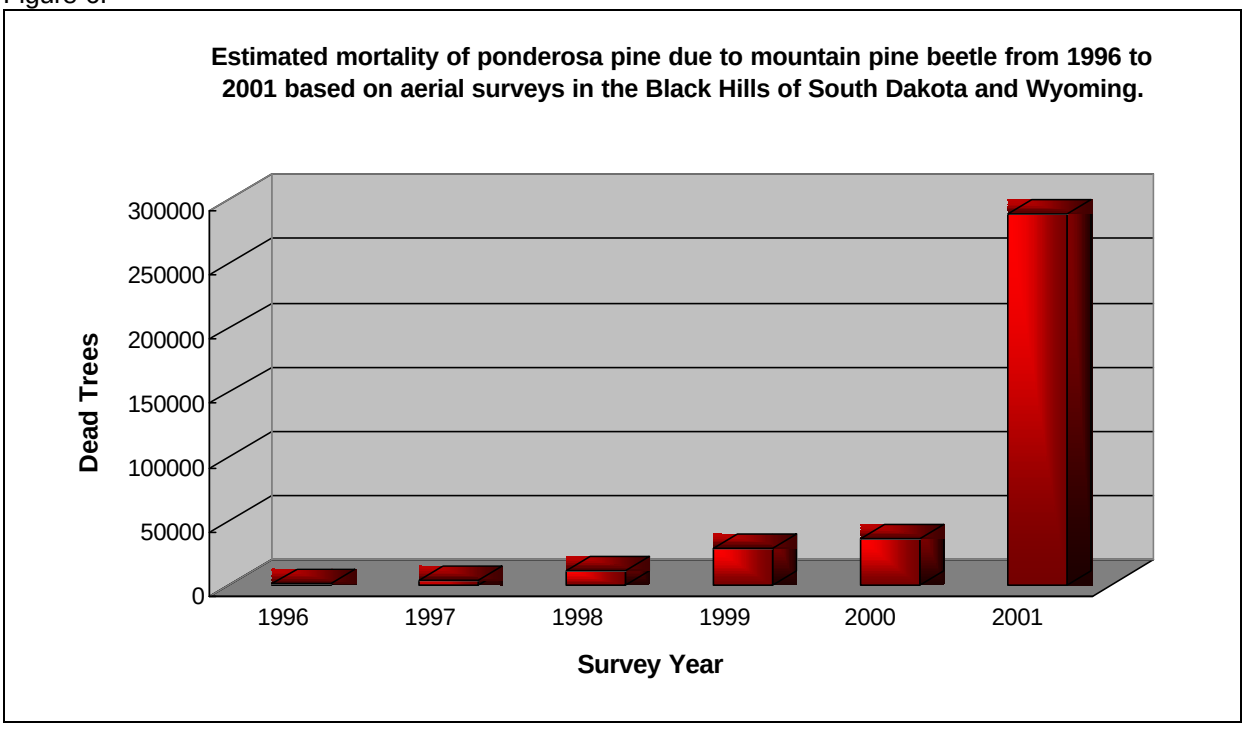
Areas of ponderosa pine where mountain pine beetle populations are increasing, but have not yet reached outbreak stage, are on the northern portion of the Uncompahgre Plateau and just due west of the Monarch Pass area of the GMUG Nat'l Forest. This infestation is scattered over the landscape to the south where it can be found near the headwaters of Saguache Creek.

Concentrations of mountain pine beetle infested lodgpole pine in Grand, Summit, Eagle, Jackson and Chaffee Counties. 2001 marked the fifth year of a mountain pine beetle outbreak around Vail, CO (Eagle County). A formal agreement has been developed to address the mountain pine beetle situation there on all land ownerships, including ski area lands under permit with the USDA Forest Service

SD: Ponderosa pine mortality caused by mountain pine beetle increased throughout the Black Hills of South Dakota. An estimated 300,000 trees were killed in 2001 as compared with about 40,000 in 2000. An area west of Sturgis accounted for about 1/3 of this mortality, but there were numerous other areas throughout the Hills where activity increased. In all areas with significant beetle activity, populations are expected to increase again in 2002.

This was the fifth consecutive year of increased beetle-caused tree mortality in the Black Hills area. In 1996, there were an estimated 1,500 trees killed by mountain pine beetle compared to nearly 300,000 this year (Figure 6). Therefore, tree mortality has increased nearly 200 times over five years. The following chart depicts this trend.

Figure 6.



WY: Park County, WY had significant mountain pine beetle caused tree mortality in 2001. An estimated 69,000 trees were reported to have been killed here. The majority of damage was thought to be occurring in white bark pine, with the remainder in limber pine; almost all of which was found within the upper reaches of the South Fork of the Shoshone River watershed. Some of this damage may be associated with white pine blister rust disease.

Mountain pine beelte continues to infest large areas of the Black Hills on the Wyoming side. Crook and Weston Counties contained mountain pine beetle infestations with over 15,000 trees killed in this Wyoming Black Hills area.

Mountain pine beetle populations are building in Natrona, Carbon, and Albany counties. Ponderosa pines mostly on private lands were attacked in the Casper Mountain Area. Over 13,000 lodgepole pines were killed by this beetle in the Sierra Madre and Snow Range on the Medicine Bow National Forest.

Spruce beetle,
Dendroctonus rufipennis

Colorado, Wyoming
Host (s): Engelmann spruce

In 2001, tree mortality from the spruce beetle increased 10-fold from survey data of 1999 in Region 2. Spruce beetle attacked more than 260,000 trees on 74,000 acres in the Rocky Mountain Region (Table 2). Because beetle-killed spruce trees lose their needles quickly, it is often hard to detect spruce beetle activity by aerial survey. Extensive ground survey work was used in conjunction with aerial detection surveys to assess the spruce beetle activity in the Region.

Table 2. Estimated tree mortality caused by spruce beetle from aerial detection surveys in 2001 in Wyoming and Colorado.

County (State)	***Approximate Number* of Trees Killed**
PARK (WY)	238,810
BIG HORN (WY)	2,776
SHERIDAN (WY)	1,833
JOHNSON (WY)	240
FREMONT (WY)	165
CARBON (WY)	118
WASHAKIE (WY)	6
TOTAL for WYOMING	**243,948**
ROUTT (CO)	9,826
RIO BLANCO (CO)	1,777
JACKSON (CO)	1,617
GARFIELD (CO)	1,489
EAGLE (CO)	408
MESA (CO)	347
MOFFAT (CO)	307
MONTROSE (CO)	176
CONEJOS (CO)	135
PITKIN (CO)	132
GRAND (CO)	64
MONTEZUMA (CO)	55
GUNNISON (CO)	51
SAN MIGUEL (CO)	34
ARCHULETA (CO)	24
OURAY (CO)	18
TOTAL for COLORADO	**16,460**

WY: In Park County, WY, a spruce beetle epidemic started with 130,000 trees killed in 2000 and nearly 240,000 killed in 2001. This infestation is in northern Absaroka Mountain wilderness areas of the Shoshone and Bridger-Teton National Forests, and in Yellowstone National Park. In the northern Bighorn Mountains, spruce beetle mortality in Bighorn, Sheridan and Johnson Counties, WY increased in 2001. Spruce beetle populations are also increasing in the Sierra Madre and Snowy Range of the Medicine Bow National Forest following small blowdown events in 1997-1999.

CO:
The Routt Divide Blowdown of 1997 flattened 20,000 acres of high elevation spruce in 1997. Spruce beetle broods emerging from the fallen trees have started to infest and kill standing spruce in 2000 and 2001. Within Routt, and Jackson Counties, CO, over 11,000 spruce trees were detected by aerial survey in 2001.
Nearby in the Flat Tops of Rio Blanco, Garfield, and Moffat Counties, CO, spruce beetle killed trees are also on the rise. Spruce beetle within these three counties killed an estimated 3,500 trees in 2001, which is more than double survey data in 2000. Ground surveys confirming the presence of spruce beetles in standing trees have been conducted in similar areas of the Flat Tops.

In addition to increased spruce beetle activity in the vicinity of the Routt Divide Blowdown, there are a large number of sites scattered throughout Colorado where spruce beetle is a major concern. Spruce stands in the Land's End area of the Grand Mesa were subject to scattered blowdown due to wind events that occurred in late 1999. Spruce beetle began to attack standing green spruce trees in the summer of 2001, and it is hoped that continuing efforts at sanitation and salvage will defuse the potential for a full-blown outbreak and contribute to a diversification of stand conditions on the Grand Mesa.

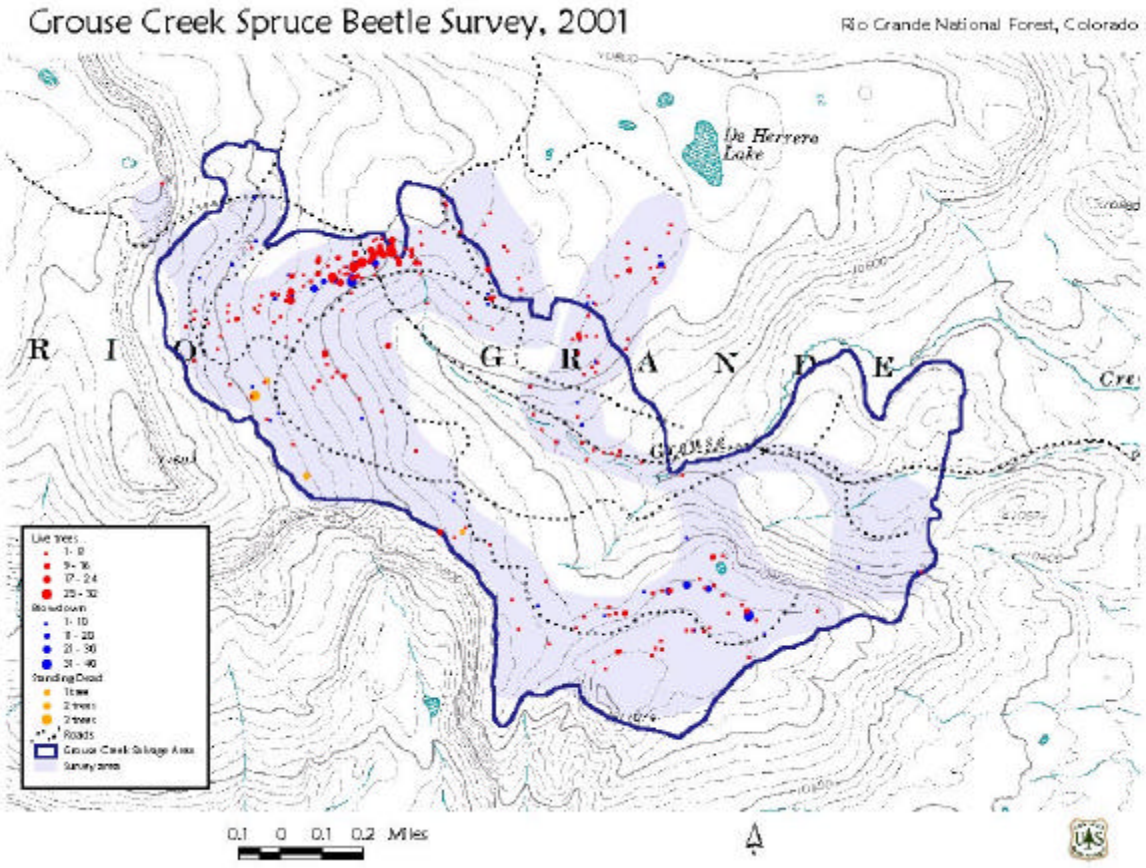
Blowdown of spruce was also noted in late summer of 2000 in the vicinity of Triangle Park and the Buford-Newcastle road corridor of the Blanco Ranger District of the White River National Forest. Assessment of the degree of blowdown was begun shortly thereafter and plans were made to begin sanitation and salvage of the most significant portions of the downed material. The efforts to remove the material that was infested in the spring of 2001 are underway and these sanitation efforts are being conducted in conjunction with plans for continued monitoring and hand treatment of infested materials found in inaccessible locations.

A windthrow event in Baylor Park on the Sopris Ranger District of the White River National Forest has been infested with spruce beetle since first exposed to a beetle flight in the late spring of 1999. Efforts to reduce the potential for a large-scale outbreak centered upon hand treatment during the summer of 2001. With the completion of NEPA requirements, efforts to reduce the beetle risk will include the use of trap trees and thinning of adjacent stands.

The 600 acres of blowdown located near the town of Creede, CO, on the Rio Grande Nat'l Forest which occurred in late fall of 1997, has now been almost entirely salvaged. The endemic spruce beetle population responded slowly to the host material and it is hoped that this combination of low beetle numbers and removal of the great majority of what was infested will serve to reduce the risk of a large-scale outbreak. Efforts to follow up on these management activities will include monitoring with insect traps, field crew surveys and hand treatment of infested material.

Spruce beetle populations have continued to expand at Grouse Creek on the Conejos Ranger District of the Rio Grande National Forest. Ground surveys have documented that hundreds of standing green spruce have been attacked and killed in the past several years. Data on surrounding stands indicate that the area is generally at high risk to spruce beetle. This risk factor, coupled with the presence of a very active spruce beetle population may result in a large outbreak. In addition, the close proximity to the South San Juan Wilderness Area probably reduces the scope of response options should a large-scale outbreak begin. Management activities are planned, but this situation warrants major concern. Monitoring will continue at Grouse Creek, the results of the 2001 spruce beetle survey are noted in Figure 7.

Figure 7.



Douglas-fir bark beetle,
Dendroctonus pseudotsugae

Colorado, Wyoming
Host (s): Douglas-fir

CO - In Douglas County, CO, approximately 2,200 were killed by Douglas-fir beetle in 2001. This figure is lower than past years; the outbreak of Douglas-fir beetle that resulted from the disturbances of 1993-1996 Douglas-fir tussock moth outbreak and the Buffalo Creek fires appears to be ending.
Douglas-fir beetle caused tree mortality in Saguache, County, CO dramatically decreased in 2001. Only 435 trees were detected in 2001 compared to an estimated 3,640 trees detected in 2000. This beetle has been present at low population levels here for 10 years; they attack trees weakened by endemic, but chronic populations of western spruce budworm.

WY - While still high in Park County, the 2001 total of 15,645 trees killed by Douglas-fir beetle was nearly half of 2000's count. Most of this mortality is occurring throughout the North and South Forks of the Shoshone River. Impacts are being felt as trees die in campgrounds and around summer cabins and resorts. In places where there is still considerable amounts of Douglas-fir left, the population is expected to continue to rise. Efforts to minimize impacts to high value recreation areas are ongoing.

Engraver beetle,
***Ips* spp.**

Colorado, Nebraska, South Dakota, Wyoming
Host (s): Black Hills spruce, Colorado blue spruce, Jack pine, Lodgepole pine, Ponderosa pine

CO - These insects are becoming increasingly conspicuous for a number of reasons. In general, weather conditions over the last decade have been dry and mild, which leads to the type of pine and spruce forest stress these insects prefer. Also, the mountain pine beetle creates a lot of dead limbs and tops that are being colonized by engraver beetles. [This has resulted in sapling mortality near the base of Mount Shavano in Chaffee County.] Third, the tremendous human development of forested areas in Colorado is placing stresses on native forests and resulting in lots of landscaping with ball-and-burlap pines (and subsequent Ips-caused mortality). Examples of this would be Coal Creek Canyon (Boulder County), Elizabeth (Elbert County), Castle Pines (Douglas County), mountain subdivisions throughout Jefferson County, the Colorado Springs area, and south of Montrose. Lastly, vegetation management resulting from the National Fire Plan is creating large amounts of slash that lend the sites to engraver beetle colonization. [As for the latter, roller-chopper operations to thin dense forests and reduce fire hazard, particularly in pinyon pine, have resulted in flare-ups of Ips-caused mortality in live trees nearby. A 50-acre area on Colorado Division of Wildlife property 8 miles northwest of Salida in Chaffee County is a good example.
Major pinon mortality is occurring in the southwest corner of the state centered around Mancos in Montezuma County. Usually the primary organism in these trees is Pinon Ips (*Ips confusus*). In some trees, signs of blackstain root disease are found, but this situation appears to be mostly drought/Ips in nature (this, despite relatively normal winter weather and good summer rains in 2000 and 2001). The affected area includes at least lower Dolores Canyon on the north, McElmo Canyon on the west, and Mesa Verde on the south, and Hesperus on the east. Current mortality totals at least 5000 trees.
In the pinon forested areas of the eastern San Luis Valley (near Crestone), Ips beetle activity is usually found in conjunction with Armillaria root disease. No doubt this disease is associated with much more of the so-called "Ips" problem than is ever reported.
Ips beetles, mostly *I. pini* and other larger species (probably *I. calligraphus* and *I. knausi*) are causing pockets of mortality in the northern part of Colorado Springs and a nearby pocket of 68 acres (estimated 400 dead trees) occurs on the Air Force Academy.
Ips attacks on urban Colorado blue spruces (*Ips hunteri*) continue in Greeley, Denver, and Colorado Springs but have subsided from levels of 5 years ago.
NE - Ips populations moved into jack pine stands that had been defoliated by jack pine budworm on the Halsey unit of the Nebraska National Forest. In severely defoliated areas, up to 25% of the trees had Ips attacks. In the Pine Ridge area, there was light and scattered mortality caused by Ips.
SD - Ips populations that had built up in storm damage and fire areas increased exponentially around the Black Hills. Green tree attacks increased to levels that have not been seen historically in this area. From Sturgis to Edgemont along the southeastern edges of the Black Hills, 50-100 sites had tree mortality caused by Ips beetles. There was also considerable mortality in the Hill City area. Many of the areas getting hit hardest by Ips in the Black Hills are in the wildland-urban interface.
In 2001, aerial surveyors mapped over 170,000 ponderosa pines that were killed by pine engraver beetles in the Black Hills. This unprecedented level of *Ips* activity is a consequence of wildfires and weather events, such as hail and snow-breakage, which have occurred over the past few years. *Ips* beetles bred in this weakened and damaged tree material. With a nearly unlimited supply of food, the *Ips* beetle populations increased significantly. Now that this food supply is becoming less suitable, *Ips* have exited it and are killing standing trees.
Some of the Black Hills mortality attributed to mountain pine beetle damage might have truly been caused by Ips. It is not always possibly to distinguish *Ips* from mountain pine beetle activity during aerial survey, this data is only an approximation of the tree mortality. Ground surveys provide a more accurate count.
WY - Ips bark beetle is severely impacting smaller-sized ponderosa pines on state-trust sections in northeast Wyoming. Large patches are also being observed on private property in this area.

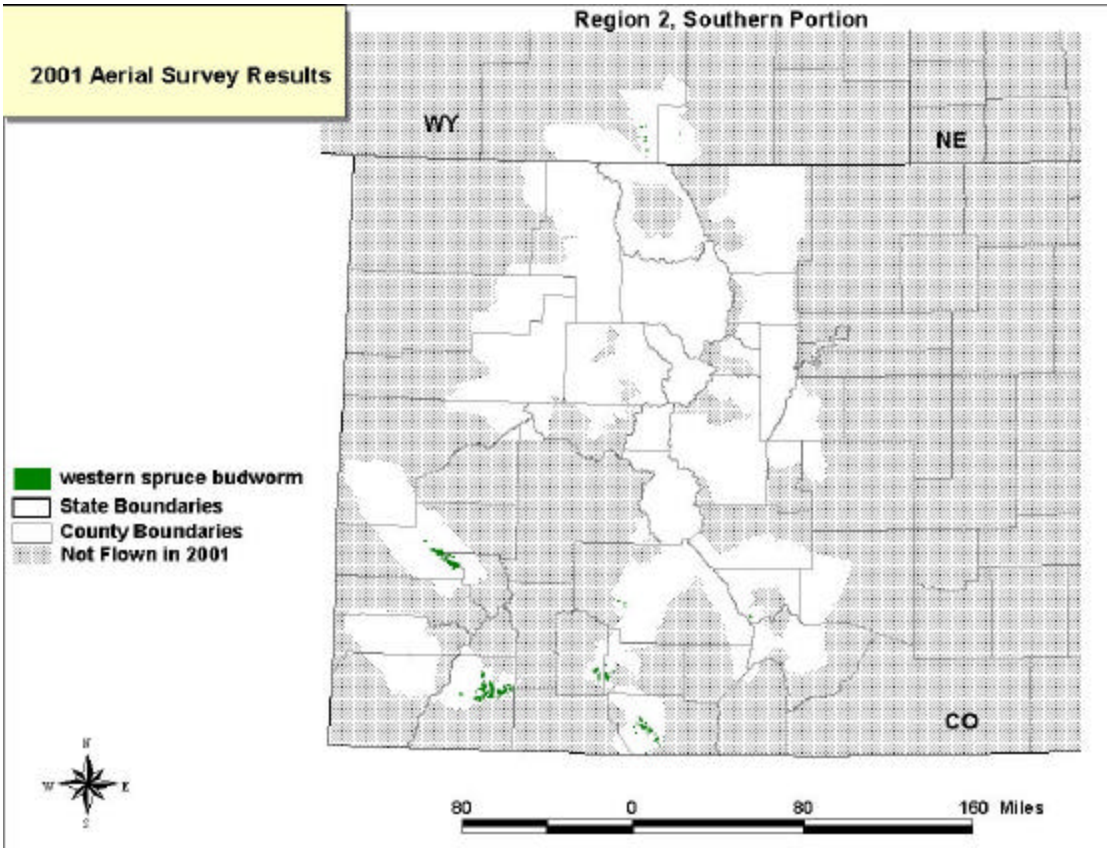
Western spruce budworm,
Choristoneura occidentalis

Colorado, Wyoming
Host (s): Douglas-fir, Engelmann spruce, Blue spruce, True fir

The southern portion of the Uncompahgre Plateau has seen significant levels of western spruce budworm defoliation in Englemann spruce. This activity is also evident to the east of the Plateau where the spruce in the vicinity of Ouray, Colorado has also been defoliated. Currently there is little mortality associated with this defoliation. The total WSBW defoliated acreage detected during the 2001 aerial survey in southern Colorado is estimated to be 35,715, and includes the following counties: Conejos, Custer, Hinsdale, La Plata, Mineral, Montrose, Ouray, Rio Grande and Sagauche. The actual acreage defoliated in southern Colorado could be several times higher as many areas were not surveyed there in 2001 (Figure 8)

There was no noticeable Western spruce budworm defoliation in Wyoming in 2000. However in 2001, there was an estimated 36,500 acres affected. In the Medicine Bow Mountains of southern Wyoming, an estimated 765 acres in Albany and Carbon counties, were defoliated by the budworm. Most of this defoliation is taking place in and around the North Platte River valley on the range's western slopes.

Figure 8. 2001 aerial survey results depicting western spruce budworm defoliation in the Colorado and Southern Wyoming.



Gypsy moth,

Lymantria dispar (Non-native)

Colorado, Kansas, Nebraska, South Dakota, Wyoming

Host (s): Hardwoods

CO – Fifty-two traps were deployed in 2000 and 2001 in USDA Forest Service campgrounds in southwestern Colorado. No moths were caught in the traps in 2000 and 2001. Single gypsy moths were caught in 1998 and 1999 in Rocky Mountain National Park. A total of 66 traps were placed in the Park in 2000 and 2001. A single moth was caught in 2000 and no moths were caught in 2001.

SD - Trapping throughout the state resulting in catching 4 male moths during 2000. Two moths were on the eastern boarder and 2 were in private Black Hills camping areas. The catches are attributed to movement of tourists from infested areas. A total of 7 viable egg masses were found on Christmas trees imported from Michigan this winter. Approximately half the trees were destroyed prior to sale and news reports were distributed to have people check their trees prior to disposal. The areas where the trees were sold were trapped more intensely in 2001; no catches were found.

Dwarf mistletoes,

***Arceuthobium* spp.**

Colorado, Wyoming

Host (s) lodgepole pine, ponderosa pine, limber pine, pinyon pine, Douglas-fir,

Dwarf mistletoes cause the greatest amounts of disease losses in the Rocky Mountain Region. Program emphasis continues for landscape-scale surveys and resulting suppression projects in developed recreation sites and wood fiber production areas. Dwarf mistletoe presence along with expanding mountain pine beetle populations complicate efforts to meet certain resource management goals.

Lodgepole pine dwarf mistletoe *(A. americanum)* infests about 50% of lodgepole pine stands in CO and WY. In Wyoming, this mistletoe is common in the Green Mountain area in Fremont County where 5,000 acres (state, federal, and private properties) are adversely affected. This parasite is widespread and a concern throughout the Bighorn and Shoshone National Forests.

Ponderosa pine dwarf mistletoe *(A. vaginatum subsp. cryptopodum)* is widespread throughout the host type only in Colorado. Dwarf mistletoe infests approximately 20 percent of the ponderosa pine stands in Colorado's Front Range. In conjunction with mild winter conditions and drought, these parasitic plants contribute to mortality in many Front Range areas.

Limber pine dwarf mistletoe *(A. cyanocarpum)* and pinyon pine dwarf mistletoe *(A. divaricatum)* commonly occur in sites with significant amounts of the host trees. The Douglas-fir dwarf mistletoe *(A. douglasii)* occurs mostly in the southern two-thirds of Colorado.

Armillaria root disease,

Armillaria ostoyae

Colorado, South Dakota, Wyoming

Host (s): Engelmann spruce, Colorado blue spruce, Lodgepole pine, Ponderosa pine, Douglas-fir, Subalpine fir, White fir, Hardwoods, and Aspen

Armillaria, the most common root disease in the Region, was evident in the mixed conifer and spruce-fir cover types. This root-rotting fungus was among the key causal agents of subalpine fir decline, which accounts for the most tree mortality in spruce-fir cover type in the Rocky Mountain

Region. Armillaria incidence in developed recreation sites in Colorado resulted in tree failures and numerous tree removal projects. Although no acreages are available, Armillaria is building up in northeast Wyoming (Crook and Weston counties). Permanent plots were established in 1991 and re-measured in 2001 to assess the role of this and other root diseases (see Special Projects section).

Annosus root disease,
Heterobasidion annosum

Colorado, Nebraska
Host (s): Ponderosa pine, White fir, Jack pine

Annosus root disease has scattered distribution within white fir in the mixed conifer type throughout southern Colorado. It also occurs at low incidence levels in plantings of Nebraska. In campgrounds, the disease creates hazardous conditions by increasing the probability of tree failure.

Black Stain root disease,
Leptographium wageneri, L.terrebrantis

Colorado, Nebraska
Host (s): Pinyon pine, Jack pine, ponderosa pine

Black stain, in combination with other factors, caused widespread pinyon mortality in southwestern Colorado. This area experienced unprecedented urban development pressure that may be compounding the problem. Black stain has not been identified east of the Continental Divide in Colorado pinyon forests. A cooperative effort with CSU was initiated to assess this phenomenon on a landscape scale (see Special Projects section).
This root disease also causes mortality and destroys young pines in Nebraska plantations.

Oak wilt,
Ceratocystis fagacaerum

Kansas, Nebraska
Host (s): Bur oak, red oak

Oak wilt continues to be a problem in forests along the eastern edge of the state of Nebraska. Only a few cases were reported in extreme northeast Kansas.

Ponderosa Pine Needlecast
Davisomycella ponderosae

Colorado
Host: Ponderosa pine

In 2000 and 2001, ponderosa pine across the San Juan National Forest showed foliage discoloration that has increased in severity each year since it was first noted in 1999. It was most apparent in spring and became less noticeable later in the year as the new foliage became more prominent and the discolored foliage dehisced. Damage was reported over a wide area, from the West Fork of the Dolores River to the eastern and southern extent of the Pagosa Ranger District and throughout the elevational range of ponderosa pine. There were similar reports from the

southern portions of the GMUG that may represent the same phenomenon. Trees of all sizes were discolored and there was no consistent part of the crown that was more affected than another. Discoloration was mostly in needles produced two years before or older, but in some cases the previous year's needles were affected. Discolored needles were eventually lost, leading to thin crowns with poor needle retention in more severe cases.

In 2000, preliminary evidence of a needlecast disease was discovered but no sexual fruiting was available. In 2001 fruiting was much better and the fungus, identified as *Davisomycella ponderosae*, was found throughout the area where the discoloration was evident (Figure 9).

Although it appears likely that the needlecast plays a major role in the damage, we are analyzing climatic and other data to evaluate the potential role of additional factors.

Figure 9.

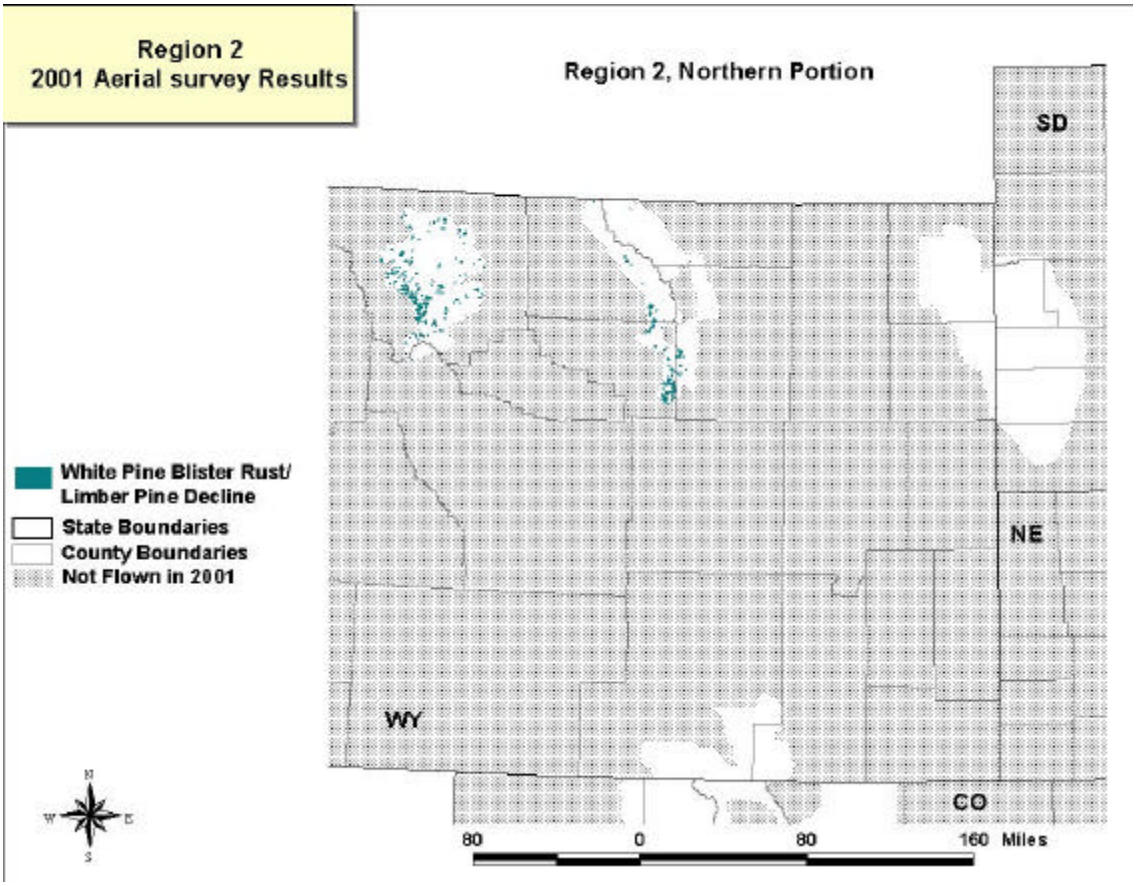
Discoloration of ponderosa pine near Yellowjacket Pass on the San Juan National Forest on May 31, 2001 and fruiting bodies of the needlecast *Davisomycella ponderosae* (inset).

White pine blister rust,
Cronartium ribicola (Non-native)

Colorado, Wyoming, South Dakota
Host (s): Limber pine, Whitebark pine

White pine blister rust occurs at low to moderate infection levels in whitebark and limber pine stands in Colorado, South Dakota, and Wyoming. Some stands have higher disease levels with more than 50% of the trees infected and dying due to the rust. Forest Service aerial surveys show white pine blister rust and other agents (mountain pine beetle, needlecasts, etc.) damaged more than 46,000 acres of white pine in Big Horn, Fremont, Johnson, Park, Sheridan and Washakie Counties (Figure 10).

FIGURE 10.



Dutch elm disease,
Ceratocystis ulmi (Non-native)

Colorado, Kansas, Nebraska, South Dakota
Host (s): American elm

Dutch Elm Disease occurs in low numbers in eastern Colorado and continues to be a problem in riparian areas and cities throughout the state. This disease progressed at an accelerated pace in South Dakota, probably due to increased rainfall. Dutch elm disease was a problem in riparian areas and cities throughout Nebraska and Kansas.

Subalpine fir decline (Western balsam bark beetle and root disease),
Dryocoetes confuses, Armillaria ostoyae

Colorado, Wyoming
Host (s): Subalpine fir

Subalpine fir mortality was the most widespread damage detected in Colorado in 2000 – 2001 (Table 1). The condition can be found in nearly all stands of subalpine fir, and can be a significant challenge for management in developed recreation areas.
In Wyoming, roughly 70,000 subalpine fir (SAF) located on 36,000 acres within the Bighorn National Forest were affected by SAF decline in 2000. In 2001, 20,000 trees on 4,000 acres were affected in the Bighorn National Forest. A total of 20,000 trees on 10,000 acres were affected by SAF decline in the Shoshone National Forest in 2001.

Pinyon pine decline

Colorado
Host (s): Pinyon pine

Pinyon pines in Colorado were greatly affected by decline. Affected areas include native pinyon stands and many areas of planted ornamentals. The Buena Vista area is well-known for its "decline". Other areas of widespread dieback and death of this species include the southeastern plains east of Walsenburg (Pinyon Canyon and Kim, in particular), the west side of the Sangre de Cristo Mountains near Crestone, near Canon City, south of Montrose, the Mesa Verde area, and northwest of Paradox. The widespread nature of these occurrences would seem to indicate a weather-induced cause. (see Special Projects section)

Weather Damages

Colorado, Kansas, Nebraska, South Dakota, Wyoming
Host (s): All Species

Drought - Pinyon pine was declining in the Buena Vista, CO area due to mild winters and warm, dry summers. High conifer seedling mortality was noted in the region.

Frost – Late freezes in Colorado during May and June resulted in foliage loss for many deciduous and conifer trees. Aspen, fir and spruce throughout Colorado showed damaged buds or lack of foliation; gamble oak in Southern Colorado showed significant discoloration caused by freezing. The loss of new coniferous growth may setback defoliating insects dependant on new growth such as western spruce budworm. Loss of fruit on some of the deciduous trees and shrubs resulted in more frequent reports of bears venturing into residential areas.

Hail - A large hail storm damaged 2,000 acres of forest in the Black Hills. Damage varied considerably but many ponderosa pine were later infested with Ips beetles and Diplodia blight. Oaks and other hardwood species survived with minimal setbacks.

Strong Winds - A wind/snow event occurred in the Black Hills during April 2000. This storm impacted about 661 square miles of private land. Approximately 1000 ponderosa pines on state-trust lands were blown over in northeast Wyoming. Wind damaged 3,000 acres in high elevations of the White River National Forest in Colorado. This blow down will contribute to the increase of spruce beetle populations in the area. Other areas of concern include the San Juan, Routt, and Medicine Bow National Forests where past blow down events have created suitable breeding habitat for spruce beetle.

Chemical Damage

Colorado, Kansas, Nebraska, South Dakota, Wyoming
Host (s): All Species

Dust-control materials utilizing magnesium chloride are being increasingly applied in the mountain road systems in Colorado, with corresponding increases in tree damage. Both coniferous and deciduous hosts have been affected, particularly Engelmann spruce and narrowleaf cottonwood. Herbicide damage to windbreaks and other tree plantings continued to be a serious problem in the central portion of Kansas. Pesticide drift from crop weed control programs caused noticeable damage in parts of Kansas.

Table 3.

NON-NATIVE, INVASIVE INSECTS AND PATHOGENS IN THE ROCKY MOUNTAIN REGION (Insects and pathogens historically not found in the Rocky Mountain Region)

Common Name	Scientific Name	CO	KS	NE	SD	WY
INSECTS						
Bronze Birch Borer	*Agrilus anxius*	x		x	x	x
Juniper Scale	*Carulaspis juniperi*	x				
Pine Needle Scale	*Chionaspis pinifoliae*		x	x	x	
Jack Pine Budworm	*Choristoneura pinus*			x		
Poplar and Willow Borer	*Cryptorhynchus lapathi*	x			x	x
Honeylocust Pod Gall Midge	*Dasineura gleditchiae*				x	x
Juniper Webworm	*Dichomerus marginnela*	x				
Spruce Needleminer	*Endothenia albolineana*				x	
Elm Leafminer	*Fenusa ulmi*	x				
European Elm Scale	*Gossyparia spuria*	x	x		x	x
Honeysuckle Witches-broom Aphid	*Hyadaphis tartaricae*	x			x	
Oystershell Scale	*Lepidiosaphes ulmi*	x	x	x	x	x
European Sawfly	*Neodiprion sertifier*		x	x	x	x
Lilac (ash) Borer	*Podosesia syringae*	x	x	x	x	x
San Jose Scale	*Quadrispidiotus perniciosus*	x				
Nantucket Pine Tip Moth	*Rhyacionia frustrana*		x	x		
Smaller Elm Bark Beetle	*Scolytus multistriatus*	x	x	x	x	x
Bagworm	*Thyridoptereyx ephemeraeformis*		x	x		
Pine Tortoise Scale	*Toumeyella parvicornis*		x			
Elm Leaf Beetle	*Xanthogaleruca luteola*	x	x	x	x	x
PATHOGENS						
Pinewood Nematode	*Bursaphelenchus xylophilus*		x	x		
Juniper Botyrodiplodia	*Botryodiplodia spp.*		x	x		
Oak Wilt	*Ceratocystis fagacaerum*		x	x		
Dutch Elm Disease	*Ceratocystis ulmi*	x	x	x	x	x
Cercospora Blight	*Cercospora sequoiae*		x	x		
White Pine Blister Rust	*Cronartium ribicola*	x			x	x
Brown Spot	*Scirrhia acicola*		x			
Pine Tip Blight	*Sphaeropsis sapinea*		x	x		
Thyronectria canker	*Thyronectria austro-americana*	x	x	x		

Other Insects and Diseases of Concern

Insect Activity

ORGANISM	HOST and LOCATION	REMARKS
FOLIAGE FEEDING INSECTS		
Bagworm *Oiketicus* spp. *Thyridopteryx* spp.	Eastern redcedar, Rocky mountain juniper **KS**	After 3 years of heavy damage, the bagworm population moderated
Brownheaded Ash Sawfly (*Tomostethus multicinctus*)	*Ash* **CO**	Overwintering adults of Brownheaded Ash Sawfly (*Tomostethus multicinctus*) staged an impressive late spring flight in the Boulder-Denver-Colorado Springs corridor but defoliation was thwarted by late frosts that apparently impacted egg hatch and early larval development.
Cankerworms *Alsophila pometaria* *Paleacrita vernata*	Bur oak, Elm, Green ash, Hackberry, Honeylocust **KS, SD, WY**	Damage was light in KS in 1998.
Douglas-fir tussock moth, *Orgyia pseudotsugata*	Douglas-fir **CO**	Tussock moth defoliation of white fir was noted in 2000 in extreme southern Colorado. Approximately 200 acres of private land were impacted southeast of Trinidad, CO.
Elm leaf beetle *Xanthogaleruca luteola*	American elm, Siberian elm **CO, KS, NE, SD**	Damage was unusually light in Kansas. Elm Leaf Beetle (*Xanthogaleruca luteola*) defoliation of elms, particularly Siberian elm, was noticeably increased in 2000 over the past several years throughout the eastern plains of Colorado. These leaf skelitonizers are severe in pockets throughout South Dakota on residential trees.
European pine sawfly *Neodiprion sertifer*	Scotch pine **KS, NE, SD**	Reports of damage were quite common from Christmas tree growers in eastern Kansas.
Fall webworm *Hyphantria cunea*	Cottonwood, Walnut, Hickory, Mulberry **CO, KS, SD, WY**	In Kansas, first generation populations were very common, while second generation populations were low. Fall Webworm defoliation and "tenting" of various hosts, particularly plains and narrowleaf cottonwoods, in Colorado's Front Range canyons and on the eastern plains was abundant in 2000. Cottonwoods and Boxelder trees along the Arkansas River near Salida, CO were completely defoliated during summer 2001. Grand Junction, CO had heavy fall webworm activity.
Imported Honeysuckle aphid *Hyadaphis tataricae*	Tatarian honeysuckle **KS, SD**	In Kansas, populations were light to heavy. Tatarian honeysuckle is seldom planted in windbreaks now due to this very serious insect pest.
Jack pine budworm, *Choristoneura pinus*	Jack pine **NE**	Populations of jack pine budworm have declined on the forest. Stands that were severely defoliated are now being attacked by Ips beetles.
Juniper sawfly *Monoctenus fulvus*	Eastern redcedar, Rocky Mountain juniper KS	Populations in Kansas were light.

Loblolly pine sawfly *Neodiprion taedae* *N. fulviceps*	Austrian pine, Ponderosa pine **CO, KS**	Light damage appeared restricted to three northwest counties. This insect species is expected to move south and east into Kansas and will be monitored. A 1998-1999 infestation of sawfly (*Neodiprion fulviceps*) scattered over 20,000 acres of ponderosa pine "stringers" in the eastern Black Forest of Colorado totally collapsed in 2000. Very few trees suffered permanent injury.
Oak leaf roller Tortricidae	Gambel Oak **CO**	The oak leaf roller defoliated large acreages of Gambel oak over large areas of Colorado. Outbreaks occurred spontaneously in widely separated locales on both sides of the Continental Divide. Most of the defoliation occurred in the late spring and most of the affected oaks were able to produce a second flush of leaves, which escaped defoliation. The widespread defoliation was a previously unrecorded phenomenon and it was unknown if the defoliation will re-occur. Approximately 43,254 acres were affected.
Pine butterfly *Neophasia menapia*	Ponderosa pine **SD**	Very light and scattered in the Black Hills
Pine needle miner	Scotch pine **KS**	Common in northeast Kansas. The damaging agent is not yet identified and may be either a pine needle miner or one or more pine tip moth species. Economic importance is limited to Christmas tree plantations.
Pine needle scale *Chionaspis pinifolia*	Austrian pine, ponderosa pine, Scotch pine **KS**	Damage increased to an overall moderate level ranging from light to heavy.
Pine sawflies *Neodiprion autumnalis,* *Neodiprion fulviceps*	Ponderosa pine **CO, SD, WY**	Only very light and scattered populations in South Dakota and Wyoming.
Pine tortoise scale *Tourmeyella parvicornis*	Austrian, red, Scotch pines **KS**	Populations increased this year. Heavy populations were reported in Butler County. This insect is very common in northeastern Kansas and probably occurs statewide.
Pinyon Needle Scale (*Matsucoccus acalyptus*).	Pinyon pine **CO**	This has reappeared in a historical area of periodic infestation near Nathrop and as far north as Buena Vista. In combination with the areas of "pinyon decline", considerable discoloration and dieback are occurring
Ponderosa Pine Needleminer (*Coleotechnites ponderosae*)	Ponderosa pine **CO**	This insect continues at high levels throut the forested portions of the Black Forest in Colorado. Tip damage occurs to the distal half of old needles and is not considered particularly harmful other that reduced radial growth.
Tiger Moth (*Lophocampa ingens*)	Conifers **CO**	This insect occurred on many conifers in scattered locations throughout the lower elevations east side of the Rockies. One unusual case involved infestation of pinyon at Ridgway State Park; this defoliator of conifer leaders was considered common in the Pingree Park area, Larimer Co.

Walnut caterpillar *Datana integerrima*	Black walnut, Bur oak, Hickory, Pecan **KS, NE**	Damage was light in Kansas.
Walnut trunk webbing caterpillar *Gretchena concitatricana*	Walnut **KS**	Larval populations and leaf damage were low. The populations were not sufficient to cause any webbing on tree trunks. Little is known of the population dynamics or long-term host impacts of this insect.
Yellownecked caterpillar *Datana ministra*	Oaks, Basswood, Elm, Fragrant sumac, Maple **KS**	Damage was below normal and populations were not large enough to cause complete tree defoliation.
BORING SHOOT AND STEM INSECTS		
Ash/lilac borer *Podosesia syringae*	Green Ash **KS, SD**	These boring pests have caused lodging of green ash in shelterbelt plantings on private lands. Sporadic reports from Kansas ranged from light to heavy. This very common pest limits the use of green ash in windbreaks to very fertile, moist sites.
Carpenterworm (*Prionoxystus robiniae*)	Hardwoods **CO**	This affected globe willow ornamentals in the Grand Junction area and was reported at chronically moderate levels in deciduous hosts in windbreaks and ornamentals in eastern Colorado.
Dioryctria pine moths *Dioryctria sp.*	Austrian pine, Pinyon pine, Ponderosa pine, Scotch pine **CO, NE, SD**	Populations appeared to be down, however, there were areas of heavy damage in the Nebraska NF. These insects continue to kill branches and entire trees in pine windbreaks and plantations in central and western NE.
Peach Tree Borer (*Synanthedon exitiosa*)	Stone fruit trees **CO**	This continued as a major pest of ornamental stone fruits in the Grand Junction area.
Pine tip moths *Rhyacionia bushnelli, R. neomexicana* *Dioryctria albovitella*	Austrian pine, Ponderosa pine, Scotch pine, Virginia pine, Pinyon pine **CO, NE, KS, SD, WY**	Pine Tip Moths (*Rhyacionia* neomexicana in the northern plains and foothills and *R. bushnelli* in the southern plains, *Dioryctria albovitella* in pinyon and other minor species continue to cause chronic tip damage on seedling and sapling pine hosts.
Red turpentine beetle *Dendroctonus valens*	Jack pine, Ponderosa pine **CO, NE, SD, WY**	Populations of red turpentine beetle have increased dramatically due to large fires. Many of the heavily fire scorched trees were infested. At this time, there has been little movement from fire scorched trees out into green trees.
Southern pine engraver *Ips grandicollis*	Scotch pine **KS**	The large population increase this year may be due to tree stress from high temperatures and wind in May.
Twig beetles *Pityophthorus* spp. *Pityogenes* spp.	Pinyon pine, Ponderosa pine **CO**	Large numbers of twig beetles were evident in pinyon stands south of Montrose, CO. Large clearings and resulting untreated slash piles may be contributing factors. Urbanization of the pinyon juniper forests is creating stresses not previously documented in this cover type.
Zimmerman pine tip moth *Dioryctria ponderosae* *D. zimmermani*	Austrian pine, Scots pine, ponderosa pine **CO, KS**	Zimmerman Pine Moth (*Dioryctria zimmermani*) and relatives continue to increase in impact to ornamental ponderosa, Scots and particularly Austrian pines along the Front Range and eastern plains.

Disease Activity

STEM, BRANCH, AND CANKER DISEASES		
Black knot *Apiosporina morbosum*	Chokecherry, Plum **CO, KS, NE, SD, WY**	This disease is common on wild plums and chokecherry bushes.
Black target canker *Ceratocystis fimbriata*	Aspen **CO**	The most common canker disease of aspen in Colorado. It is mainly a concern in developed recreation sites.
Comandra blister rust *Cronartium comandrae*	Lodgepole pine, Ponderosa pine **CO, SD, WY**	This disease continues as one of the most common and destructive diseases of hard pines in northern Colorado, western South Dakota and Wyoming, but is of concern in only a few areas.
Cryptosphaeria canker *Cryptosphaeria populina*	Aspen **CO, SD**	Common in many aspen stands throughout Colorado.
Cytospora canker *Cytospora spp*. *Leucocytospora spp.*	Aspen, Cottonwood, Poplar, Spruce, Willow **CO, KS, NE, SD, WY**	This disease is common on aspen.
Elytroderma needlecast *Elytroderma deformans*	Ponderosa, lodgepole, and Jack pines **CO, NE, SD, WY**	This disease damages trees in many areas with hard pines.
Fir broom rust *Melampsorella caryophyllacearum*	Subalpine fir **CO, WY**	This disease is common throughout the spruce/fir cover type in Colorado and south central Wyoming where it causes only minor damage.
Fire blight Erwinia amylovora	Apple species, Cotoneaster, Crabapple **CO, SD, WY**	Around Beulah, SD, very heavy incidence was noted in 2000 to ornamental fruit trees, particularly apple.
Russian Olive canker *Phomopsis arnoldiae* *Tubercularia* spp. *Lasiodiplodia* spp.	Russian olive **KS, NE, SD, WY**	Continues to be a very serious problem in the eastern half of Kansas; Russian Olive is no longer recommended for use in conservation plantings.
Sooty bark canker *Encoelia pruinosa*	Aspen **CO**	Common in aspen stands in CO. The most important mortality agent of aspen in CO.
Spruce broom rust *Chrysomyxa arctostaphyli*	Engelmann, blue and white spruces **CO, SD**	Common on spruce trees in Colorado and South Dakota where it generally causes only minor damage.
Thyronectria canker *Thyronectria austro-americana*	Honeylocust **CO, KS, NE**	Appears to be increasing statewide in KS in windbreaks and landscape trees.
Western gall rust *Endocronartium harknessii*	Lodgepole pine, Ponderosa pine **CO, KS, NE, SD, WY**	Widely distributed in the Black Hills and contributing to the death of small ponderosa pine trees. The disease also can be found on the limbs of larger trees but normally not a severe problem.

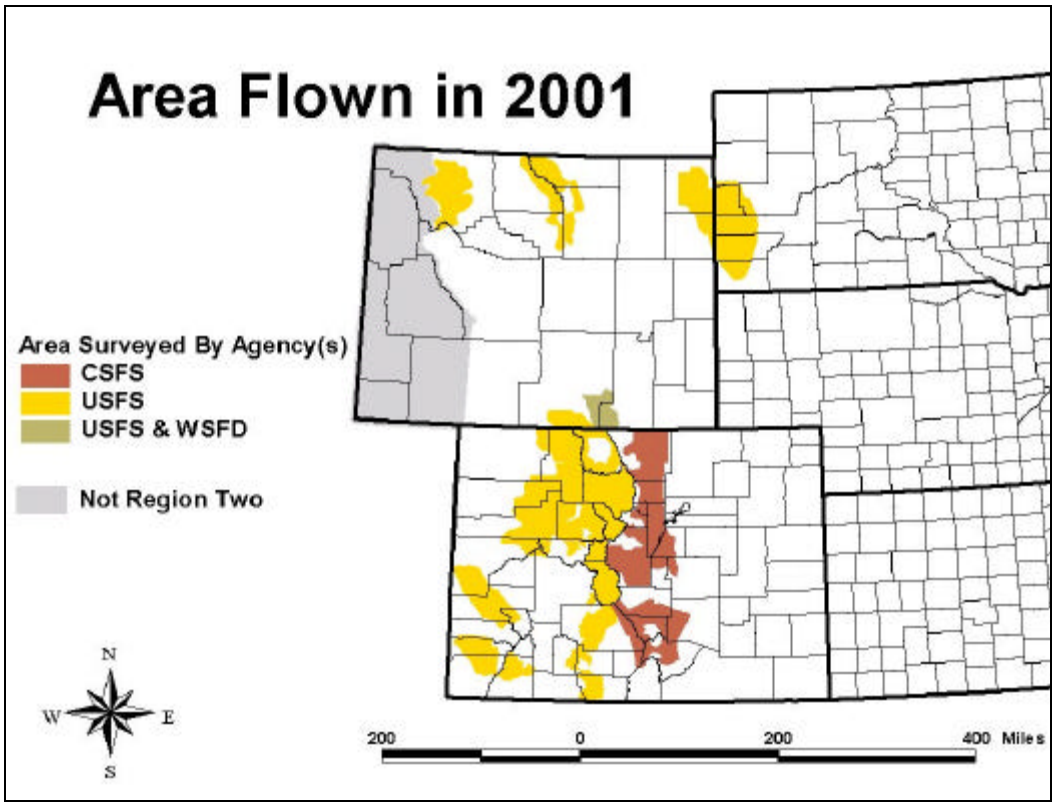
VASCULAR WILTS, DECAYS AND ROOT DISEASES		
Ash yellows Caused by phytoplasmas	Green ash, white ash **CO, KS, NE, SD, WY**	Large-diameter green ash in Grand Junction, the Denver area and other urban centers are declining in 2000. Biotic causes are difficult to assign to this, although the elusive Ash Yellows virus could be involved.
Aspen trunk rot *Phellinus tremulae*	Aspen **CO, SD**	Common throughout Colorado aspen stands.
Oak wilt *Ceratocystis fagacearum*	Bur and red oaks **NE**	Oak wilt continues to cause mortality in forests along the eastern edge of the state.
Pine wilt and Pinewood nematode *Bursaphelenchus zylophilus*	Scotch, Austrian, and white pines **KS, NE, SD**	The incidence of pine wilt was lower in 2001 than it had been in the previous two years. About 900 of the trees killed in NE are Scotch pines. Serious mortality from pine wilt is occurring mostly in Lincoln and North Platte, NE. Heavy mortality linked to this nematode was found frequently throughout the Kansas, mostly affecting Scotch Pine. This damage has been found in native ponderosa pine southeast of Sturgis, SD.
White mottled rot *Ganoderma applanatrum*	Aspen **CO, WY**	Common an aspen stands in Colorado, especially on rich, deep soils. Contributes to hazard conditions in campgrounds.
FOLIAGE DISEASES		
Anthracnose *Gnomonia* spp. *Discula* spp. *Gnomoniella fraxini*	Walnut, Ash, Maple, Sycamore **CO, KS, NE, SD, WY**	A recurring problem on several hardwood species in Kansas. Reported as heavy.
Aspen leaf blights *Ciborina whetzelii* *Marssonina populi*	Aspen **CO, SD**	Foliage diseases were rare since much of the spring and summer was dry. Presence of Marssonina in aspen declined significantly following two years of widespread impact in southwestern CO.
Brown spot needle blight *Scirrhia acicola* *Mycosphaerella dearnessii*	Scotch pine **KS, NE**	Continues as a serious threat to Christmas tree plantations in KS. Growers continue to remove and destroy many heavily infected trees.
Cedar apple rust *Gymnosporangium juniperi-virginiana*	Apple species, Eastern redcedar, Rocky Mtn. juniper, Utah juniper **CO, KS, NE, SD, WY**	A serious economic pest in some fruit orchards. Moderate to heavy infection reported this last year.

Cercospora blight of juniper *Cercospora sequoiae*	Eastern redcedar, Rocky Mtn. juniper **KS, NE, SD**	A severe problem on Rocky Mtn. juniper in eastern Kansas. It is recommended that this species not be planted in these areas. This disease continues to severely defoliate and kill junipers and redcedars in windbreaks in central and eastern NE.
Conifer-aspen rust *Melampsora medusae*	Aspen, Douglas-fir, lodgepole pine, ponderosa pine **CO, NE, SD**	No significant activity was reported.
Dothistroma needle blight *Dothistroma spp.* *Mycosphaerella pini*	Austrian, ponderosa, limber pines **KS, NE, WY**	Damage was reported as light to heavy in the eastern half of Kansas and timely pesticide applications are needed to control the disease.
Juniper Blight *Phomopsis juniperovora*	Eastern redcedar, Rocky Mountain Juniper **NE, KS**	This disease usually occurs at low infection levels throughout the Rocky Mountain Region. Bessey Nursery in Nebraska and Kansas nurseries had fewer disease problems than in recent years due to very dry summers.
Juniper Rust *Gymnosporangium nelsonnii* *G. juniperi-virginianae* *G. bethelii* *G. speciosum*	Rocky Mountain juniper, Eastern redcedar, Utah juniper, Serviceberry **CO**	In 2000, heavy telial sporulation occurred for various rusts on junipers and cedars. Particularly cedar-apple rust (*G. juniperi-virginianae*) on the extreme eastern plains, cedar knotgall rust (*G. bethelii)* in Rocky Mountain juniper in the Front Range foothills, and orange gall rust (*G. speciosum)* on Utah juniper throughout western Colorado had increases in these diseases.
Melampsora leaf rusts *Melampsora* spp.	Aspen, Cottonwood, Willow **CO, KS**	No significant activity was reported.
Needle casts *Lophodermella concolor* *L. montivaga* *L. cerina* *Rhabdocline pseudotsugae*	Lodgepole pine, ponderosa pine, Douglas-fir **CO, WY**	Douglas –fir needlecast disease (*R. pseudotsugae*) continues to be common in foothills regions west of the northern Front Range (Poudre and Rist Canyons, for example).
Sphaeropsis (Diplodia) blight *Sphaeropsis sapinea*	Austrian pine, ponderosa pine, lodgepole pine **KS, NE, SD, WY**	Although widespread in 2000, this disease is seldom a lethal disease on ponderosa pine in the Black Hills. In 2001, concern for this disease increased following 2 years of heavy, widespread hail damage in areas west of Rapid City and Hill City.

2001 Rocky Mountain Region Aerial Survey

General aerial detection surveys of damage and mortality in forest stands due to insects, diseases and other forest health stressors in the Rocky Mountain Region were flown between early July and late September of 2001 by Erik Johnson, Bill Schaupp, Kelly Sullivan, Daniel Long, (USFS Region 2, Forest Health Management), Les Koch (Wyoming State Forestry Division) and Dave Leatherman (Colorado State Forest Service). Approximately 25 million acres were surveyed within the Rocky Mountain Region in 2001 (Figure 11, Table 4). Most of the areas known to have significant forest pest activity in 2001 were included in this survey.

Figure 11. Rocky Mountain Region's 2001 aerial survey coverage by surveying agency.



County	State	% Forested Acres Flown	County	State	% Forested Acres Flown
Alamosa	CO	100%	Jefferson	CO	100%
Archuleta	CO	30%	La Plata	CO	43%
Boulder	CO	87%	Lake	CO	100%
Chaffee	CO	100%	Larimer	CO	71%
Clear Creek	CO	55%	Mesa	CO	45%
Conejos	CO	80%	Mineral	CO	20%
Costilla	CO	50%	Moffat	CO	14%
Custer	CO	83%	Montezuma	CO	37%
Delta	CO	7%	Montrose	CO	48%
Dolores	CO	65%	Ouray	CO	36%
Douglas	CO	93%	Park	CO	83%
Eagle	CO	95%	Pitkin	CO	49%
El Paso	CO	34%	Pueblo	CO	65%
Fremont	CO	43%	Rio Blanco	CO	33%
Garfield	CO	57%	Rio Grande	CO	57%
Gilpin	CO	84%	Routt	CO	99%
Grand	CO	100%	Saguache	CO	75%
Gunnison	CO	7%	San Juan	CO	15%
Hinsdale	CO	1%	San Miguel	CO	15%
Huerfano	CO	48%	Summit	CO	100%
Jackson	CO	98%	Teller	CO	39%
Butte	SD	10%	Lawrence	SD	100%
Custer	SD	95%	Meade	SD	90%
Fall River	SD	80%	Pennington	SD	90%
Albany	WY	36%	Johnson	WY	48%
Bighorn	WY	96%	Park	WY	61%
Carbon	WY	72%	Sheridan	WY	92%
Crook	WY	82%	Washakie	WY	51%
Fremont	WY	3%	Weston	WY	84%

Table 4. Listing of state counties surveyed by percentage of the county's forested area flown. Percentage figures for South Dakota's counties are approximations due to lack of forest cover data.

Due to the nature of aerial surveys, the data and maps within this document will only provide rough estimates of location, intensity and trend information for agents detectable from the air. Many of the most destructive diseases are not represented in this document because these agents are not detectable from aerial surveys. The data presented in this document 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. Shaded areas on maps show locations with tree mortality or defoliation apparent from the air. Intensity of damage is variable and not all trees in shaded areas are dead or defoliated.

2001's aerial survey data for the state of Colorado is available in digital format for use in a Geographic Information System (GIS) database. The files can be found at the following FTP address: ftp://ftp.fs.fed.us/incoming/r2/ro/aerial_survey/2001/ (please note that the *entire* pathway must be typed). Download the forest damage coverage (r201_dmg.e00) and the areas flown and not flown coverage (r201_flown.e00). ArcView shapefiles are also available at this site. In addition to the GIS files, please open the folder entitled "meta_data" ftp://ftp.fs.fed.us/incoming/r2/ro/aerial_survey/meta_data/ and download the three documents explaining the fields in the polygon attribute tables (PAT): the ***Aerial Survey Geographic Information System Handbook***: *Sketchmaps to Digital Geographic Information* (gis_handbook.pdf), the PAT explanation document (about_pat_table.xls), and the USFS Region 2 "pest code" document (r2_pest_codes2000.doc). The ***Aerial Survey Geographic Information System Handbook***: *Sketchmaps to Digital Geographic Information*, is also available at the Forest Health Technology Enterprise Team's (FHTET) Forest Health website: http://www.fs.fed.us/foresthealth/id/id_guidelines.html (bottom of page). For additional information regarding the GIS data, please contact Steve Gregonis sgregonis@fs.fed.us 303-275-5017, or Erik Johnson ejohnson02@fs.fed.us 303-236-8001.

Forest Health Management Special Regional Projects
2000 - 2001

Project Title: Insect/Disease and Hazard Tree Surveys in campgrounds and other recreational sites:

Investigators: Jim Worall; Carol McKenzie, Bob Vermillion, Kathy Peckham and Lew French, GMUG NF; Mike Kenealy and Cary Green, White River NF; Mena Shepard, Dave Crawford and Steve Hartvigsen, San Juan NF.

Years: 2000 - 2001

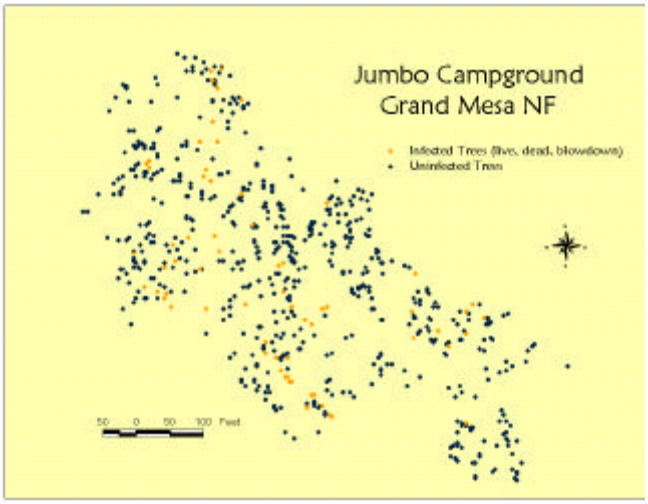
Project Description: General Insect/Disease and hazard tree evaluations were performed for several campgrounds and other recreational sites (trailheads, overlooks, points of interest) around the Rocky Mountain Region. Defective trees were documented and reports were provided to recreation managers of each national forest. Forest managers were encouraged to do complete, annual, documented surveys of the campgrounds. In 2000, FHM training in hazard tree detection was done June 26-27 on the Grand Mesa, CO and June 11 in Spearfish, SD. Trainings in 2001 were held June 26 in Steamboat Springs, CO and July 10-11 in Carbondale, CO.

Project Title: Epidemiology of Armillaria Root Disease in Campgrounds

Investigators: Jim Worrall, Kelly Sullivan, Tom Harrington (Iowa State Univ.)

Years: 2000 - present

Project Description: The goal of this project is to better understand how Armillaria root disease spreads in campgrounds of the central Rocky Mountains. In 2000 we intensively surveyed three campgrounds for Armillaria. Infected trees and stumps were mapped, data on trees and symptoms were recorded, and samples were collected. From over 500 samples, 370 isolates were purified. A subset will be identified to species by restriction digests of amplified IGS sequences, and somatic incompatibility and DNA fingerprinting will determine clonal identity of isolates. Based on the pattern of genet structure and other information, managers will be informed of mode of spread, factors that may influence infection, and any modified management recommendations.



Results of sampling and mapping Armillaria in one of the campgrounds that were intensively surveyed. Of the live trees in the campground, 10% had advanced infection by the root disease.

Project Title: GIS - based Landscape Scale Root Disease Hazard Rating/Prediction System for Pinyon Pine Decline in southern Colorado FHM.

Cooperators: William Jacobi, Dept. of Plant Pathology, Colorado State University (CSU), Robin Reich and Gene Kelly of Dept. of Forestry, CSU, Holly Kearns and Sam Harrison, Master of Science graduate students CSU; Jose Negron and John Lundquist, Rocky Mountain Forest and Range Experiment Station, USDA Forest Service. Eric Smith, Forest Health Technology Enterprise Team; John Guyon, Region 4, Forest Health Protection; Terry Rogers, Region 3, Forest Health Protection; Dolores Ranger District, San Juan NF; Jim Friedley, BIA Southern Ute Agency; John Waconda, BIA Albuquerque Area Office; Dan Ochocki, Colorado State Forest Service, Durango District

Years: Began 1998; End 2002.

Project Description: Although a variety of causes are responsible for mortality of pinyon pine in various areas, in many locales the key agents are black stain root disease *(Leptographium wageneri)* and pinyon Ips *(Ips confusus*). Black stain, a vascular wilt, was first noted in Colorado in 1942, within Mesa Verde National Park. It is now a significant concern on federal, tribal, state and private lands in southwestern Colorado.

Using aerial photography and site visits by field personnel, mortality centers in pinyon pine on the San Juan National Forest and Southern Ute Indian Reservation were located and entered into a GIS database along with soil and site characteristics and locations of disturbed areas. By analyzing the data using spatial statistics, a hazard rating system will be developed for pinyon pine decline in southwest Colorado.

Ground transects were run over a sample of mortality sites, where insect, disease, and site characteristics were recorded. Kearns (2001) completed a Master's thesis documenting tree and stand characteristics within pinyon mortality centers.

Project Title: Pest Trend Impact Plots in the West-Rocky Mountain Region

Investigators: Jeri Lyn Harris, Tom Eager, Jim Worrall, Dave Johnson, Bernard Benton, Dan Long, Lee Pederson, and Kelly Sullivan

Cooperators: Judy Adams, FHTET; Jim Friedly, BIA Southern Ute Agency; Elizabeth Stiller, Phil Grumstrup, and Gary Say, Black Hills NF; Sam Schroeder, White River NF; Gary Roper, Mike Morrison and Mark Westfahl, Routt NF; Paul Langowski and Steve Johnson, Roosevelt NF; Jon Morrissey, Grand Mesa / Uncompahgre / Gunnison NF's; Phil Kemp and Bob Vermillion, San Juan NF; Dennis Eckhardt, Kim Barber, Karl Brauneis, Pat Heuer, Mark Hinschberger, and Roy Bergstrom, Shoshone NF; Chris Thomas, Bighorn NF; and Bill Hill, Custer State Park, South Dakota.

Years: Began 1991; ongoing.

Project Description: Since 1991, Region 2 has been actively involved with the technology development project, "Pest Trend Impact Plots in the West". The objective of the project is to establish a series of permanent plots to provide data for the validation and calibration of various insect and disease computer simulation models. A second objective of these plots was to monitor the spread and impact of these diseases and insects.
Region 2 installed several plots to provide modeling and monitoring data. In 1997, dwarf mistletoe plots were established in Colorado and white pine blister rust plots were installed throughout Wyoming and South Dakota. In 1998, all of the root disease permanent plots throughout Colorado and South Dakota were re-measured, and more white pine blister rust plots were established in Wyoming. In 1997-1998, several subalpine fir decline plots were established in national forests in Colorado, Utah, and Wyoming to evaluate subalpine fir mortality caused by root disease and western balsam bark beetle.

The Comandra Blister Rust and White Pine Blister Rust plots were remeasured in 2000. Most of the root disease plots were remeasured in 2001; summary reports of the root disease conditions on the various plot sites are in preparation for future modeling efforts.

Project Title: Alternatives to Fumigation for Nursery Diseases II.

Investigators: Mike Teberg and Jay Dunbar, Bessey Nursery; Jeri Lyn Harris, R2 FHM.

Cooperators: Robert James, Coeur d'Alene Nursery, USFS Region 1; Lucky Peak Nursery, USFS Region 4; Susan Frankel, Placerville Nursery, USFS Region 5; Diane Hildebrand, J. Herbert Stone Nursery, USFS Region 6; Michelle Cram, Toumey Nursery, USFS Region 8; Joe O'Brien and Jill Pokorny, Northeastern Area; Jenny Juzwik, USFS North Central Station; Raymond Allmaras, Agricultural Research Service, St. Paul; Neil Anderson and Cynthia Buschena, University of Minnesota; Badoura State Nursery, Minnesota; Griffith State Nursery, Wisconsin; Jeff Stone and Cynthia Ocamb, Oregon State University; Edward A. Hauss Nursery, Alabama Forestry Commission; Flint River Nursery, Georgia Forestry Commission; Clarence Lemons, Hendrix and Dale, Inc.; Stephan Fraedrich and David Dwinell, Southern Station; Scott Enebak, Auburn University.

Years: Began 1998; End 2001.

Project Description: Building on the information learned from a previous nursery Technology Development Proposal (Alternatives to Fumigation, R6-93-01), nurseries in every Region (except 3 and 10) participated in field comparisons of a variety of chemical and cultural treatments customized for each nursery. Four soil treatments were compared at Bessey Nursery in Nebraska: methyl bromide fumigation, Basamid addition, solarization, and fallowing with tilling. Experimental blocks were treated with one of the above treatments and then planted with eastern redcedar. Soil samples were collected from each block before and after treatments; these were analyzed for the presence of pathogenic fungi and nematodes. As seedlings germinate and grow, the experimental blocks were evaluated for quantity and quality of the seedlings in 1999 and 2000. Seedlings were lifted and sold in Spring 2001 and final soil samples and seedling quality tests performed.

Project Title: Evaluation of Phomopsis blighted Eastern redcedar seedlings from Bessey Nursery in 4 Great Plains outplantings

Investigators: Jeri Lyn Harris and Dave Johnson.

Cooperators: Jay Dunbar and Mike Teberg, Bessey Nursery; Bill Lovett, Nebraska Forest Service; Kathy Vliem, SD Natural Resource Conservation Service; Brent Olson, Iowa State Forestry; Bob James, R1 FHP; Tom Landis, USDA Forest Service nursery specialist.

Years: Began 1999; End 2002.

Project Description: After an epidemic of Phomopsis blight on the Eastern redcedar crops at Bessey Nursery in 1999, nursery managers were interested in testing the survival of blighted seedlings in Great Plains outplantings. In early April 2000, two seedlots of 2-0 Eastern redcedar seedlings experiencing the epidemic were lifted and evaluated as to the level of blight damage. Seedlings with less than 33% blight symptoms were outplanted in 4 locations (Central NE, Eastern NE, Western IA, and Western SD) using a randomized block design of seedlots and disease levels. Seedling survival in the 4 outplantings was evaluated after the 2000 growing season. Two-thirds of the seedlings survived the first year. The outplantings will be evaluated again after the 2001 growing season.

Project Title: Test of carbaryl and permethrin as preventatives for mountain pine beetle in South Dakota and Colorado

Investigators: Kurt Allen, Tom Eager, Roy Mask, Joel McMillin , Dan Long

Cooperators: Blaine Cook and John Natvig, Black Hills NF, Pat Shea, PSW (Retired),John Ball, SDSU, Pope and Talbot, Warne Chemical

Years: 2000-2001

Project Description: Field tests were undertaken to look at the effectiveness and longevity of carbaryl and permethrin as preventative sprays against the mountain pine beetle in South Dakota and Colorado. Trees were sprayed at labeled rates to runoff and then baited to assure beetle pressure. Preliminary data indicate that both chemicals provide protection for one year, and perhaps a second year with carbaryl.

Project Title: Use of verbenone as an anti-aggregant for mountain pine beetle in the Black Hills.

Investigators: Kurt Allen, Joel McMillin , Dan Long

Cooperators: Blaine Cook and John Natvig, Black Hills NF, Jose Negron, RMRS

Years: 2000

Project Description: Verbenone has been suggested to have some anti-aggregation effects against mountain pine beetle. A field trial of verbenone bubble caps was set up in an area of moderate mountain pine beetle activity in the Black Hills to determine what, if any, effect it would have as a stand protection measure. Two levels of verbenone were used, and though results proved inconclusive, when used at the higher rate, there did seem to be some effect. At this point, we cannot suggest the use of verbenone as a potential stand protection method. New pheromone dispenser technology and inclusion of other chemicals with the verbenone may provide better results in the future.

Project Title: The role of wildland fire and subsequent insect attack on ponderosa pine mortality

Investigators: Kurt Allen, Joel McMillin , Dan Long

Cooperators: John Anhold and Linda Wadleigh, R-3, Ken Gibson, R-1, Carolyn Sieg and Jose Negron, RMRS, Black Hills NF, Custer, NF, Arapaho-Roosevelt NF, Coccnino NF, Kaibab NF

Years: 2000-2002

Project Description: This project will help to define the impact caused by insects when interacting with another disturbance agent, wildfire. This will allow FHP to more accurately assist land managers in predicting potential tree mortality in post-fire situations. Currently, there is little information regarding fire/insect impact in ponderosa pine ecosystems across its range in the western United States. For example, written or visual guidelines are lacking for field personnel to determine what tree will live or die relative to the amount of damage caused by fire or the probability of injured trees being killed by insects. Furthermore, the probability of fire-damaged trees providing the source of an insect outbreak that subsequently spreads to uninjured trees remains unknown. The proposed project will address this lack of adequate information by formulating models and creating visual guides and, therefore, permit land

managers to make more informed decisions regarding salvaging and insect control. This information also will be useful in the development of prescriptions for prescribed burning.

- **Year 1 (FY 2001)**

- **Summary**

1. During January through May, the investigators and cooperators met by phone and in the field to standardize procedures, work out kinks in methodology, and train field personnel.
2. Beginning in June, multiple ½ acre transects were installed on five national forests across 4 states (Black Hills National Forest in South Dakota, Custer NF in Montana, Arapaho-Roosevelt NF in Colorado, Kaibab & Coconino NF's in Arizona). Approximately 1,500 ponderosa pine trees were assessed at each site for fire damage and insect presence across varying fire intensities. In addition to quantifying the amount of damage to the crown and bole of trees and insect presence, trees were categorized by diameter, height, dwarf mistletoe infection (Arizona only) and fire-intensity rating of aboveground soil.
3. Approximately the same number of trees were assessed for status and insect presence in undamaged stands adjacent to the fire-impacted lands. These "green tree" transects will be used to monitor the potential movement of insects to and from fire areas and provide background estimates of tree mortality.
4. To determine the relationship between exterior fire damage and the damage to the cambium, 200+ additional trees per fires in Montana, South Dakota, and Arizona were assessed for scorch intensities and cambium health by removing 1-inch phloem plugs from the base of each tree on the four Cardinal directions. These same measurements will be conducted in Colorado in FY 2002.
5. The location of all transects (burned, green tree, and cambium health) were recorded using GPS units and are being entered into GIS layers for relational database analysis.
6. Data collected from fire, cambium health, and green tree transects are being entered.
7. Digital photographs were taken of representative trees by fire-damage categories and different insect symptoms and signs. These will be used to create visual guidelines for forest managers.
8. Aerial surveys also have been conducted over the areas of interest.

- **Preliminary findings**

1. Insect activity was considerable at the Black Hills NF, South Dakota, and Kaibab & Coconino NF, Arizona, fire sites. Both primary (*Ips*, western pine beetle, turpentine beetle) and secondary (wood borers) insects were detected in fire-damaged trees.
2. Additional tree mortality caused by insects is being observed and quantified within the fire study areas.

Project Title: Development of a Monitoring and Management Tool for the Central Rocky Mountain Populations of Mountain Pine Beetle, *Dendroctonus ponderosae*

Investigators: Kurt Allen, Tom Eager, Joel McMillin

Cooperators: Steve Munson, R-2, Steve Seybold, University of Minnesota, Darrell Ross, Oregon State University

Years: 2001

Project Description: Through laboratory and field studies we propose to substantially improve our ability to detect and manage populations of the mountain pine beetle in stands of ponderosa and lodgepole pine in the Rocky Mountains. Through an already established collaborative network at three locations with previously constructed rearing facilities (Ogden, UT; Gunnison CO; & Rapid City, SD), mountain pine beetles will be reared, population-specific blends of semiochemicals will be determined, and field responses will be assayed. Trap catch data will be matched with succeeding aerial mapping data to establish an early warning tool to forecast population trends in this region of the US. An improved mountain pine beetle attractant will also be used to bait trap trees for suppression treatments. Management guidelines utilizing the geographically specific monitoring and tree-baiting tool will be developed and published for widespread use by land managers throughout the central Rocky Mountain area.

Project Title: Flight periodicity of the western balsam bark beetle in Wyoming

Investigators: Kurt Allen, Joel McMillin, Dan Long

Cooperators: Jeff Hogenson, Shoshone NF, Chris Thomas, Bighorn NF

Years: 2000-2001

Project Description: Traps baited with lures were used to determine the periods of flight activity over a five-year period. A consistent pattern of flight initiation and peaks in flight activity was found for western balsam bark beetle. Similar to previous studies in other geographic locations there were two main periods of flight activity. However, flight initiation and the first and larger peak of flight activity occurred later in the season (mid-July) compared with northern Utah and Idaho. The second and smaller peak of flight activity occurred in late August. In the 2000 season, males dominated trap catches during the first 2 weeks and then were female biased the rest of the year. In addition, trap catches of western balsam bark beetle were compared by lure (1999, 2000, 2001) and trap type (2000). No significant differences were detected between lure, trap, or their interaction on the number of beetles trapped during 2000; however, the most beetles were caught in the panel trap/3-component lure combination.

Project Title: Western balsam bark beetle use of spruce-fir blowdown in Wyoming

Investigators: Kurt Allen, Joel McMillin , Dan Long

Cooperators: Chris Thomas, Bighorn NF, Jeff Hogenson, Shoshone NF, Jose Negron, RMRS

Years: 2001-2002

Project Description: Western balsam bark beetle (*Dryocoetes confusus* Swaine) attacks subalpine fir throughout western North America. Tree blowdown is known to trigger outbreaks of certain bark beetles but has not been examined for western balsam bark beetle. This is despite observational studies having found outbreaks of this beetle adjacent to areas of tree blowdown. Objectives of this 2001-2002 study were to determine if western balsam bark beetle successfully attacks and produces brood in downed fir

and determine its life history in blowdown. Study sites were chosen in mixed conifer stands on the Bighorn and Shoshone National Forests in Wyoming. Several trees were felled on both forests in July 2001; ½ were baited with beetle pheromone *exo*-brevicomin. In September, trees were sampled for the number of brood by life stage at various locations on the tree bole. Brood sampling will be repeated in the spring, summer, and fall 2002 to determine the life cycle of this beetle. Western balsam bark beetle attacked and brood are developing to the egg or larval stage in the felled trees. Pheromones did not increase the number of brood in felled trees. Based on the preliminary data, we conclude that western balsam bark beetle takes advantage of storm events that create downed host material. This suggests that prompt management of downed material is needed to reduce the likelihood of subsequent western balsam bark beetle outbreaks.

Project Title: Sixth Annual Forest Health Congressional Tour

Cooperators and Participants: Over 30 people participated in this tour from the USDA Forest Service, Colorado State Forest Service and DNR, county extension agents and community business associates, staff members of the US House of Representatives – Subcommittee on Forests and Forest Health, and other congressional representatives. A list of cooperators and participants will be supplied upon request.

Years: 2001

Project Description: On August 22-24, 2001, the Sixth Annual Congressional Tour visited Steamboat Springs and Vail areas in Colorado to become familiar with forest health, National Fire Plan, and invasive species issues of significance in the Rocky Mountain Region. Participants were able to view the impact of recent bark beetle outbreaks, including the mountain pine beetle and the spruce beetle, and resulting management response at the wildland-urban interface and in developed recreation areas on the Routt National Forest (Steamboat Springs) and the White River National Forest (Vail).

In Steamboat Springs, tour members learned about the 1997 Routt Divide Blowdown event that felled more than 20,000 acres of Engelmann spruce. Speakers described the development of the community-based Bark Beetle Information Task Force to manage public information dissemination following the windstorm, the development of a programmatic Bark Beetle Environmental Impact Statement to address planned management actions, and the efforts undertaken by the Steamboat ski area and Forest Service staff to manage mountain pine beetle and building spruce beetle problems on the ski area. Participants also viewed the impact of the windstorm on a developed recreation area and were presented with information concerning the affects of invasive species on native vegetation.

The tour proceeded to Vail to see the impact of mountain pine beetle on the community. Tour members learned about the coordinated and complementary actions taken by community, state, and federal agencies to implement effective programs to minimize the impact of mountain pine beetle and fuels buildup (National Fire Plan efforts) in the community and the adjacent national forest.

Finally the tour stopped at the Holy Cross Ranger District and looked at thinning actions undertaken by the district to manage stand density and limit losses to mountain pine beetle. Members also saw additional evidence of the impact of invasive species on native plant communities.

Publications 2000 - 2001

Allen, K.K. and J.D.McMillin. 2001. Evaluation of Mountain Pine Beetle activity on the Black Hills National Forest. USDA For. Serv., Renewable Resources, RM Region. Bio. Eval. R2-01-01.

Allen, K.K. and McMillin, J.D. 1999. Evaluation of mountain pine beetle activity in Beaver Park on the Spearfish/Nemo Ranger District of the Black Hills National Forest. USDA For. Serv., Renewable Resources, Rocky Mountain Region. Bio. Eval. R2-00-01. 17p.

Harris, J.L.; Frank, M.; and Johnson, S. 2001. Forest insect and disease conditions in the Rocky Mountain Region, 1997 – 1999. USDA For. Serv., Rocky Mountain Region, Renewable Resources, Forest Health Management. 39p.

Harris, J.L. 1999. White pine blister rust disease of limber pine in the Bighorn and Medicine Bow National Forests. USDA For. Serv., Renewable Resources, Rocky Mountain Region. Bio. Eval. R2-00-02. 8p.

Johnson, D.W. 2000. Evaluation of Porcupine and Snyder Creeks dwarf mistletoe thinning studies Routt National Forest, Colorado. USDA For. Serv., Renewable Resources, Rocky Mountain Region. Tech. Rep. R2-62. 12p.

Johnson, D.W. 2000. Disease survey of Buckhorn Creek lodgepole pine stand forty years after establishment, Canyon Lakes Ranger District, Arapaho and Roosevelt National Forests. USDA For. Serv., Renewable Resources, Rocky Mountain Region. Tech. Rep. R2-63. 5p.

Johnson, D.W. and Jacobi, W.R. 2000. First report of white pine blister rust in Colorado. Plant Disease 84(5): 595.

Koch, L.; Rogers, P.; Frank, M.; Spiegel, L. and Atkins, D. 2001. Wyoming forest health report: a baseline assessment, 1995-1998. Wyoming State Forestry Division and USDA For. Serv., Rocky Mountain Research Station. 52p.

McConnell, T. J.; Johnson, E.W. and Burns, B. 2000. A guide to conducting aerial sketchmapping surveys. USDA For. Serv., Forest Health Technology Enterprise Team, Ft. Collins, CO. FHTECT 00-01. 88p.

McMillin, R.D. and Allen, K.K. 1999. Evaluation of mountain pine beetle activity in the Black Hills National Forest. USDA For. Serv., Renewable Resources, Rocky Mountain Region. Bio. Eval. R2-00-03. 18p.

McMillin, J.D. and Allen, K.K. 2000. Impacts of Douglas-fir beetle on overstory and understory conditions of Douglas-fir stands, Shoshone National Forest, Wyoming. USDA For. Serv., Renewable Resources, Rocky Mountain Region, Tech. Rep. R2-64. 17p.

McMillin, J.D.; Harris, J.L. and Allen, K.K. 2000. Insect and disease survey of the Bighorn National Forest. USDA For. Serv., Renewable Resources, Rocky Mountain Region. Bio. Eval. R2-00-04. 27p.

McMillin, J.D., K.K. Allen, D.F. Long and J.L. Harris. 2001. Impact of Subalpine Fir Decline on the Spruce-Fir Forest Type of the Bighorn National Forest, Wyoming. USDA For. Serv., Renewable Resources, RM Region. Tech. Rep. R2-65.

Negron, J.F.; Schaupp, W.C. Jr. and Johnson, E.W. 2000. Development and validation of a fixed-precision sequential sampling plan for estimating brood adult density of *Dendroctonus pseudotsugae* (Coleoptera:Scolytidae). The Canadian Entomologist 132: 119-133.

Rogers, P.; Atkins, D.; Frank, M. and Parker, D. 2001. Forest Health Monitoring in the Interior West: A baseline summary of forest issues, 1996-1999. USDA For. Serv., Rocky Mountain Research Station and State and Private Forestry, Regions 1-4. 40p.

Schaupp, W.C., Jr. and M. Frank. 2000. Spruce beetle evaluation – 1999. Hahns Peak/Bears Ears Ranger District and Surrounding Areas, Medicine Bow – Routt National Forest, Colorado. USDA For. Serv., Renewable Resources, Rocky Mountain Region. Bio. Eval. R2-00-05. 35p.

Service Trip Reports

GUNNISON SERVICE CENTER

GSC-00-01 Sig Creek Campground, Hazard Tree Follow-up Report, SJNF
GSC-00-02 Lone Cone Spruce Fir Forest Conditions, GMUG NFs
GSC-00-03 Grand Mesa Spruce Beetle/Blowdown, GMUG NFs
GSC-00-04 High Mesa Spruce Fir Blowdown, GMUG NFs & BLM
GSC-00-05 Baylor Park Spruce Fir Blowdown, WRNF
GSC-00-06 Pagosa Recreation Areas – First Priority, SJNF
GSC-00-07 Site Visit Lantern Ridge, Fawn and Ellison Areas, Blanco RD, WRNF
GSC-00-08 Forest Diseases and Insects in the Sparks Analysis Area, SJNF
GSC-00-09 Root Diseases in Williams Divide Timber Sale Area, SJNF
GSC-00-10 Hazard Tree and Disease Evaluation in Jumbo, Little Bear, Island Lake and Ward Lake Campgrounds, GMUG NFs
GSC-00-11 Site Visit to Little Cone Area, Norwood RD, GMUG NFs
GSC-00-12 Pagosa Recreation Areas – Second Priority, SJNF
GSC-00-13 Log Decks at Vail Mountain, Holy Cross RD, WRNF
GSC-00-14 Log Decks at Vail Mountain #2, Holy Cross RD, WRNF
GSC-00-15 Aspen Branch Dieback Associated with Leafhopper, Gothic, CO
GSC-00-16 Spruce beetle activity at Telluride Ski Area (Grand Mesa, Uncompahgre and Gunnison NFs)
GSC-01-01 Hazard trees, root disease and spruce beetle at Wolf Creek and Williams Creek Campgrounds, Pagosa District (San Juan NF)
GSC-01-02 Dieback on ponderosa pine plantation, Vigil Abeyta Mesa (BLM) and Pagosa District (San Juan NF)
GSC-01-03 Millswitch Analysis Area, Marshall Pass, Gunnison District (Grand Mesa, Uncompahgre and Gunnison NFs)
GSC-01-04 Hazard trees, root disease and spruce beetle at Wolf Creek and Williams Creek Campgrounds, Pagosa District (San Juan NF)
GSC-01-10 Hail damage and the potential associated pathogens along Sheridan Lake Drive, Mystic
LSC-01-10 Ranger District, Black Hills NF

LAKEWOOD SERVICE CENTER

LSC-00-01 Buffalo Jones Ecosystem Management Project (Pike and San Isabel NFs)
LSC-00-02 Site Visit Report, Brush Creek/Hayden RDs Blowdown and the Haskins Creek House Log Sale (Medicine Bow and Routt NFs)
LSC-00-03 1999 Gypsy Moth Detection Survey (Colorado and Wyoming)
LSC-00-04 Haines Mountain Pine Beetle (Medicine Bow and Routt NFs)
LSC-00-05 Snowy Range Windthrow and Spruce Beetle (Medicine Bow and Routt NFs)
LSC-00-06 Aerial Survey of the State of Colorado
LSC-00-07 Aerial Survey of the State of Wyoming
LSC-01-01 Continuing fungicide laboratory tests for control of Phomopsis blight at Bessey Nursery (Nebraska NF)
LSC-01-02 Evaluation of Big Creek Lakes Campground Project (Med.Bow/Routt NFs)
LSC-01-03 Evaluation of dwarf mistletoe suppression work at Gore Pass, Yampa Ranger District (Med. Bow/Routt NFs)
LSC-01-04 FY2000 Gypsy Moth Detection Survey (LSC zone)

LSC-01-05 Interim report on the outplanting project of Phomopsis blighted Eastern redcedar seedlings from Bessey Nursery
LSC-01-06 Site visit to Sledgehammer suppression project
LSC-01-07 Site visit to US Air Force Academy
LSC-01-08 CO aerial survey
LSC-01-09 WY aerial survey
LSC-01-11 Dwarf mistletoe suppression work at Gore Pass, Routt NF
LSC-01-12 Hazard tree assessment of two campgrounds on the Douglas Ranger District, Medicine Bow NF
LSC-01-13 Douglas-fir tussock moth at USAFA

RAPID CITY SERVICE CENTER

RCSC-00-01 Insect and Disease detection at Wind Cave National Park
RCSC-00-01 Bark beetles in transplanted trees (Mt. Rushmore National Monument)
RCSC-00-02 Douglas-fir beetle in North Fork Campgrounds (Shoshone NF)
RCSC-00-03 Forest Health Management Aerial Survey (Shoshone NF)
RCSC-00-04 1999 Forest Health Management Aerial Survey (Bighorn NF)
RCSC-00-05 Forest Health Management Bark Beetle Sampling (Bighorn NF)
RSCS-00-06 Forest Health Management Bark Beetle Sampling (Black Hills NF)
RCSC-00-07 White Pine Blister Rust Disease on Limber Pine in Custer State Park, South Dakota
RCSC-00-08 *In vitro* fungicide tests for control of *Phomopsis* blight at Bessey Nursery (Nebraska NF)
RCSC-00-09 Hazard Rating Armillaria Root Disease in Custer State Park of South Dakota
RCSC-00-11 1999 Monitoring of history plots at Bessey Nursery (Nebraska NF)
RCSC-00-12 Visit to Bessey Nursery by a Basamid Representative (Nebraska NF)
RCSC-00-14 Probability of insect caused tree mortality following the Jasper fire (Black Hills NF)
RCSC-00-15 Douglas-fir beetle activity along North Fork (Shoshone NF)
RCSC-01-01 FHM Aerial Survey (Black Hills NF)
RCSC-01-02 Forest Health Management Aerial Survey (Shoshone NF)
RCSC-01-03 Hail Damage in the Black Hills (Black Hills NF)
RCSC-01-04 Deterioration of fire damaged trees (Megan Timoney, Black Hills NF)
RCSC-01-05 FHM Aerial Detection Survey (Bighorn NF)
RCSC-01-06 FHM Bark Beetle Monitoring (Black Hills NF)
RCSC-01-07 FHM Bark Beetle Monitoring (Bighorn NF)
RCSC-01-08 Hail Damage Assessment (Black Hills NF)
RCSC-01-09 Ips activity and control (Rosebud IR)
RCSC-01-10 Insect Activity in Fire Areas (Black Hills NF)
RCSC-01-11 Deterioration of Fire Killed Trees (Black Hills NF)
RCSC-01-12 Bark Beetle and Wood Borer Activity in the Uncle Timber Sale (Black Hills NF)
RCSC-01-13 Insect Activity in the Rogers Shack Fire (Black Hills NF)