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Department of
Conservation and
Natural Resources

Forest Pest Conditions in Nevada 2009

Front cover photos: Mountain pine beetle on whitebark pine in the Jarbidge Mountains, July 2008 – Rob Cruz & Gail Durham; Pinyon needle sawfly and scale damage on northeast Monitor Range August, 2009 by Gail Durham

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2009 Aerial Detection Survey Damage Areas

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Introduction and Summary

In an effort to simplify discussions of forest health in Nevada, this report focuses only on the impacts of insects, diseases, and weather on the various tree species of the state. Aerial detection surveys (ADS) from USDA Forest Service and Nevada Division of Forestry are the principle data used to describe mortality trends in the state from year to year. Mortality trends are described in terms of acres affected; however, not all trees on these acres are dead. Thus, an estimate of the number of trees killed is also provided. Not all forested lands are surveyed, and not all the same acres are surveyed every year. If the same areas are surveyed and tree mortality occurred, the same acres may be counted more than once in separate years. Total acres tallied may also change between years due to increases or decreases in the total number of acres surveyed Most of this area was the National Forest Service (FS) and Bureau of Land Management (BLM) lands in eastern and central Nevada. The ADS data encompasses most of the Humboldt-Toiyabe National Forest including portions of the Bridgeport and Carson Ranger Districts located in California. A large portion of the survey area is also composed of BLM acres with smaller acreage surveyed for Great Basin National Park, other federal lands, state lands, and private lands (Table 1).

Table 1. Total number of acres surveyed in each of the ownership categories for the years 2002-2009.

Land Ownership/Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	2008	2009
NF H-T (NV)	3,760,500	3,551,800	3,924,900	3,697,000	2,508,400	3,739,200	4,757,970	3,998,170
NF-HT (CA)	515,900	529,400	59,5000	531,600	548,000	560,700	582,000	551,238
BLM	554,300	1,069,100	1,076,400	1,109,000	712,300	938,600	1,924,990	2,074,498
Private (NV)	309,800	284,900	298,600	344,300	153,200	381,900	440,637	540,760
Private (CA within NF)	29,800	30,500	32,600	31,500	38,000	36,200	31,800	28,071
Great Basin NP	76,500	77,100	76,200	76,700	77,000	76,900	75,995	77,005
Other Federal*	2,600	1,500	42,000	2,900	10,800	4,500	41,967	38,530
NV State Lands	17,900	18,300	17,800	18,000	3,000	20,100	17,073	22,113
TOTAL	5,267,300	5,562,600	6,063,500	5,811,000	4,050,700	5,758,100	7,872,432	7,330,385

*Includes United States Fish and Wildlife Service, Department of Defense, Bureau of Indian Affairs, and other tribal lands

Long term insect trend data summarizes activity detected on all surveyed ownerships in NV and CA. However, discussion of activity by individual insect and disease agents detected in 2009 is for Nevada only and summarized on a county basis. Total acres surveyed and percent of each county surveyed in 2009 are provided in Table 2.

Table 2. Number and percent of acres surveyed in Nevada counties in 2009.

COUNTY	Total Acres in County	2009 Acres Surveyed	2009 % Surveyed
Carson City	103,569	89,063	86.0
Clark	5,176,177	249,441	4.8
Douglas	478,351	265,510	55.5
Elko	10,979,963	1,413,068	12.9
Eureka	2,663,738	247,717	9.3
Humboldt	6,219,557	265,389	4.3
Lander	3,534,543	301,828	8.5
Lincoln	6,782,623	494,415	7.3
Lyon	1,310,315	95,278	7.3
Mineral	2,462,989	0	0.0
Nye	11,686,348	1,708,347	14.6
Pershing	3,863,680	0	0.0
Storey	167,774	56,066	33.4
Washoe	4,234,009	168,202	4.0
White Pine	5,676,727	1,413,905	24.9
Total	65,340,363	6,768,229	10.4

In 2009, most insect and disease mortality numbers increased for the third year in a row. 2006 through 2009 had below average precipitation in Nevada. Adequate precipitation is necessary to maintain tree vigor and resistance to insects and pathogens. The western states, including Nevada, experienced below average precipitation from 1999 to 2004 and in 2006 to 2009 (Figure 1, National Climate Data Center). Oftentimes drought-induced mortality will become evident one or more years after a drought.

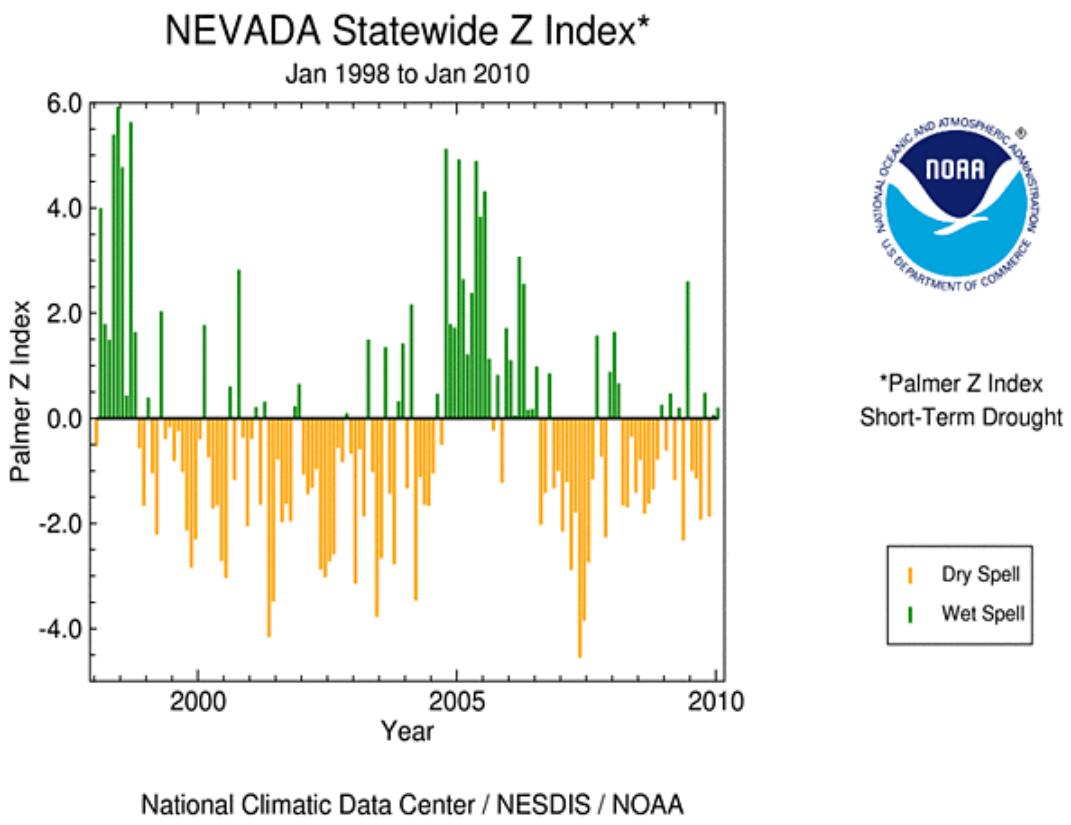

Figure 1. National Oceanic and Atmospheric Administration (NOAA) Nevada Precipitation from 1998-2010.
(http://www.ncdc.noaa.gov/oa/climate/research/2010/jan/st026dv00pcp201001.html)

Most of the mortality noted in 2009 is attributed to bark beetle activity and/or drought affects. Please note that most bark beetle-killed trees are not typically symptomatic (faded foliage) until the summer following the year of attack. Therefore, the numbers of acres affected or trees killed by bark beetles as recorded by the ADS flights are typically a reflection of the previous year's beetle populations and attacks. Defoliation levels, however, can reflect current year's activity or activity since bud break, but most of the pinyon pine defoliation from pinyon needle scale most likely had been ongoing and was only visible from the air this year. Aspen and curlleaf mountain mahogany declines/drought damage are attributed to current as well as past year's drought and or other factors.

In 2009, mortality caused by insects and diseases (number of trees killed) had mixed results compared to 2008 levels. Fir engraver beetle on white fir decreased to about 60% of 2008 levels, Jeffrey pine beetle mortality decreased to 52% of 2008 levels, and subalpine fir mortality decreased to 75% of 2008 levels. However, mountain pine beetle on white pines increased about 23%, and over an eight-and-a-half- fold increase of pinyon pine engraver-caused mortality (Table 3)

Table 3. Mortality detected in 2009 of forest pest for Nevada counties[1]

	Mountain Pine Beetle White Pines[1]		Fir Engraver Beetle		Jeffrey Pine Beetle		Pinyon Engraver Beetle		Subalpine Fir Mortality Complex	
COUNTY	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres
Carson City	0	0	12	6	35	17	960	13,463	0	0
Clark	225	116	21	12	0	0	8	4	0	0
Douglas	0	0	35	17	28	14	15,357	47,082	0	0
Elko	16,564	22,942	10	14	0	0	51	133	1,326	3.079
Eureka	210	142	0	0	0	0	21	10	0	0
Humboldt	0	0	0	0	0	0	0	0	0	0
Lander	434	350	0	0	0	0	45	22	0	0
Lincoln	55	110	119	59	0	0	290	2160	0	0
Lyon	137	205	0	0	0	0	1,090	8,538	0	0
Mineral	0	0	0	0	0	0	0	0	0	0
Nye	3,,864	3,391	35	16	0	0	496	3,707	0	0
Pershing	0	0	0	0	0	0	0	0	0	0
Storey	0	0	0	0	0	0	228	1264	0	0
Washoe	131	65	58	158	100	159	62	76	0	0
White Pine	5608	12,249	858	3004	0	0	1,051	7,719	0	0
Total	27,228	40,070	1,148	3,326	163	190	19,659	84,178	1,326	3,079

[1] Mountain pine beetle-caused mortality occurred in western white, whitebark, bristlecone and limber pines only and does not include lodgepole/ponderosa pine mortality. Mortality in lodgepole included 23 trees/5 acres, 41 trees/41 acres and 140 trees/138 acres in Douglas, Elko and Washoe counties, respectively. Mortality in ponderosa included 26 trees/13 acres, 7 trees/5 acres, and 19trees/10 acres in Clark, Nye and White Pine counties, respectively.

In 2009, most estimates of defoliation and decline caused by insect and disease activity or drought in Nevada increased from 2008 levels. This included more than three-fold increase in mountain mahogany decline. Acres with aspen decline were similar to 2008; however, the number of acres with aspen defoliation by the forest tent caterpillar was nearly seven times higher than the 2008 acres. The biggest change noted this year was the heavy defoliation of pinyon due to pinyon needle scale and sawfly which increased over 400 times greater than in 2008. Douglas-fir tussock moth defoliation increased to just over 800 acres from 0 in 2008 (see Figure 2 and Table 4).

Table 4. Insect defoliation and decline by Nevada County in 2009.

	Aspen Decline	Forest Tent Caterpillar on Aspen	Singleleaf Pinyon Pine defoliation by needle scale and sawfly	Curl leaf Mountain Mahogany Drought Damage
COUNTY	Acres	Acres	Acres	Acres
Carson City	20	0	13,541	0
Clark	0	0	0	40
Douglas	45	0	37.867	863
Elko	8,322	2,741	41,795	31
Eureka	239	0	89,131	19,801
Humboldt	863	2,967	0	0
Lander	160	0	26,930	3,902
Lincoln	10	0	127,438	2,355
Lyon	0	0	8,377	335
Mineral	0	0	0	0
Nye	2,718	0	467,769	86,843
Pershing	0	0	0	0
Storey	7	0	1,211	1
Washoe	67	0	48	1,987
White Pine	77	81	38,556	2,066
Total	12,528	5,789	798,426*	118,224

*Total excludes overlap in sawfly/scale areas;

[2] Tables 3 & 4. Produced by G. Durham, Nevada Division of Forestry, using data provided by USDA FS Forest Health Protection.

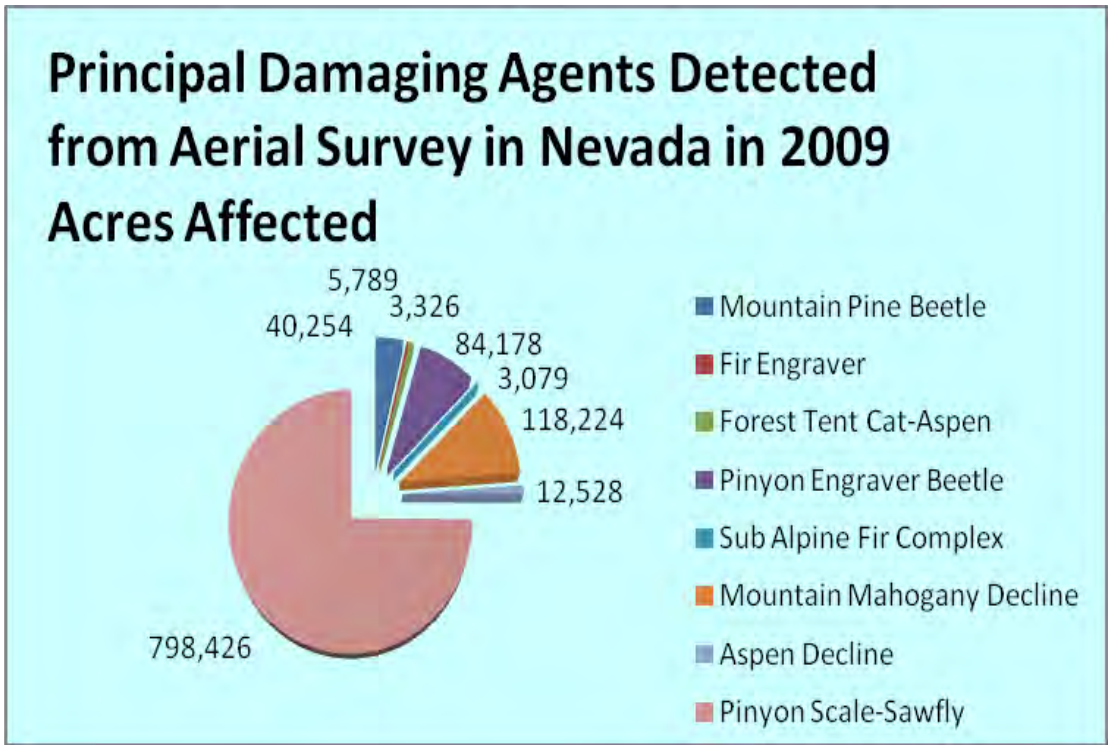

Figure 2. Acres of mortality/defoliation detected in 2009 from various insects/diseases and drought affects.

Noxious weed species are widespread throughout the State. A few species are widespread such as Canada thistle, musk thistle, Scotch thistle, diffuse knapweed, spotted knapweed, Russian knapweed, salt cedar (tamarisk), perennial pepper weed, hoary cress, and yellow star thistle (Table 5).

Nevada Department of Agriculture (NDOA) began receiving USDA State and Private Forestry grants in 2002. Working cooperatively with Coordinated Weed Management Areas (CWMA), they have been able to treat over 50,000 acres of noxious weeds statewide since 2002. Currently there are 31 CWMA's in the state, most created in the past six years. Each county in Nevada has at least one CWMA. In 2007, NDOA released bio-control agents for the following weeds and counties: spotted knapweed in Ely in White Pine County, Canada thistle in Gardnerville in Douglas County, and dalmatian toadflax in Pioche in Lincoln County. Dalmatian toadflax and tamarisk beetle collections and releases are being coordinated by Jeff Knight, State Entomologist. Tamarisk beetle (*Diorhabda elongate*) has been observed working its way south along the Virgin River from St. George Utah, defoliating the tamarisk as it goes. The main concern with this southern movement is that it will hit critical southwest willow flycatcher habitat when the birds are nesting and leave little cover for this listed federally endangered bird species. No further efforts have been made to expand the tamarisk beetles range.

Table 5 - Noxious weeds by Nevada Counties in 2009

							Nevada County										
State Declared Noxious Weeds	Carson City	Churchill	Clark	Douglas	Elko	Esmeralda	Eureka	Humboldt	Lander	Lincoln	Lyon	Mineral	Nye	Pershing	Storey	Washoe	White Pine
African Rue			**N**				**N**					**X**					
African (Sahara) Mustard			**X**							**X**			**X**				**X**
Black Henbane					**X**		**X**		**X**				**X**				**X**
Canada Thistle	**X**			**X**	**X**		**X**	**X**	**X**	**X**	**X**		**X**	**X**	**N**	**X**	**X**
Camelthorn			**N**														
Dalmatian Toadflax			**N**	**X**	**X**					**X**			**X**		**X**	**X**	**X**
Diffuse Knapweed		**N**	**N**	**X**	**X**		**X**	**N**	**X**	**X**	**N**		**X**	**N**		**X**	**X**
Dyer's Woad					**X**											**X**	
Eurasian Water milfoil							**N**										
Green Fountain Grass			**X**														
Giant Reed			**N**														
Goat's Rue			**X**														
Hoary Cress/Whitetop	**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**
Houndstongue					**X**												

Johnson Grass			x														
Leafy Spurge	X				X		X	X					X				X
Malta Starthistle			X				N										
Medusa Head grass	N		N	N	N			N						N		X	
Mediterranean Sage					X											X	
Musk Thistle	N	X		N	X		X	X	X	X	X		X		X	X	X
Perennial Pepperweed	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X
Poison Hemlock	N			X	X		X	N	N	N	N		X		X	X	X
Puncturevine	N		X	N	X		N	N	N		N	N		N	N	X	
Purple Loosestrife											X					X	
Rush Skeletonweed	X															N	
Purple Starthistle				X	X		X		X								
Russian Knapweed	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
Salt Ceder (Tamarisk)	N	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Scotch Thistle	X	X	X	X	X		X	X	X	X	X	X	X	X		X	X
Sowthistle													X				

Spotted Knapweed	**X**		**X**	**X**	**X**	**N**	**X**	**N**	**N**	**X**			**X**	**N**	**X**	**X**	**X**
Squarrose Knapweed					**X**				**X**	**X**			**X**				**X**
Sulfur Cinquefoil					**X**												
Water Hemlock					**X**		**X**		**X**								N
White Horsenettle			**N**														
Yellow Toadflax					**X**			**N**								**N**	**N**
Yellow Starthistle	**X**	**X**	**X**	**X**	**X**	**X**		**X**			**X**			**X**	**N**	**X**	N

X indicates the weed is located in the respective county according to the Nevada Noxious Weed GIS database, Natural Resources Conservation Service, 5/24/02, NDOA Weed Coordinator, the various weed control districts representatives and BLM personnel as of 2007.

N Indicates new location since 2007 update. From current (2009) weed database housed at Nevada Dept. of Conservation and Natural Resources Natural Heritage Program contact kimwilliams@heritage.nv.gov

Insects: Native

DEFOLIATORS

Douglas-fir Tussock Moth
Orgyia pseudotsugata

Hosts: All true firs and spruce

The Douglas-fir tussock moth (DFTM) is an important native insect capable of causing significant defoliation. Heavy defoliation causes reduced growth, stress, and tree mortality. Heavy defoliation can cause top kill and mortality of advanced regeneration during a single season. Outbreaks are cyclic, usually appearing quickly followed by an abrupt decline within a one to four year period.

Figure 3. Douglas-fir tussock moth larvae.

Only small amounts of DFTM defoliation was detected during aerial surveys in 2009 in Elko County, Nevada. A total of 1,326 acres of light defoliation was observed in the northeast Jarbidge Mountains, and south and southeast of the Bull Run Mountains. Traps set in the Spooner Lake State Park area of Lake Tahoe, NV captured no DFTMs in 2009.

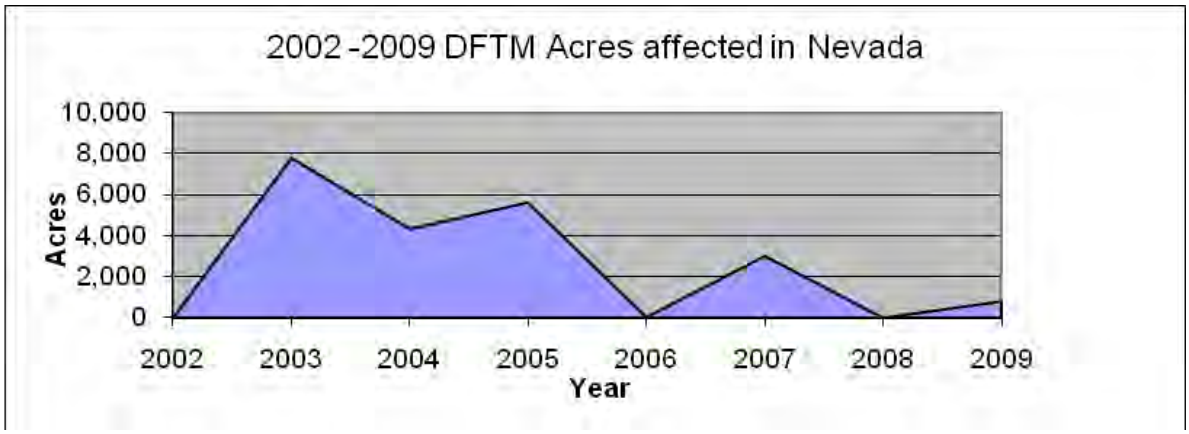

Figure 4. Acres with Douglas-fir tussock moth defoliation in Nevada during eight years (2002-2009).

Pinyon Sawfly
Neodiprion edulicolus

Host: pinyon pine

The pinyon sawfly is an important native insect capable of causing significant defoliation, but usually goes undetected because it occurs in small numbers, and causes little damage. Heavy defoliation causes reduced growth, stress, and tree mortality. Thin crowns cause a ghostly see-through appearance of the forest. In many locations, this outbreak is occurring in conjunction with pinyon needle scale (*Matsucoccus acalyptus*) defoliation.

In 2009, this outbreak spread to the north end of the Antelope, Monitor, Toquima, Hot Creek Ranges, as well as the Antelope Range north of the Schell Creek Range in White Pine and Elko Counties. Other areas of the state may have been infested but were not surveyed. Most of the surveyed areas were heavily defoliated between 2006 and 2008; a large area of defoliation was reported on the east side of Whistler Mountain just northwest of Eureka, NV (Figure 5). Of the nearly 9,950,000 acres of pinyon in Nevada, 181,000 acres were mapped as pinyon needle sawfly defoliated; this is approximately 0.7% of Nevada's pinyon forest.

Figure 5. Note the gray see-through appearance of the pinyon sawfly defoliated areas on the northeast side of the Monitor Range in central Nevada in summer of 2009

Elko County – 6,808 acres found in southern Elko county completely affecting the north end of the Antelope Range and causing severe defoliation on the affected areas.
Eureka County- 47,064 acres found at the lower elevations in the southern Eureka county affecting the north end of the Antelope and Monitor Ranges and all of Whistler Mountain and the north and south sides of Lone Mountain.
Lander County – 13,462 acres found on the north end of the Toquima Range at the lower elevations

Nye County – 106,425 acres found at the lower elevations of Toquima Range in four spots in the north, south and east central areas; northeast edge of the Monitor Range, and along the north and central edges of the Hot Creek Range.
White Pine County – 7,590 acres found at the lower elevations on the west side and northern edge of the Schell Mountains, and the western edge of the Pogonip Ridge of the White Pine Range.

Pinyon Needle Scale
Matsucoccus acalyptus

Host: pinyon pine

The pinyon needle scale is a sap-sucking insect that feeds on previous year's needles. Foliage of infested trees turns yellow then brown. Heavy defoliation causes reduced growth, stress, and tree mortality. Past outbreaks have been recorded since 1959 throughout Nevada, causing localized defoliation and mortality of some trees. Historic outbreaks were noted between 1957 and 1963 in southeast Nevada and southwest Utah, affecting several hundred thousand acres. Between 1969 and 1970, portions of the Humboldt-Toiyabe NF in California and Nevada were defoliated. A mild winter was cited as one of the many factors that triggered this severe outbreak. Again, it was mostly the younger trees on the lower elevations alluvial fans that were affected. In 2007 a localized outbreak was found on Currant Summit on the border of Nye and White Pine Counties. In 2008, an area of 776 acres was found on the east side of the Schell Creek Mountains, in the low foothills north and south of Cleve Creek and north of Taft Creek in White Pine County. In 2008, more evidence of this infestation was found further south on the east side of Connors Pass on the Schell Creek Mountains.

In 2009, approximately 7% of Nevada's pinyon/juniper forest was mapped as affected by this insect with many areas having very light mortality of pinyon by pinyon ips or other causes exacerbated by the drought and by the defoliation. The most affected areas were the lowest areas of the alluvial fans and hill slopes, with the most affected trees being the younger trees (Figure 6). Of the nearly 9,950,000 acres of pinyon in Nevada, 671,000 acres were mapped as scale-defoliated.

Figure 6. Pinyon pine scale on singleleaf pinyon needles in late summer of 2009 on the south end of the Pinenut Mountains showing severe defoliation with probable mortality.

Carson City – 13,451 acres occurring primarily in large patches on the north and east side of the Pinenut Mountain Range in the lower alluvial fans and typically on the smaller trees. Most of the defoliation in this county was severe.

Douglas County – 37,867 acres of the Pinenut Mountain Range on the lower alluvial fans and hill slopes of all aspects. Most of this defoliation was light with a few severe patches along the road leading from the east into Sunrise Pass and on the northwest end of the range between Eldorado and Brunswick Canyons.

Elko County – 34,987 acres found in large patches on the lower elevations of Spruce Mountain and the Pequop Range, southern Ruby mountains and the middle section of the Antelope Range in southeast Elko County.

Eureka County- 42,067 acres found in large patches on the northwest end of the Monitor Range.

Lander County – 13,468 acres found in large patches at lower elevations in the northwest edge of the Toquima Range and one large patch in the northeast most edge of the Toiyabe Range above Rye Patch Canyon.

Lincoln County –127,438 acres found in small to large patches along the lower elevations of the Wilson Creek and White Rock Mountains (extending into Utah) and throughout most of the Fortification Range.

Lyon County – 8,377 acres on the southwest side of the Virginia Range in small- to medium-sized patches, and on the northern end of the Pinenut Mountains in large patches.
Nye County – 361,344 acres throughout the lower elevations of the Hot Creek, Monitor, and Toquima Ranges in large patches and in small to medium patches of the Toiyabe and Shoshone Ranges, south White Pine, north Horse Range, and northeastern Grant Range.
Storey County – 1,211 acres on the southwest side of the Virginia Range in medium-sized patches
Washoe County – 48 acres in one spot on the northwest edge of the Virginia Range above a Quarry.
White Pine County – 30,966 acres in large patches at the lower elevations on the south end of the Ruby Mountains, White Pine Mountains, south and southwestern edge of the Schell Creek Mountains, as well as one patch in the Snake range just north of Osceola and one patch on the northwest edge of the White Pine Range west of Pogonip Ridge

Spruce Spider Mite
Oligonychus spp.

Host: Engelmann Spruce

The spruce spider mite causes a yellowing of the older spruce foliage by piercing the needles and feeding on fluids. A 7 acre spot was mapped in the Snake Creek Range in White Pine County in 2008. This represents only 1% of the acreage mapped in 2007.

Figure 8. Spruce spider mite damage on Engelmann spruce in the Schell Creek Mountains in July 2007. (Photo by April Johnson, United States Forest Service, Ely Ranger District).

Forest Tent Caterpillar
Malacosoma disstria

Hosts: aspen, birch, oak, some maples, and other deciduous species

The forest tent caterpillar (FTC) is a native defoliator of aspen. Overwintering takes place as a fully developed embryo inside the egg shell. When they hatch in the spring, the larvae tend to migrate high in the tree where they feed on expanding flower and leaf buds. After bud break, larvae feed on the foliage, being most gregarious in their early life stages. The adult is a tan moth about 4 cm long with two dark brown, oblique stripes on each forewing. The caterpillar (the most often seen life stage) is mostly dark blue with wavy reddish brown lines and distinct white, keyhole-shaped markings down the back. Larvae feed in groups without making any webbing. (Western Tent Caterpillar makes the large webs found on chokecherry and are reddish brown caterpillars). Flight and mating activities begin late afternoon through

most of the night. There is one generation each year. Parasites tend to keep the outbreaks of this insect cyclic and in check over time.

In 2009, the acreage of FTC increased nearly seven-fold from 831 acres in 2008 to 5,789 acres in 2009. This mortality was observed in Humboldt and Elko Counties, including scattered patches in aspen in the Santa Rosa Mountains of Humboldt County totaling 2,967 acres, and 2,741 acres in the Bull Run, Independence, and Mahogany Mountains, around Tennessee Mountain and the Jarbidge Mountains. A significant increase in FTC-caused defoliation occurred in 2009 on aspen and various riparian species (Figure 9).

Figure 9 – Forest Tent Caterpillar on aspen on the Santa Rosa Mountains, 2009.

BARK BEETLES

Fir Engraver Beetle

Scolytus ventralis

Hosts: true firs

Figure 10. Older (with very little new) white fir mortality from fir engraver beetle on top of Success Summit, Schell Creek Mountains, White Pine County, July 2009.

Mortality due to Fir-Engraver Beetle (FEB) continued to decrease in 2009 to about 60% of the number of trees killed in 2008. In 2009, 1,148 trees were killed on 3,326 acres (Figure 11).

For the seventh consecutive year, White Pine County had the highest amount of tree mortality with approximately 858 dead trees spread out on about 3,044 acres in 2009. This represents a decrease to 60% of the 2008 mortality levels. Fir mortality decreased in Carson City, Clark, Lincoln, Washoe and White Pine Counties but increased in Douglas, Elko and Nye Counties compared to the 2008 data.

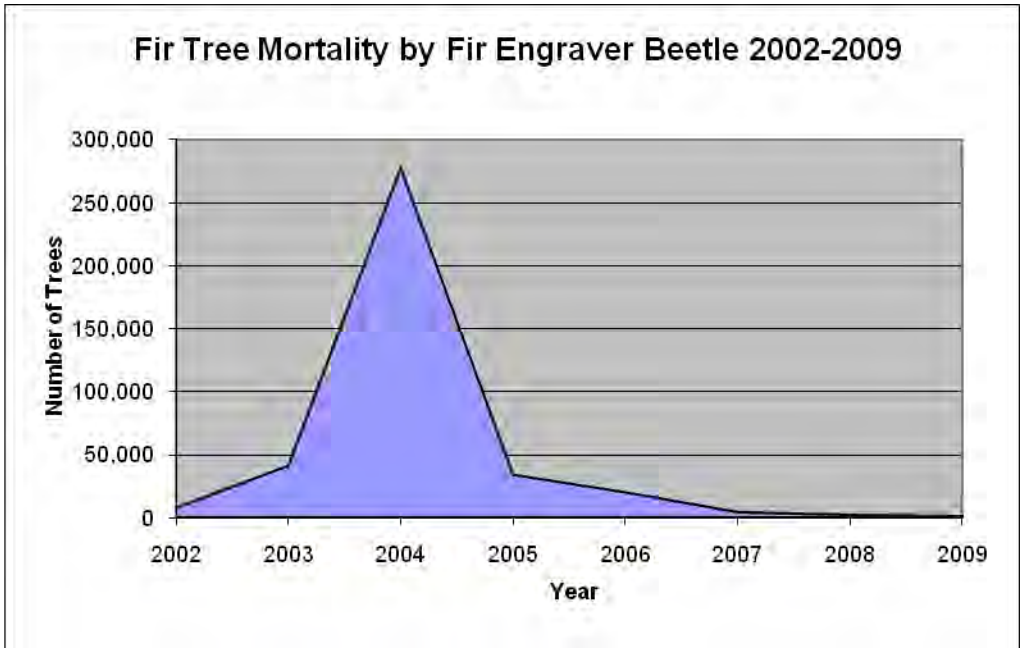

Figure 11. Number of trees with mortality caused by the fir engraver beetle in Nevada and in Alpine and Mono counties in CA during eight years (2002-2009).

Carson City – There was only 12 trees on 6 acres mapped in 2009, half the amount of mortality observed in 2008. These were two pockets one located west of Spooner Lake and north of Secret Harbor just below Highway 28 and another at the headwaters of Clear Creek, just northeast of Spooner Lake.

Clark County- Mortality decreased to about 12% of last year's levels. Only 21 trees on 12 acres were mapped in 2009. Scattered pockets were mapped throughout the upper elevations of the Spring Mountains.

Douglas County – Mortality increased slightly from the 25 trees killed on 13 acres in 2008 to 35 trees on 17 acres in 2009. Scattered spots were located near the top of the Carson Range just south of Glenbrook Creek, south of Highway 50, midway up Logan Creek, south of James Canyon, and along the south Fork of Daggett Creek just south of Kingsbury Grade.

Elko County – There were only 10 trees on 14 acres mapped in 2008 in one patch on the top of the Pequop Mountains south of Ninemile Canyon.

Lincoln County – Because there was no survey of true fir done in this county in 2008, there was an increase in 2009 to 119 trees on 59 acres in the Wilson Creek and White Rock Ranges.

Nye County – 35 trees on 16 acres were mapped in 2009, which was approximately 150% of 2008 levels. Much of this increase in observed mortality was due to the increased survey area in Nye County in 2009. Most of this mortality was found in small spots on south east portion of the Grant Range and the southernmost area of the White Pine Range.

Washoe County – Approximately 58 trees on 158 acres were mapped in 2009. This represents a greater than 60% decrease in trees compared to 2008. This mortality was found in the Carson Range in small spots at the headwaters of Hunter Creek and Thomas Creek, and in and around Incline Village, NV. There were also spots on the

hillside west of Little Valley, at the mouth of Tunnel Creek and just above Highway 28 at Sand Harbor State Park.

White Pine County – Most of the mortality in Nevada was found again in this county– 858 trees on 3,044 acres. However, this tree mortality is only about 55% of the number reported in 2008. The majority of the 2009 FEB activity was found on the north end of Snake Range, scattered on the south end of the Mt. Moriah Wilderness Area, and in a large patch in upper Smith Creek. Spots were found on USFS lands scattered around the southern edges of Great Basin National Park. Several spots were also found around the Success Summit, in the headwaters of Cleve Creek, scattered along the backbone of the Schell Creek Range from Schellbourne Pass south to Berry Creek, in the White Pine Range just east of Pogonip Ridge, at the headwaters of Ellison Creek and the White River, and scattered in many spots throughout the northern end of the Egan Range.

Jeffrey Pine Beetle
Dendroctonus jeffreyi

Host: Jeffrey pine

The Jeffrey pine beetle is the most destructive bark beetle of Jeffrey pine. Endemic populations usually attack scattered, slower growing, mature and over-mature trees and trees struck by lightning. In Nevada, Jeffrey pine is only found naturally along the Sierra Nevada Mountains. Field examinations of some of the mortality mapped in Alpine County, California revealed that some of the Jeffrey pine is also being killed by *Ips pini* in combination with roundhead and flathead woodborers. Flathead woodborers are also found as the main mortality agent on Jeffrey pine along the eastern front of the Carson Range in western Nevada.

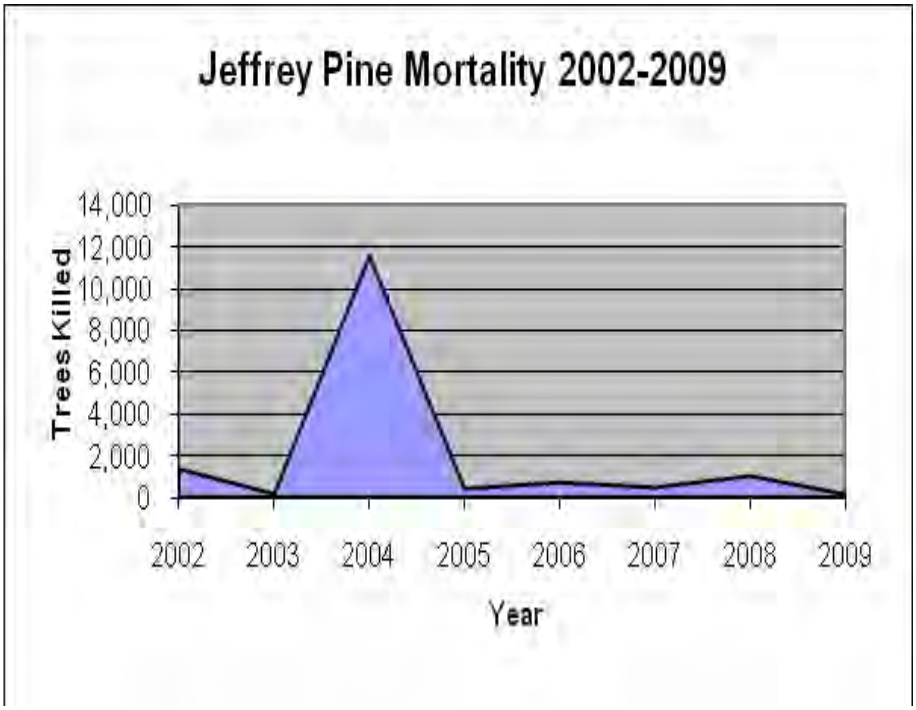

Figure 12. Jeffrey pine mortality in Nevada and in two California counties (Alpine and Mono) during eight years (2002-2009)

Figure 13. Jeffrey pine mortality in Alpine county in California along Highway 88. (Photo by Sheri Smith, Forest Health Protection, Susanville, CA)

In 2009, Jeffery pine beetle-caused tree mortality decreased to half the trees observed in 2008, affecting 163 trees on 190 acres in Nevada (Figure 12). The mortality was predominantly in Washoe County with the remaining mortality nearly equally divided between Douglas and Carson City counties.

Carson City County – 35 trees killed on 17 acres in spots scattered throughout the Carson Range and concentrated at the headwaters of Clear Creek, south of Squaw Valley Peak, with two spots southwest of Marlette Lake, and one south of Sand Harbor.

Douglas County – 28 trees killed over 14 acres scattered throughout the Carson Range with spots found mostly in the mid-slope elevations and higher. Spots were observed from Deadman Point south to Job's Canyon. Many of these trees most likely killed by California Flathead Borer (*Melanophila californica*), especially along the eastern Carson Range front, but it is impossible to differentiate from the air.

Washoe County – 100 trees killed on 159 acres were scattered in small spots east of Deep Canyon, in pockets on the West and North Forks of Gray Creek, between the Mt. Rose Wilderness Area and Incline Village, in a pocket between Winters and Davis

Creeks, south and west of west Washoe Valley, and in a large patch just east of Incline Village mixed with white fir mortality.

Mountain Pine Beetle
Dendroctonus ponderosae

Hosts: whitebark, bristlecone, limber, lodgepole, sugar, and ponderosa pine

Mountain pine beetle (MPB) can kill thousands of trees per year during outbreak conditions and millions of trees during extended epidemics in western forests. At endemic levels, MPB favors weakened, less vigorous trees with adequate phloem thickness to complete its life cycle. During epidemics, beetles may attack smaller diameter trees down to 4 inches diameter at breast height. Extensive mortality may alter large forest landscapes by converting pine forest ecosystems to grass and shrub landscapes for a period of 10-20 years. This conversion affects wildlife species, water yields and fuel loading.

In 2009, MPB-caused mortality in lodgepole pine decreased to about 25% of the amount reported in 2008. Western white, whitebark and bristlecone pine mortality remained about the same as in 2008, but the mortality in limber pine increased nearly 190% of the number of trees reported in 2008. This increase in upper elevation limber pine mortality mostly occurred in Elko and White Pine counties (Figures 14 and 15).

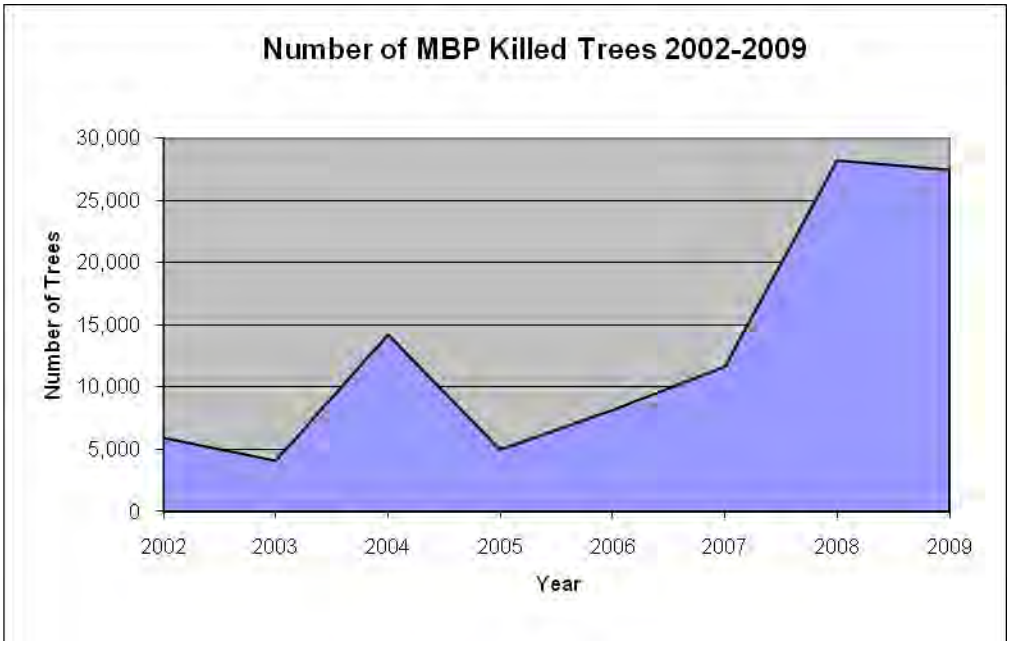

Figure 14. Number of whitebark, limber, and bristlecone pine trees killed by mountain pine beetle in Nevada and eastern California in the last eight years (2002-2009).

Mountain Pine Beetle – Limber/Whitebark/Bristlecone/Western White Pine

In 2009, mortality of limber pine caused by MPB increased to 18,767 acres and 12,217 trees, which is 319% of the 2008 acreage and 189% of the 2008 tree mortality. Most of the mortality occurred as small spots of up to five trees on tops of the mountain ranges surveyed. Whitebark, bristlecone and western white pine tree mortality in 2009 remained about the same as 2008.

Clark County – 225 trees on 116 acres was a slight decrease in mortality from 2008 due to a slight decrease in the amount of limber and bristlecone pine mortality in the upper elevations of the Spring Mountains. Most of the mortality was in scattered spots at the headwaters of Lee, Kyle, Lovell and Trout Canyons at the highest elevations of the Spring Mountains.

Elko County – 1,926 limber pine trees on 2,004 acres and 14,638 whitebark pine trees on 20,938 acres were mapped in 2009. Although the amount of limber pine mortality increased to 280% of the amount mapped in 2008, the whitebark pine mortality is similar to that mapped in 2008. Most of the limber and whitebark pine mortality was scattered in small pockets at moderate elevations throughout t the Ruby Mountains, on the northern end and eastern side of the East Humboldt Mountains with a few large and small spots in the Independence and Bull Run Mountains. There were large areas of whitebark pine mortality throughout the higher elevations of the Jarbidge Mountains (Figure 14). In addition, there were numerous patches of limber pine mortality at the higher elevations of Pequop Mountains and Spruce Mountain.

Eureka County –210 limber pine trees were mapped on 142 acres in small spots at the north end of the Monitor Range around Summit Mountain and in the north end of the Antelope Range by Ninemile Peak.

Lander County – 432 limber pine trees on 349 acres and 2 bristlecone pines on 1 acre were mapped in large to small patches along the upper elevations of the Toiyabe and northern Shoshone Ranges.

Lincoln County – 55 limber pine trees on 110 acres in the highest elevations of the Wilson Creek Range around Mt. Wilson and in one spot around White Rock Peak in the White Rock Range.

Lyon County – 137 whitebark pine trees on 205 acres in large to medium sized patches at the north end of the Sweetwater Mountains at the highest elevations mostly on north facing slopes.

Nye County – 3,844 dead limber pine trees were observed on 3,377 acres and 20 bristlecone on 14 acres. This is nearly 320% more mortality than 2008 mostly found in numerous small to medium sized spots of limber pine mortality mapped throughout the highest elevations of the Shoshone, Toiyabe, Toquima and Monitor Ranges with the vast majority of the spots in the Arc Dome, Alta Toquima, and Table Mountain Wilderness Areas, and in the Stoneberger Basin in the northern Toquimas. In addition, limber pine mortality on four spots on the Hot Creek Range around Ninemile Peak, in numerous small spots on the south end of the White Pine Range and on the of the Grant and Quinn Canyon Mountains.

Washoe County –131 western white pine and whitebark pine trees on 65 acres were scattered throughout the higher elevations of the Carson Range.

White Pine County – 5,551 limber pine trees on 12,682 acres and 57 bristlecone pines on 67 acres, representing about a 135% increase in limber pine mortality, mostly observed in small- to medium-sized patches of scattered mortality along the tops of Ward Mountain in the Egan Range, throughout the Snake Range (including Great Basin National Park), throughout the Schell Creek Range, and in a few spot on Pogonip Ridge and near the tops of adjacent mountains in the White Pine Range. There were large patches around the Wheeler Peak Scenic Area and one large patch on the north side of Table Mt.

Figure 15. Mountain pine beetle-caused mortality in Jarbidge Mountains.
Photo by Gail Durham, 2009

Mountain Pine Beetle in Lodgepole Pine

In 2009, MPB activity in lodgepole pine in Nevada decreased to 25% of 2008 numbers with 204 dead trees on 184 acres.

Douglas County –Mortality recorded in 2009 decreased to 23 trees in 5 acres in a few spots north of East Peak, at Heavenly Valley, and up Lincoln Creek.
Elko County – 41 trees on 41 acres
Washoe County – 140 trees on 138 acres were observed in small spots scattered throughout the Carson Range and on the west side of Little Valley with larger mortality pockets near the headwaters of Bronco creek and around Mt. Rose Summit and the Mt. Rose Wilderness Area.

Mountain Pine Beetle/Western Pine Beetle in Ponderosa Pine
In 2009, bark beetle activity decreased to approximately 25% or the 2008 mortality and was found in three counties killing only 54 trees over 49 acres.

> **Clark County** – Mortality decreased to 26 trees on 13 acres scattered in small spots mostly in the drainage bottoms throughout the Spring Mountains.
> **Nye County** – 7 trees on 5 acres were mapped in a spot on the Quinn Canyon Range north of the North Fork of Cottonwood Creek and one spot north east of Timber Mountain in the Grant Range.
> **White Pine County** – Mortality decreased to 40% of 2008 figures with 19 trees affected on 30 acres in spots in Silver Canyon and Muncy Creek on the northeast side of the Schell Creek Range and a spot in Rowe Creek in the Egan Range south of Ward Mountain.

Pinyon Engraver Beetle
Ips confusus

Host: single leaf pinyon

The pinyon engraver is a pest in pinyon-juniper ecosystems often affecting valuable home landscape trees. The insect produces multiple generations each year and consequently populations can build and spread rapidly.

Figure 16. Mortality caused by pinyon Ips in the Pinenut Mountains during peak outbreak in 2004.

Prior to 2003, pinyon pine was not frequently surveyed. In response to increasing concern of pinyon pine mortality in 2003, a multi-state effort was made to survey the extent of pinyon Ips-caused pinyon mortality. Approximately 3 million of the estimated 11.9 million acres of single-leaf pinyon that occur in Nevada were surveyed in 2003. In 2004, approximately 3.5 million acres of pinyon-juniper woodlands were flown and pinyon Ips-caused mortality of single leaf pinyon increased again. Again in 2005, 2006 and 2007, a dramatic decrease of pinyon mortality was seen within the surveyed area, in twelve counties. In 2009, this mortality increased up above 2006 levels, but did not represent a significant increase compared to the 2003 to 2005 mortality (Figure 17).

In 2009, 84,178 acres were infested by pinyon Ips, affecting over 19,659 trees. This was nearly a 870% increase compared to the 2008 tree mortality (Figure 16). For a third year, Douglas County had the greatest number of trees killed (15,357 trees, 78 % of the state total). Most of this new mortality is associated with the affects of the last three years of drought and the large pinyon needle scale and pinyon sawfly outbreaks.

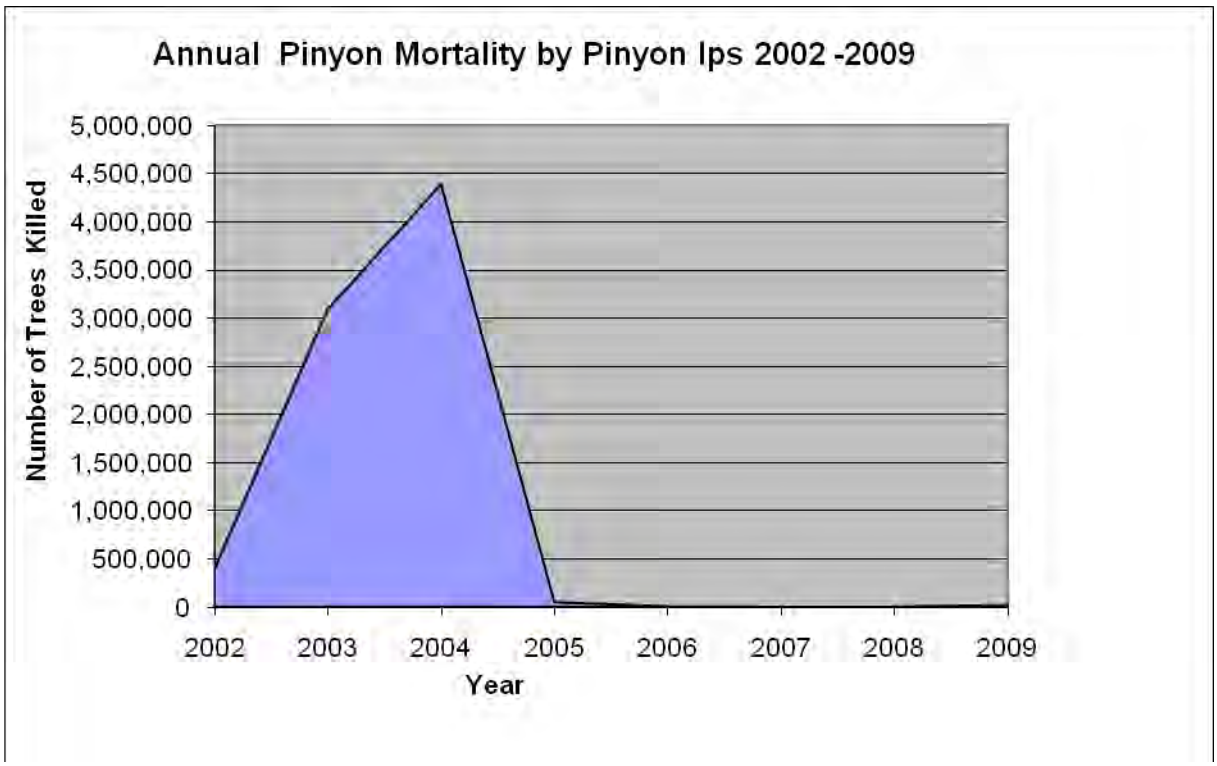

Figure 17. Number of pinyon pine killed by pinyon Ips in Nevada and two adjacent California counties (Alpine and Mono) during eight years (2002-2009).

Carson City County – 13,463 acres with 960 trees in large areas associated with the pinyon scale outbreak and in small spots throughout Brunswick Canyon watershed and around McTarnahan Hill in the Pine Nut Range.
Clark County – 4 acres with 8 trees in two spots: one north of Carpenter Canyon and one north of Trout Canyon in the south end of the Spring Mountains.

Douglas County – An eleven-fold increase from 2008 to 47,082 acres and 15,357 trees killed. Much of this mortality is included in the large patches associated with the severe pinyon needle scale outbreak areas throughout the lower elevations of the Pine Nut Mountain Range from California border north into Lyon County and Carson City County border. Small areas of mortality expanded throughout the Pinenut Mountains.
Elko County – 133 acres with 51 trees were mapped in small spots on the north end of the Pequop Mountains and the south end of the Ruby Mountains.
Eureka County – 21 trees and 10 acres were recorded in three spots on the south end of Whistler Mountain and three spots at the lower elevations of Wallace Canyon on the northwest end of the Monitor Range.
Lincoln County - There were 290 trees on 2,160 acres scattered in spots throughout the White Rock Range, in the a large patch around Atlanta Summit, and a smaller one south of Tunnel Springs in the Wilson Creek Range.
Lyon County – 8,538 acres with 1,090 trees were associated with the large polygons of scale defoliation mortality in the northeast Pine Nut Range east of El Dorado Canyon.
Nye County – 3,707acres with 496 trees were observed in large polygons in the north end of the Horse Range associated with pinyon scale outbreak, and in small spots of mortality throughout the Quinn Canyon Range, Shoshone Mountains, and the southernmost Monitor Range.
Storey County – 1,264 acres with 228 trees were mapped in the Virginia Range in scattered spots in the northeast area of the Virginia Range and associated with large polygons of pinyon scale southeast of Gold Hill and Virginia City.
Washoe County – 76 acres with 62 trees was mapped in small spots throughout the northwestern portion of the Virginia Range.
White Pine County – Mortality was mapped on 7,719 acres with 1,051 trees. Some mortality was associated with pinyon needle scale in the western White Pine Range west of Pogonip Ridge as well as scattered mortality throughout the rest of the range. Mortality was also observed on the north and south end of the Schell Creek Mountains, with two larger polygons just south of East Creek. Two spots were also found on the north and south edges of the northern Snake Range and the northern Egan Range around Ward Mountain.

Pitch Mass Borer
Dioryctria spp.

Hosts: Singleleaf pinyon, ponderosa pine, Jeffrey pine

In the larval stage, *Dioryctria spp.* bore into the cambium of the trunk, branches, and shoots. This borer kills lateral branches and treetops of singleleaf pinyon and Jeffrey pine. With prolonged drought, this injury has weakened pinyon trees sufficiently to allow pinyon engraver beetle to successfully attack and kill pinyon pine trees. Pitch mass borer is found throughout the state of Nevada in most counties with singleleaf pinyon. The heaviest concentrations seem to occur in western Nevada where it also affects Jeffrey and ponderosa pine. Many young Jeffrey pines on the east slope of the Carson Range that came in after fires have been affected by this insect. In 2006 several entomologists, pathologists and

foresters conducted a pinyon blister rust (*Cronartium occidentale)* search through the central portion of Nevada. They noted that pitch mass borer frequently uses rust cankers as an entry point (Figure 18). The rust and borer are found extensively across the state but are not mapped by ADS.

Figure 18. Pitch mass borer on pinyon pine infected with pinyon blister rust.

Spruce Beetle
Dendroctonus rufipennis.

Hosts: Engelmann spruce

Larvae are present for two summers, pupate, then overwinter the second year as adults beneath the bark. Adults overwinter beneath the bark in the root collar. Trees that are infested usually turn yellow green one year after the year they are attacked. In 2009, all spruce beetle-caused mortality was mapped in Great Basin National Park with two large patches on the ridge above Lower Lehman Creek Campground and another of 45 trees with three 20 tree spots at the headwaters of Baker Creek. There was a total of 446 acres affected.

TWIG INSECTS

Pinyon Tip Moth
Dioryctria albovitella

Host: Singleleaf pinyon

The pinyon tip moth causes tip killing, branch flagging, and stunted growth. Larvae of this small gray moth feed in the tips of branches killing new shoots and giving the tree a conspicuous scorched appearance. Pinyon tip moth is found throughout Nevada wherever singleleaf pinyon occurs. In 2009, this insect was found commonly in the areas with the heavy scale infestations. In 2007, a large outbreak over hundreds of acres was noted throughout the lower elevations of the east side of the Wilson Creek Mountains west of Camp Valley Creek, and south of Pine Creek (Figure 19). This moth was still active in this eastern Nevada area in 2008 and early 2009.

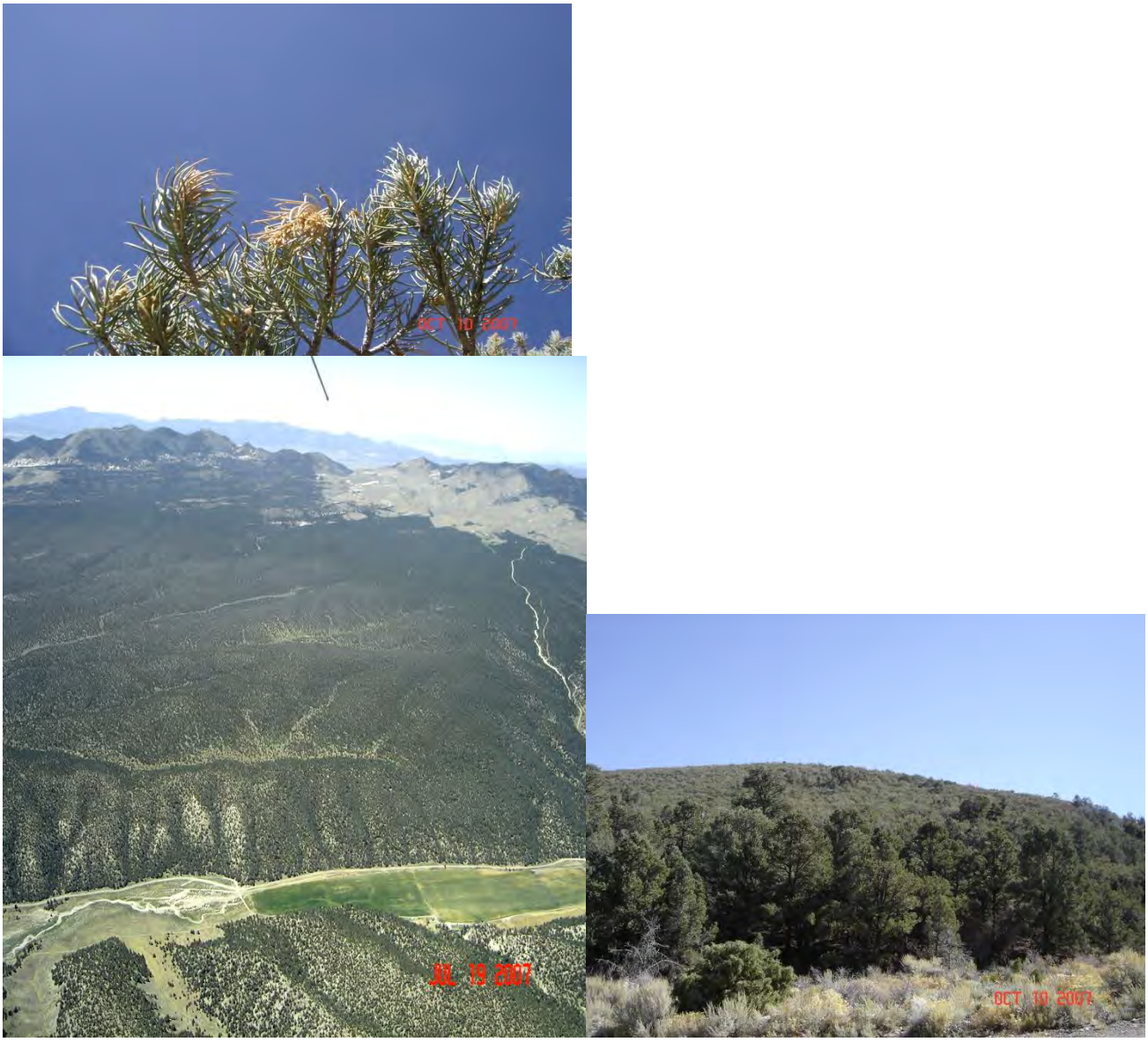

Figure 19. Pinyon tip moth damage having a gray hazy appearance from the air and on the ground on the west side of Camp Valley Creek south of Pine Creek in 2007.

Insects: Non-native

European Gypsy Moth
Lymantria dispar

Hosts: various deciduous species

In 2009, gypsy moth was surveyed in all 17 Nevada counties by Nevada Department of Agriculture (NDOA). Traps were placed and then recovered at the end of the season. A total of 875 traps were set but no gypsy moths were captured. The last identified adult male was discovered in an RV park in Winnemucca in 1999.

Figure 20. Adult gypsy moths, female above, male below.

Pink Gypsy Moth
Lymantria mathura

Hosts: various deciduous species

In 2009, pink gypsy moth was surveyed in 14 Nevada counties by Nevada Department of Agriculture (NDOA). Trapping was conducted from August 8th to October 8th. A total of 191 traps were set but no pink gypsy moths were captured.

Banded Elm Bark Beetle
Scolytus schevyrewi

Hosts: various deciduous species, primarily elm

Statewide detection surveys from 2003 to 2005 conducted by the Nevada State Department of Agriculture's entomologist using pheromone attractants showed banded elm bark beetle (BEBB) from Washoe (2003), Pershing, White Pine, Douglas, Lyon, Churchill, Elko, and Storey counties. In 2006 and 2007, studies by UC Davis and USDA, Forest Service Pacific Southwest Research Station showed that BEBB occurs in western Nevada in Douglas, Washoe and Carson City counties.

Figure 21. Banded elm bark beetle from Forestry Images (http://www.forestryimages.org).

Mediterranean Pine Engraver Beetle (MPE) and Red Haired Bark Beetle (RHBB)
Orthotomicus erosus and *Hylurgus ligniperda*

In 2007, Nevada Dept. of Agriculture placed 58 Lindgren traps in 10 Nevada counties along with five Colossus traps placed in Washoe and Lincoln counties for various wood borers, MPE, and RPBB and did not capture any. None have been found in Nevada to date. Steve

Seybold and Jana Lee of the FS Pacific Southwest Research Station and the University of California Davis checked for these beetles in Las Vegas in March 2007 and found neither beetle in their prime habitats.

Scolytinae/Sirex Wood Wasp *(Sirex noctillo)/* **Asian Longhorn Beetle (***Anoplophora glabripennis)*

Hosts: various species

In 2009, The Nevada Department of Agriculture and the Nevada Division of Forestry cooperatively completed the Early Detection and Rapid Response (EDRR) bark beetle survey of the state for 2009. Nine sites were selected for their proximity to a possible pathway for introductions and for their representation of local forest conditions. Over 4,700 specimens were screened by the State Entomologist. Three new state records of scolytids resulted from the survey. They were cedar (juniper) bark beetle (*Phloeosinus serratus)*, fir root bark beetle (*Pseudohylesinus granulatus)*, and European shothole borer (*Anisandrus dispar)*. Representative specimens of these and numerous other scoytids are being incorporated into the reference collection at the Nevada Department of Agriculture. There also appears to be several new state records for cerambycids, buprestids and other beetles that have yet to be confirmed.

In 2007, Nevada Dept of Agriculture placed fifty-eight Lindgren traps and fifty Sirex traps in ten Nevada counties as well as five Colossus traps in Washoe and Lincoln counties for various woodborers. No Sirex wood wasp, emerald ash borers or Asian longhorn beetles were found in these traps.

In 2008, forty-two intercept flat panel traps were placed in eight counties and 67 Lindgren funnel traps were placed in fourteen counties. No Sirex wood wasps were captured.

Emerald Ash Borer Beetle *(Agrilus planipennis)*

From June 16 to October 13, 2009, two seasonal Nevada Dept. of Agriculture employees in cooperation with USDA/PPQ staff from Las Vegas set 92 Emerald Ash Borer (EAB) traps in seven counties. All traps were negative. In 2008, surveys for the Emerald Ash Borer (EAB) were conducted in 12 counties with 137 traps and no EAB were captured.

European Pine Shoot Moth (EPSM) (*Rhyaclonia buoliana)*

In 2007, Nevada Dept of Agriculture trapped for EPSM with 141 traps in 9 counties in 2007. Four traps were positive in Douglas County in 2006 and one trap was found positive in Washoe County in 2007.

Light Brown Apple Moth (*Epiphyas postvittana***)**

In 2009, fourteen counties were surveyed with 890 traps. Most of the traps were placed in the Reno and Las Vegas areas. No light brown apple moths were captured.

Japanese Beetle (*Popillia japonica* Newman)

In 2008, 545 traps were placed in 16 counties with the majority concentrated in the greater Reno and Las Vegas metropolitan areas. This was an increase of about 150 traps from last year. No Japanese beetles were found in 2008 or 2007.

STATUS OF DISEASES

STEM AND BRANCH DISEASES

Dwarf Mistletoes
Arceuthobium spp.

Hosts: Douglas-fir, pines, true firs, and single-leaf pinyon

Dwarf mistletoes (DMT) are the single-most damaging agents of coniferous trees. These parasitic plants remain the most widespread and frequently observed disease within the state. Profusely branched, dense masses of host branches called “witches brooms” are often observed. Heavy dwarf mistletoe infestation can predispose trees to attack by insects and other diseases, reduce incremental growth, affect the forest canopy structure, lower resistance to drought, affect production of seed, and affect recreation and aesthetics. Since dwarf mistletoe infests trees of all ages, infestation problems may exist in secondary growth and regeneration, as well as mature and overmature tree stands.

Dwarf mistletoe on pinyon pine can be found throughout the state, but it has never been comprehensively surveyed. The State Forest Health Specialist has found DMT from the Spring Mountains in the south and north through the Toiyabes and east and west to both borders of the state. Pinyon engraver beetle-caused mortality was observed in some of the heavy dwarf mistletoe infected pinyon pine stands around the state of Nevada. Some of the dwarf mistletoe-weakened trees succumbed to pinyon engraver beetle attacks. Ponderosa and Jeffrey pines are often found heavily infected with western dwarf mistletoe and then are attacked by Ips, flathead borers, Jeffrey pine beetle, and western pine beetle as well as other agents, especially during prolonged drought periods.

Pinyon Blister Rust
Cronartium occidentale

Host: singleleaf pinyon pine

An informal survey of central Nevada by various FS pathologists and entomologists as well as BLM and Nevada State Foresters revealed that the disease is prevalent throughout the state. It attacks and kills small trees (Figure 22) and causes branch flagging on larger more resistant trees. Many of the rust infections were attacked by pitch mass borer. This disease is mainly found in a band between 6000 and 7000 feet of elevation near drainages that are suitable for the alternate host (*Ribes* spp.).

Figure 22. Singleleaf pinyon pine infected at the base by pinyon blister rust.

White Pine Blister Rust
Cronartium ribicola

Hosts: limber, bristlecone, whitebark, sugar, and western white pine

White pine blister rust has been observed in western Nevada on the east side of the Sierra Nevada Mountains. The rust has expanded its range in Nevada in recent years, with populations of rust now confirmed in the Jarbidge Mountains. Forest Health Protection conducted a ground survey for white pine blister rust in the mountain Ranges in eastern Nevada primarily focused on high elevation Great Basin bristlecone pine in 2004. No newly infected areas were discovered, and the previously reported rust infection in the Ruby Mountains was found to be dwarf mistletoe. At this point the only confirmed population of white pine blister rust in eastern Nevada is in the Jarbidge Mountains.

Sudden Oak Death
Phytophthora ramorum

Sudden Oak Death (SOD), a newly identified forest disease caused by the pathogen *Phytophthora ramorum*, has been killing thousands of tanoak and oaks in the coastal areas

of California, but has not been observed in Nevada. However, with the release of potentially infected nursery stock into all 50 states from a single California nursery, NDOA officials contracted with the USFS to conduct surveys in forest areas on host and potential host species near nurseries or where landowners may have out planted this potentially infected stock. Nevada Division of Forestry personnel have assisted NDOA officials with these surveys. NDOA forest SOD survey data showed no SOD for all regions surveyed to date.

ROOT DISEASES

Annosum Root Disease
Heterobasidion annosum

Hosts: Douglas-fir, lodgepole pine, ponderosa pine, spruce, true firs, and incense cedar

This disease can be found throughout the state on true firs, but it frequently acts as butt decay or as a saprophyte on dead trees, stumps, roots, and cull logs or fallen stems. The fungus occasionally kills young ponderosa pine, especially in plantations on droughty soils. Symptomatic small trees can frequently be found around stumps that had butt decay. The symptoms on larger trees include a thinning crown and fruiting bodies that develop at the base of the tree or inside stumps.

Figure 23. Annosum conk at the base of a tree.

Armillaria Root Disease
Armillaria spp.

Hosts: All trees

Figure 24 Armillaria mushrooms.

Evidence of Armillaria root disease can be found throughout the state causing mortality in all species of trees. This disease also frequently functions as a weak pathogen or saprophyte. Fruiting bodies grow in clusters from the roots or at the base of the tree during moist conditions. There is a close association between root disease pockets and endemic level bark beetle populations. Armillaria was observed on pinyon pine roots in the Virginia Highlands of Storey County and on white fir in the Success Summit area of the Schell Creeks of White Pine County in

2006. It has also been found on Jeffrey pine roots in Carson City County in the Clear Creek area.

Black Stain Root Disease
Ophiostoma wageneri

Hosts: pinyon pine, ponderosa pine, and Douglas-fir

Figure 25. Black stain root disease pockets (circled) in pinyon pine south of Mount Wilson in 2004.

Black stain root disease is an important disease of several hosts, but it is only found on pinyon pine in the state of Nevada. It usually kills affected trees within a few years, and it can produce groups of mortality that are several acres in size. Pockets of infected trees are preferred host for low-level populations of pinyon engraver beetles. No new pockets of black stain root disease were observed by aerial survey in 2009.

LEAF AND NEEDLE DISEASES

Aspen Leaf Spot
Marssonina populi

Host: Aspen

Blight and leaf spot caused by this disease have been seen in the past throughout the host type. Although it was not observed in aerial surveys in 2008, it was seen in the northern Toiyabes in heavily frost damaged aspen stands.

Figure 26. Symptoms of aspen leaf spot.

DECLINES / COMPLEXES

Subalpine Fir Mortality Complex

Host: Subalpine fir

The western balsam bark beetle (WBBB) is the most significant mortality agent in a complex of forest insects and disease causing subalpine fir mortality. Endemic populations will occur in storm-damaged trees, slash, or trees of poor vigor. WBBB infestations may build to epidemic levels, where mortality can occur in groups of 100 to 10,000 trees. Annosum root disease, woodborers and several species of smaller bark beetles are also involved in this complex. Environmental stress due to drought or overcrowding may also have a role in the death of trees in this category.

In 2009, mortality attributed to subalpine fir mortality complex decreased to about 75% of the 2008 levels to 1,326 trees (Figure 27). The acreage affected in 2009 was 3,079 acres. This increased acreage is due to the scattered nature of the mortality. Most of this subalpine fir mortality was on the Mountain City and Jarbidge Ranger Districts of the Humboldt-Toiyabe National Forest in Elko County.

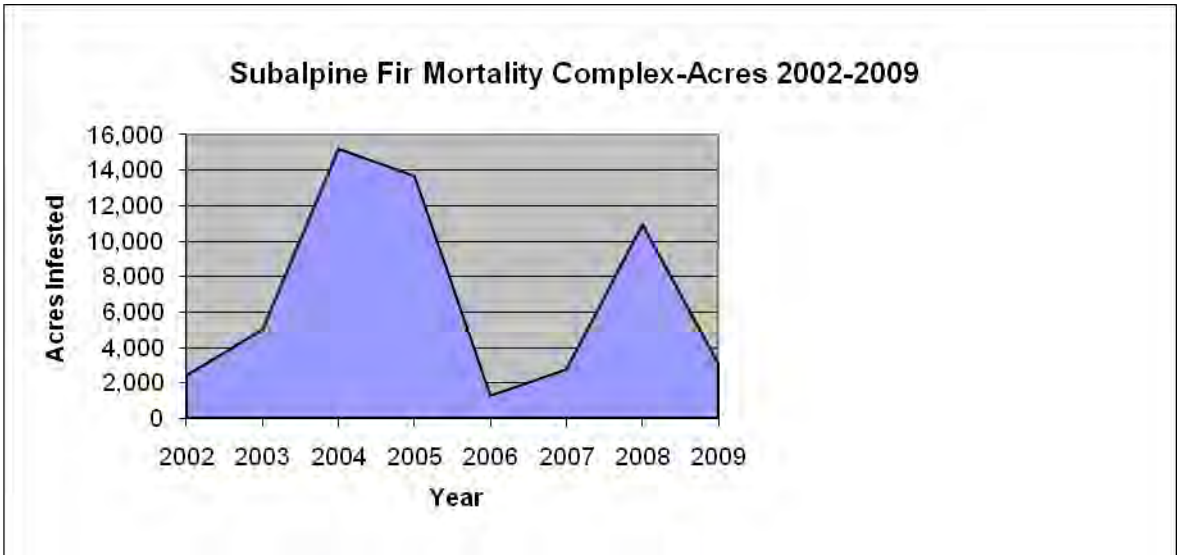

Figure 27. Number of subalpine fir killed in Nevada during eight years (2002-2009).

Figure 28. Subalpine fir mortality.

Elko County – Over 1,326 trees in scattered patches of mortality were mapped in the Jarbidge Mountains, including the Jarbidge Wilderness, in the Elk Mountains, the Bull Run Mountains, and the northern Independence Mountains.

Aspen Decline

Host: Aspen

A decrease in the amount of aspen forest acreage has been reported throughout the western U.S. for many years. The primary forces involved are succession of aspen forest to other vegetation types due to fire exclusion, and damage to young aspen sprouts by grazing animals. This phenomenon has been labeled “aspen decline” by some authors. This type of “decline” should be distinguished from the aspen dieback that has been detected in aerial survey that is caused by several agents including drought stress, insects, diseases and other stresses. This dieback can impact aspen clones that have been impacted by fire exclusion and grazing pressure causing them to decline and die.

Aspen dieback has been noted anecdotally for many years in the Intermountain Region, and dieback has been recorded by aerial survey since 2003. In 2004, Intermountain Region FHP examined what had been mapped as insect defoliator damage or Cytospora canker in

several areas in north-central Nevada and discovered that a number of insect and disease agents were involved. In 2006, FHP established monitoring plots in several areas in Nevada.

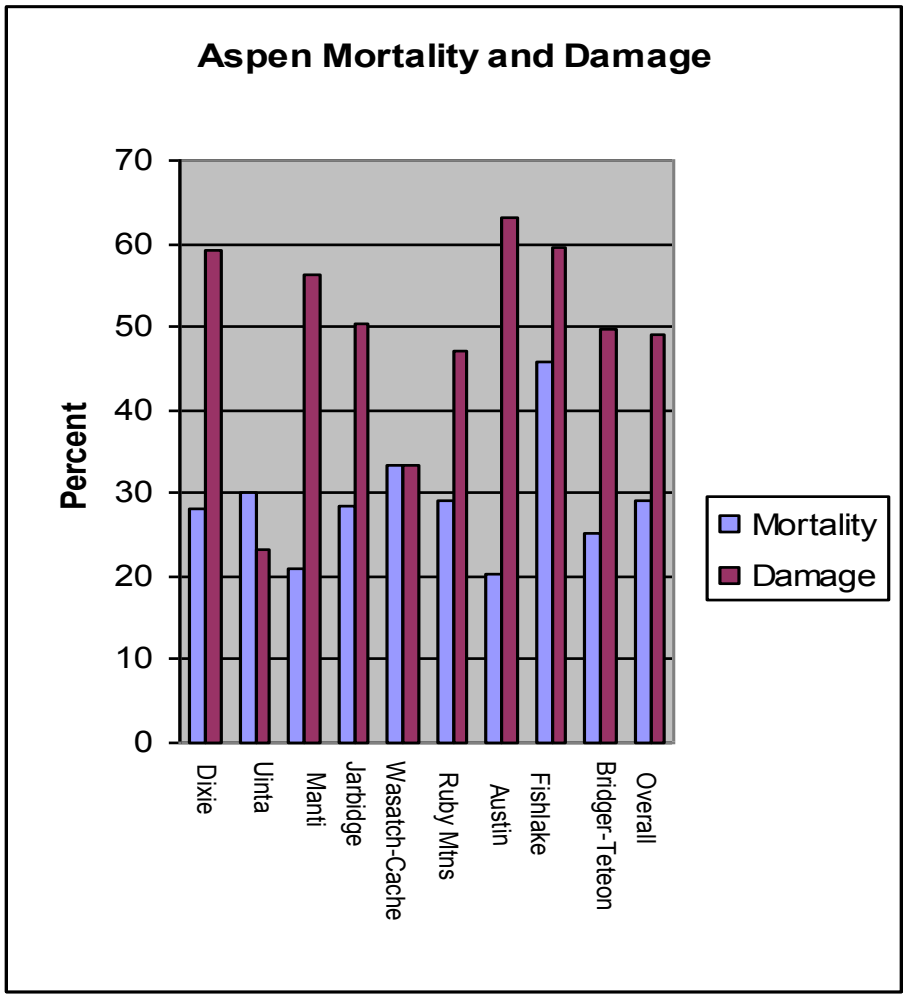

Figure 29. 2006 Percent of aspen damaged and killed in National Forests/Ranger Districts.

Data analysis of these plots is ongoing but a few trends were evident from an early review of the data. In the areas evaluated, there were observed high levels of mortality and moderate to heavy damage in the trees over 2 inches in diameter at breast height (Figure 29). The most common agents involved were canker diseases and insect borers. In the aspen regeneration, the number of trees per acre was highly variable (Table 6). In some cases regeneration was heavily damaged, primarily by animal browsing.

In many cases, if grazing pressure was not heavy, the clones involved seemed to be recovering and had produced a good crop of new sucker sprouts. However, in some cases heavy grazing pressure was removing sucker sprouts produced as a response to death of overstory trees which may contribute to the eventual death of these clones. In other cases, the clones were not recovering even in the absence of grazing pressure.

Table 6. 2006 aspen regeneration plots on National Forests (NF)/Ranger Districts (RD).

Forest (District)	Trees per acre	Percent Damaged
Dixie NF	2,300	57.4
Uinta NF	416	5.2
Manti NF	5,600	25.4
Wasatch-Cache NF	4,300	11.6
Humboldt-Toiyabe NF (Jarbidge RD)	3,360	36.9
Humboldt-Toiyabe NF (Rubies RD)	1,450	47.8
Humboldt-Toiyabe NF (Austin RD)	1,813	68.9
Fishlake NF	3,550	47.9

In 2009, 12,528 acres of aspen decline were mapped in eleven counties. This is approximately the same as 2007 and 2008's figures. There were decreases in some counties such as Eureka, Humboldt, Nye, and White Pine, but slight increases in Elko, and Washoe counties.

Carson City – 20 acres of decline in one spot in North Canyon just south of Marlette Lake.

Douglas County – 45 acres of decline in spots on headwaters of Logan and Glenbrook Creeks.

Elko County – 8,322 acres of decline was mapped in numerous spots in the lower elevations of the south and west Jarbidge Mountains, in small spots throughout the Tennessee, Mahoganies, Elk, Bull Run, Independence, East Humboldt, and Ruby Mountains.

Eureka County - 239 acres of light decline was mapped in small spots in the northernmost end of the Monitor Range.

Humboldt County – 863 acres of light to heavy aspen decline occurred throughout the Santa Rosa Mountains in small to medium-sized pockets, with a few large patches on the northwest and southeast edges. This is about 66% of the 2008 acreage.

Lander County – 160 acres of aspen decline in a number of small spots on the north end of the Toiyabe Range just south of Austin Summit.

Lincoln County – 10 acres in the Wilson Creek Mountains

Nye Counties – 2,718 acres. Decline was mapped in scattered small spots in the lower elevations of the Toiyabes, and in one spot on the Shoshone Range at Wind Comet Springs. It was found in small spots throughout the Toquima and Monitor Ranges and the northern end of the Antelope Range. The acreage of 2009 decline was about 80% of 2008's decline.

Washoe County – 2009 acreage at 67 acres was 118% of the 2008 acreage found in small pockets at the southeast end of Marlette Lake, and in the headwaters of Mystic Creek.

White Pine County – The 77 acres mapped in 2009 was approximately one third of the 2008 acreage. Most of the decline was from the small patches scattered throughout the northwestern Schell Creek Range from Mattier Creek south to Berry Creek with one patch in the northern Snakes in Smith Creek.

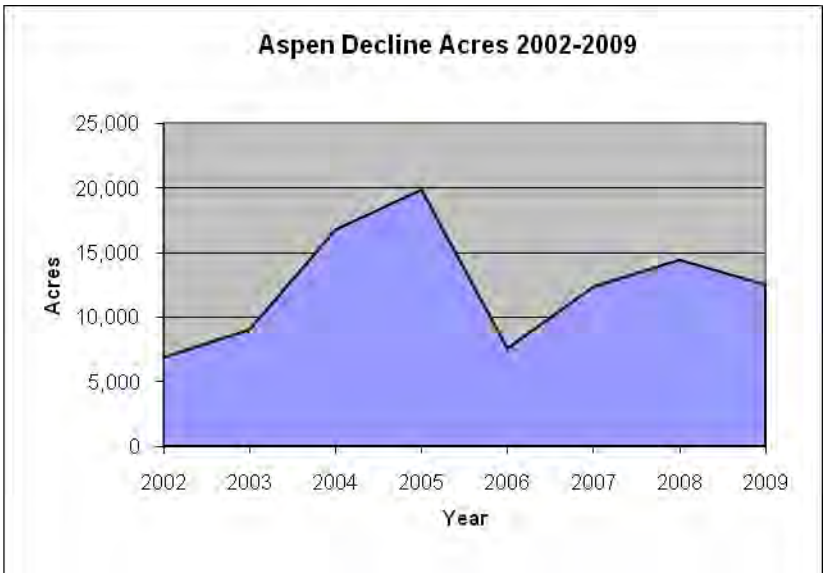

Figure 30. Acres with aspen decline in portions of California and Nevada during eight years (2002-2009).

Cytospora Canker
Cytospora spp.

Host: aspen

Cytospora canker is one of the most common diseases affecting aspen in ornamental situations and often attacks stressed trees through wounds. This fungus girdles branches by killing the cambium. Large, vigorous trees can withstand the disease and are rarely killed. Activity from this pathogen is most likely a symptom of several years of drought or defoliation from other insects or diseases. From the air, decline due to Cytospora canker can look similar to decline by forest tent caterpillar defoliation. The decline was mistakenly identified by aerial observers as forest tent caterpillar defoliation in 2002 and 2003. Further field study is needed to determine all the decline causes. In 2009, much of the aspen decline showed overstory decline but the understory regeneration was healthy.

ABIOTIC DAMAGE

Drought Damage

Host: curlleaf mountain mahogany

Extensive yellowing and leaf loss of curlleaf mountain mahogany (*Cercocarpus ledifolius* Nutt. Ex Torr. & Gray) foliage was seen during the 2007 through 2009 ADS throughout the state. These evergreen leaves had turned yellow or red, and then dropped off. In many areas only small tips of green leaves remained on the trees. In 2008 and 2009, many of the areas that were declining in 2007 had mountain mahogany mortality in the centers of the large patches that are still in decline (Figure 32).

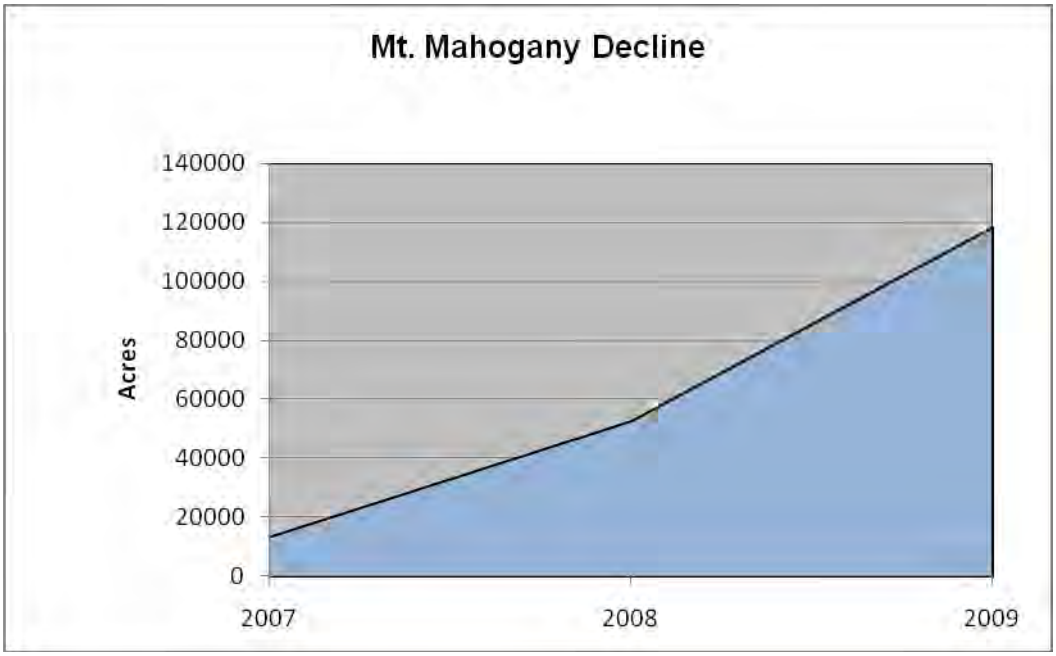

Figure 31. Curlleaf mountain mahogany decline acreage from 2007-2009.

In 2009, the affected acreage tripled again for the second year in a row to 118,224 acres from the 2008 acreage of 34,134 (Figure 30). The number of counties affected increased from nine in 2008 to eleven in 2009. Nye County had the majority of the damage with a moderate level of damage in Eureka County. Significantly less damage was found in Douglas, Lander, Lincoln, Lyon, Washoe and White Pine Counties. Clark, Elko, and Storey Counties had low damage.

Clark County – 40 acres of decline was observed in the southeast area of the Spring Mountains on the west side of Lovell Canyon.

Douglas County – 863 acres of decline was observed in small patches in the eastern Pinenut Mountains and southwest of Holbrook Junction along the California border.

Elko County – 31 acres of light decline was mapped in one spot at the headwaters of six mile creek on the north east end of Pequop Mountains.
Eureka County – 19,801 acres of decline was mapped in large patches in the northernmost end of the Monitor Range, the Antelope Range, and Whistler Mountain. Much of this decline was mixed in and adjacent to pinyon sawfly defoliated areas. This is two and a half times the amount mapped in 2008.
Lander County – 3,902 acres, which is a two and a half increase in area from 2008, was observed in large patches of the northern Shoshone and Toquima Range and in small spots in the northern Toiyabe Mountains.
Lyon County – 355 acres in one pocket around Lyon Peak in the Pinenut Mountains. This is one fifth the number of acres observed in 2008.
Nye County – 86,843 acres observed in 2009 was a six-fold increase from that observed in 2008. Decline was mapped in many medium to large areas throughout the Monitor, Toquima, southern Toiyabe, southern Shoshone ranges, northern Antelope and the northern Hot Creek Ranges.
Storey County – Only one acre was mapped in 2009 compared to 27 acres in 2008. This decline was found in a small spot directly west of Virginia City in the Virginia Range.
Washoe County – The 1,987 acres mapped in 2009 was 118% of the 2008 acreage. This decline was found in large patches just north of the Mount Rose Highway in the Whites Creek and Thomas Creek watersheds.
White Pine County – The 2,066 acres in 2009 is only 34% of the 2008 acreage. Most of the decline in acreage was from a decrease in the area affected in the Snake Range both in the north and south areas. There was still some decline in the middle portion of the Snakes, but much less than 2008. The rest of the mahogany decline was light and in small patches scattered throughout the Schell Creek Range, the Duck Creek Range, the Grant Range, the Quinn Canyon Range, and in the northern White Pine Range.

Figure 32. Drought damage on curlleaf mountain mahogany foliage near the top of the east side of the Pinenut Mountain Range 2009. Note dead gray areas from 2007-8 in middle of mahogany stands with reddish defoliation & decline around the edges.

Blowdown

Areas of concentrated, high velocity winds can cause trees to blow over. Blowdown occurs in groups or as scattered trees within the landscape. Depending on the tree species, patches of blowdown in coniferous forests can provide a food source for various bark beetles, enabling populations to build to epidemic levels. These epidemic populations may then attack and kill standing, live trees adjacent to the blowdown. No blowdown was mapped in 2009.

Wildfire Damage

A large fire of about 60,000 acres burned in the northeastern Jarbidge Mountains in late 2008. This fire, called the East Slide Rock Ridge Fire, destroyed thousands of subalpine fir and whitebark pine (Figure 31 and 32). A few smaller fires in western Nevada burned hundreds of acres of pinyon pine.

Figure 32- The start of the East Slide Rock Ridge Fire in August, 2008
at the top of the Jarbidge Mountains with loss of subalpine fir and whitebark pine stands.

Figure 33 – Timber being engulfed by the East Slide Rock Ridge Fire in 2008
from the website: spot Fire Images.com http://www.spotfireimages.com/znp1.html

Noxious weeds

Noxious weeds are a continuing problem for all Western states. They have the ability to colonize disturbed habitats, aggressively displacing native plant species and altering ecosystems. Several state and federal agencies have the responsibility for monitoring and controlling noxious weeds. Our intention by including this information is to increase awareness of these potential problems. Table 5 at the beginning of this document is the list of plants declared noxious weeds by the State of Nevada for specific counties. The NDOA in coordination with the Nevada Department of Conservation and Natural Resources' Natural Heritage Database Program had hired a Weed Geographic Information System Mapping Coordinator, Kim Williams, which significantly helped with monitoring weed populations in Nevada. There is no more funding for this work at this time. For more up-to-date information on Nevada Noxious Weeds and the newly adopted three-tier State List go to **http://www.agri.nv.gov/PLANT_NoxWeeds_index.htm**

Toadflax Bio-control
Toadflax stem boring weevils (*Mecinus janthinus*)

On September 20, 2009, four Dalmatian toadflax (*Linaria dalmatica*) stem boring weevils release sites in Pioche Nevada were inspected. One of the four sites had been mowed down in the spring. The remaining three sites all had signs of insect damage and two of the three sites had adult weevils on the plants. No inspections of the Virginia City or Gardnerville 2007 release sites, which showed no signs of over wintering success in 2008, were done this year. A trip to Utah is planned for the second week of December to collect overwintering adults in stems to be brought back to Reno for incubation and a spring 2010 release.

The following noxious weed websites, while not inclusive, give additional information on noxious weeds such as biology, history, and control.

http://www.invasivespecies.gov
This website is the gateway to federal and state efforts concerning invasive species. There are links to numerous invasive species databases. This website should be one of your first stops.

http://www.agri.nv.gov/PLANT_NoxWeeds_index.htm
This website contains any information you need about noxious weed prevention, control and management for all land managers in the state of Nevada. Another good site to look at first.

http://www.cdfa.ca.gov/phpps/ipc/encyclowedia/encyclowedia_hp.htm
California Department of Food and Agriculture has a very comprehensive website. Information includes: identification, biology, and management. Pictures of the plants in various stages are just a click away.

http://www.nwcb.wa.gov/index.htm

State of Washington's noxious weed control board website has information on black henbane, buffalo bur, camel thorn, Canada thistle, Dalmatian toadflax, dyer's woad, goatsrue, houndstongue, johnsongrass, jointed goatgrass, diffuse, Russian and spotted knapweed, leafy spurge, Mediterranean sage, musk thistle, perennial pepperweed, purple loosestrife, puncturevine, rush skeletonweed, silverleaf nightshade, scotch thistle, St. Johnswort, yellow nutsedge, purple and yellow starthistle, and velvetleaf. Topics include description, economic importance, geographic distribution, habitat, history, growth and development, reproduction, response to herbicides, response to cultural controls, and biocontrol potentials.

http://www.ipm.ucdavis.edu/PMG/selectnewpest.landscape.html#WEED
University of California pest management website has information on Bermuda grass, field bindweed, Russian thistle, yellow starthistle, and others. Topics include identification, biology, and management through cultural and chemical control options.

http://www.ext.colostate.edu/pubs/natres/pubnatr.html
Colorado State University Cooperative Extension website in the Range section has fact sheets on musk thistle, leafy spurge, Canada thistle, diffuse, Russian, and spotted knapweeds. Information includes description, phenology, and management options such as cultural, chemical, mechanical, and biological.

http://www.weedcenter.org
An interagency website housed at the Montana State University. The Center for Invasive Plant Management (CIPM) promotes the ecological management of invasive plants in the West through education, by facilitating collaboration among researchers, educators, and land managers, and by funding research projects and weed management areas. The center serves as an information clearinghouse, providing examples of ecological management, and delivering implementation tools and products to land managers. The center operates in partnership with federal, state, counties, private industry, universities, foundations, and landowners.

http://invader.dbs.umt.edu
The University of Montana's Invaders Database has a search engine that links the user to informational websites on most of the invasive weeds. You can search the database for the list of Noxious Weeds by state and most identified plants have additional information and links to more information.