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Forest Pest Conditions in Nevada 2006

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Front Cover Photos(Top) :Fir Engraver damage on top of Schell Creek Mountains August, 2006 and (Bottom) being treated by NDF Conservation Crews in October, 2006 by Gail Durham

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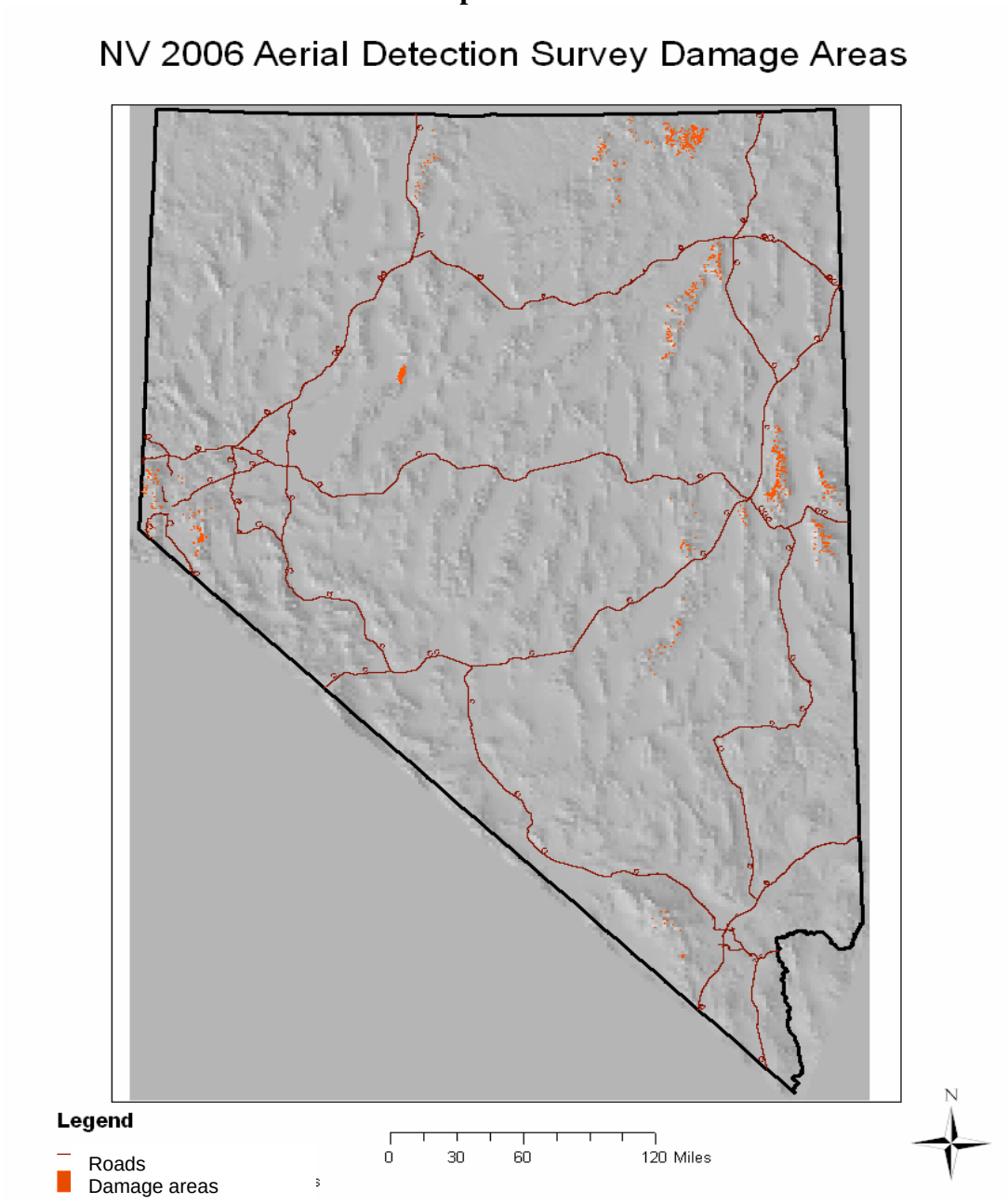

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INTRODUCTION AND SUMMARY

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. In 2006 over a million fewer acres were surveyed than in 2005 due to budgetary constraints (Table 1). Most of this area was the National Forest Service (FS) and Bureau of Land Management (BLM) lands in 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 2002-2006.

Land Ownership/Year	**2002**	**2003**	**2004**	**2005**	**2006**
Humboldt-Toiyabe National Forest (NV)	3,760,541	3,551,831	3,924,916	3,697,058	2,508,470
Humboldt-Toiyable National Forest (CA)	515,917	529,402	595,027	531,615	548,010
BLM	554,298	1,069,113	1,076,408	1,108,999	712,304
Private (NV)	309,788	284,879	298,632	344,314	153,225
Private (CA within National Forest)	29,802	30,520	32,594	31,546	38,000
Great Basin National Park	76,465	77,052	76,244	76,721	77,019
Other Federal*	2,609	1,479	41,957	2,866	10,782
NV State Lands	17,929	18,342	17,813	17,955	3,001
TOTAL	**5,267,349**	**5,562,618**	**6,063,591**	**5,811,074**	**4,050,811**

*Includes USF&W, DOD, BIA, 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 2006 is for Nevada only and summarized on a county basis. Total acres surveyed and percent of each county surveyed in 2006 are provided in Table 2.

Table 2. Number and percent of acres surveyed in Nevada counties in 2006.

COUNTY	Total Acres in County	2006 Acres Surveyed	2006 % Surveyed
Carson City	103,569	56,984	55.0
Clark	5,176,177	257,274	5.0
Douglas	478,351	254,664	53.2
Elko	10,979,963	911,957	8.3
Eureka	2,663,738	0	0.0
Humboldt	6,219,557	223,279	3.6
Lander	3,534,543	0	0.0
Lincoln	6,782,623	36,619	0.5
Lyon	1,310,315	62,919	4.8
Mineral	2,462,989	0	0.0
Nye	11,686,348	460,304	3.9
Pershing	3,863,680	26,175	0.7
Storey	167,774	20,462	12.2
Washoe	4,234,009	154,698	3.7
White Pine	5,676,727	1,165,291	20.5
Total	65,340,363	3,630,626	5.6

In 2006, insect and disease mortality numbers dropped for the second year in a row. Both 2005 and 2006 had average to above average precipitation in Nevada. Precipitation is crucial for trees to remain vigorous, which increases tree resistance to insects and pathogens. With adequate rainfall or snowmelt, the trees can maintain their defenses such as repelling attacking bark beetles with pitch or growing more foliage to replace that eaten by defoliating insects. Without adequate precipitation, a tree's resistance is significantly reduced. The western states, including Nevada, experienced drought from 1999 to 2004 (Figure 1). In 2005 and 2006, most of Nevada's watersheds had above normal precipitation and snowfall with above normal summer precipitation in the southeastern portion of the state as well.

In 2006, most estimates of mortality caused by insect outbreaks (acres affected and number of trees killed) declined significantly from 2005 levels, although there were local increases in mortality from specific agents in some counties (Table 3). In general, nearly every mortality agent had less acreage and less trees killed than in 2005 except for two insects:

1. Mountain pine beetle in white pines increased 500% from 2005 due to a nearly 1000 fold increase in Elko County, mostly in the Jarbidge area.
2. Jeffrey pine beetle in western Nevada increased approximately 150% overall and 1,200% in Carson City County. There were significant increases in adjacent eastern California as well.

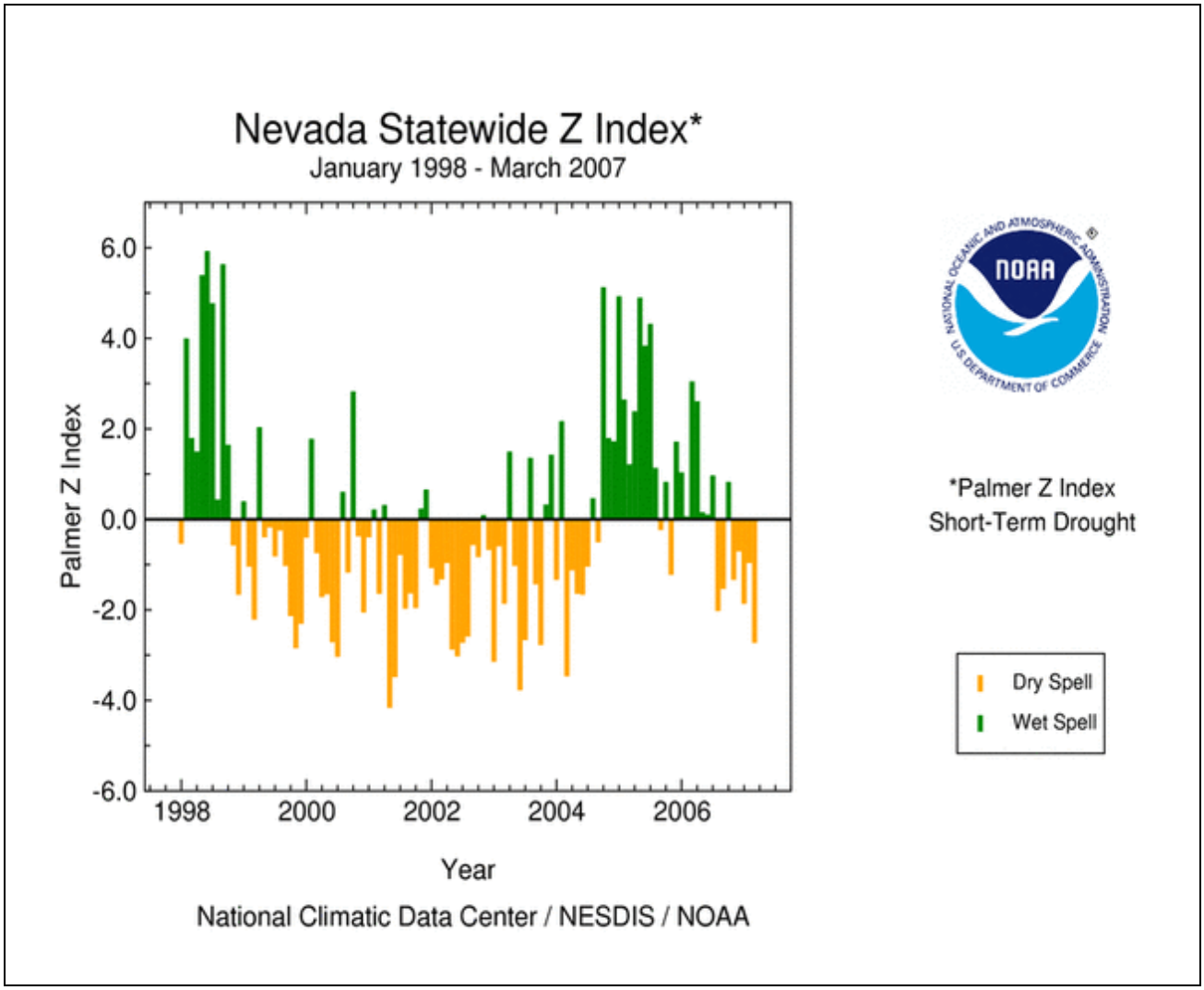


Figure 1. National Oceanic and Atmospheric Administration (NOAA) Palmer Drought Severity Index for Nevada from 1998-2007.

Most of the mortality noted in 2006 is attributed to bark beetle activity. Please note that most bark beetle-killed trees are not typically symptomatic (faded foliage) until the following summer after attack. Therefore, the numbers of acres affected or trees killed by bark beetles as recorded by the ADS flights are often a reflection of the previous year's bark beetle activity. Defoliation levels, however, reflect current year's activity or activity since bud break.

Table 3. Mortality detected in 2006 by 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	7	3	20	10	120	60	95	47		
Clark	20	9	320	352			0	0		
Douglas	70	35	245	120	90	45	4,776	3,691		
Elko	5,597	3,031	3,318	1,425					1,709	1,079
Eureka										
Humboldt	10	5								
Lander										
Lincoln							15	7		
Lyon	10	5	5	2			125	62		
Mineral										
Nye	40	20	2,233	725			150	75		
Pershing										
Storey							25	12		
Washoe	118	59	130	194	115	57	185	92		
White Pine	645	321	11,426	12,186			95	47		
Total	6,507	3,483	17,697	15,014	325	162	5,466	4,033	1,709	1,079

[1] Mountain pine beetle-caused mortality occurred in whitebark, bristlecone and limber pines only and does not include lodgepole/ponderosa pine mortality. Mortality in lodgepole included 15 trees/4 acre and 265 trees/172 acres in Douglas, and Washoe counties, respectively. Mortality in ponderosa included 30 trees/15 acres, 20 trees/5acres and 5 trees/2 acres in Clark, Nye and White Pine counties, respectively.

In 2006, most estimates of defoliation and dieback caused by insect and disease activity in Nevada (acres affected) were significantly less than 2005 levels. Douglas-fir tussock moth defoliation decreased to about 1% of levels from 2005, and aspen decline detected in 2006 was more than 1/3 of 2005 levels but mostly due to huge 500% increases in Washoe and White Pine counties offset by the 50% acreage decline in Elko county and the acreage decline in Nye county primarily due to reduced surveyed acreage in that county in 2006 (Table 4).

Table 4. Insect defoliation and decline by Nevada county in 2006.

	Aspen Decline	Douglas fir Tussock Moth
COUNTY	Acres	Acres
Carson City		
Clark		
Douglas	130	
Elko	5,620	35
Eureka		
Humboldt	455	
Lander		
Lincoln		
Lyon	35	
Mineral		
Nye	38	
Pershing		
Storey		
Washoe	173	
White Pine	1,026	
Total	**7,477**	**35**

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

Invasive weed species continued to spread throughout the State affecting additional counties in 2006. Two more noxious weed species have been added to the state list and occur in three or more counties. A few species are widespread such as salt cedar (tamarisk), perennial pepper weed, hoary cress, Russian knapweed and Scotch thistle (Table 5).

Table 5 - Noxious weeds in Nevada by county in 2006

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		**X**										**X**					
African Mustard			**X**							**X**			**X**				**X**
Black Henbane					**X**		**X**		**X**				**X**				**X**
Canada Thistle	**X**			**X**	**X**		**X**	**X**	**X**	**X**	**X**		**X**	**X**		**X**	**X**
Dalmatian Toadflax				**X**	**X**					**X**			**X**		**X**	**X**	**X**
Diffuse Knapweed				**X**	**X**		**X**		**X**	**X**			**X**			**X**	**X**
Dyer's Woad					**X**											**X**	
Giant Reed																	
Goat's Rue			**X**														
Hoary Cress/Whitetop	**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**
Houndstongue					**X**												
Leafy Spurge	**X**				**X**		**X**	**X**					**X**				**X**
Malta Starthistle			**X**														

Table 5 - Noxious weeds in Nevada by county in 2006

State Declared Noxious Weeds	Carson City	Churchill	Clark	Douglas	Elko	Esmeralda	Eureka	Humboldt	Lander	Lincoln	Lyon	Mineral	Nye	Pershing	Storey	Washoe	White Pine
Mediterranean Sage					**X**											**X**	
Musk Thistle		**X**			**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				**X**	**X**		**X**						**X**		**X**	**X**	**X**
Puncturevine					**X**												
Purple Loostrife											**X**					**X**	
Purple Starthistle				**X**	**X**		**X**		**X**								
Russian Knapweed	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**		**X**	**X**
Salt Ceder (Tamarisk)		**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**			**X**			**X**			**X**	**X**
Squarrose Knapweed					**X**				**X**	**X**			**X**				X
Sulfur Cinquefoil					**X**												
Water Hemlock					**X**		**X**		**X**								

Table 5 - Noxious weeds in Nevada by county in 2006

State Declared Noxious Weeds	Carson City	Churchill	Clark	Douglas	Elko	Esmeralda	Eureka	Humboldt	Lander	Lincoln	Lyon	Mineral	Nye	Pershing	Storey	Washoe	White Pine
Yellow Toadflax					**X**												
Yellow Starthistle	**X**	**X**	**X**	**X**	**X**	**X**		**X**			**X**			**X**		**X**	

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

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 2006, 22,070 acres were treated and 24,175 acres were inventoried for weeds. In 2006, NDOA released bio-control agents on leafy spurge in Elko County, agents for Canada thistle in Douglas County, agents for spotted and diffuse knapweed in Washoe and Douglas Counties, and agents for field bindweed in Lyon County. Dalmatian toadflax and tamarisk collections and releases are being coordinated by Jeff Knight, State Entomologist.

STATUS OF INSECTS

Insects: Native

DEFOLIATORS

Douglas-fir Tussock Moth
Orgyia pseudotsugata

Hosts: All true firs and spruce

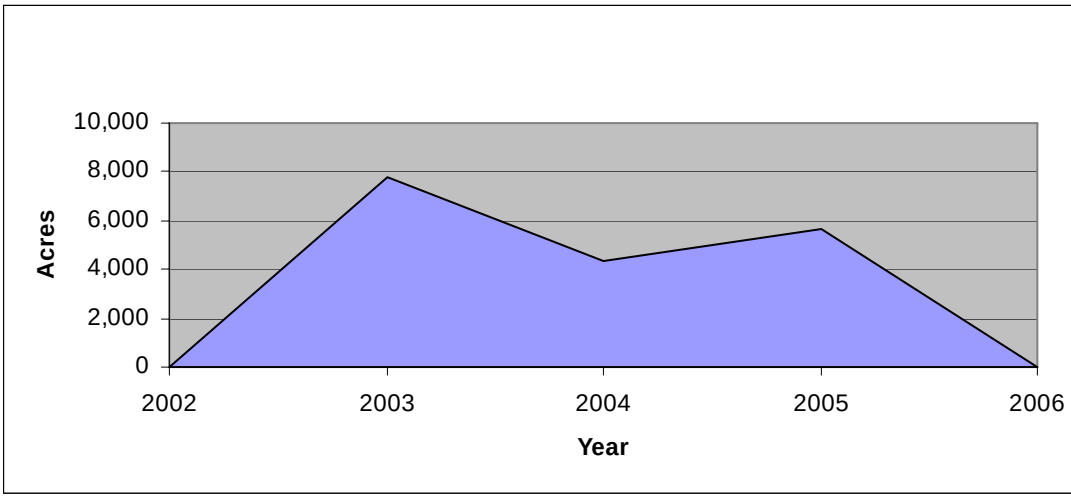
The Douglas-fir tussock moth (DFTM) is an important native insect capable of causing significant defoliation. Heavy defoliation causes reduced growth, stress, and tree mortality. Heavy defoliation can cause top kill and mortality of advanced regeneration during a single season. Outbreaks are cyclic,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

DFTM defoliation was heavy and detected on 35 acres in Nevada. This is 1% of 2005's 5,657 acres

Most of the defoliation occurred in Elko County on the Mountain City and Jarbidge Ranger Districts of the Humboldt-Toiyabe National Forest.

Figure 2. Douglas-fir tussock moth larvae.

Figure 3. Acres affected by Douglas-fir tussock moth defoliation in Nevada during five years (2002-2006).



Elko County – Only 35 acres of heavy Douglas fir tussock moth defoliation occurred in the Jarbidge Mountains. The one patch of defoliation was in the north end of the Jarbidge Mountains along a ridgeline above and southeast of the town of Jarbidge.

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. Past outbreaks have caused widespread defoliation and mortality of smaller trees. In 2006, a large area on the west backslope of Whistler Mountain just northwest of Eureka, NV was reported (Figure 4) This outbreak has been observed for over 3 years and has severely defoliated the pinyon in all size classes. The defoliation extends across the mountain range along an elevational band over hundreds of acres.

Figure 4. Pinyon sawfly defoliation on the west side of Whistle Mountain in summer of 2006

BARK BEETLES

Fir Engraver Beetle
Scolytus ventralis

Hosts: true firs

Figure 5. Old and new white fir mortality caused by fir engraver along Success Summit in the Schell Creek Mountains in White Pine County, October, 2006.

Mortality due to Fir-engraver beetle (FEB) decreased significantly from 31,000 trees killed in 2005 to 17,697 trees killed in 2006 (Figure 6). In 2006, the number of acres affected, was approximately three quarters of 2005 at 15,014 acres,

For the fourth consecutive year, White Pine County had the highest rate of tree mortality with approximately 11,426 dead trees over approximately 12,186 acres in 2006, representing a significant decrease from 2005. Fir mortality in Carson City, Clark and White Pine counties decreased significantly from 2005 figures but increased in Douglas, Elko and Nye counties.

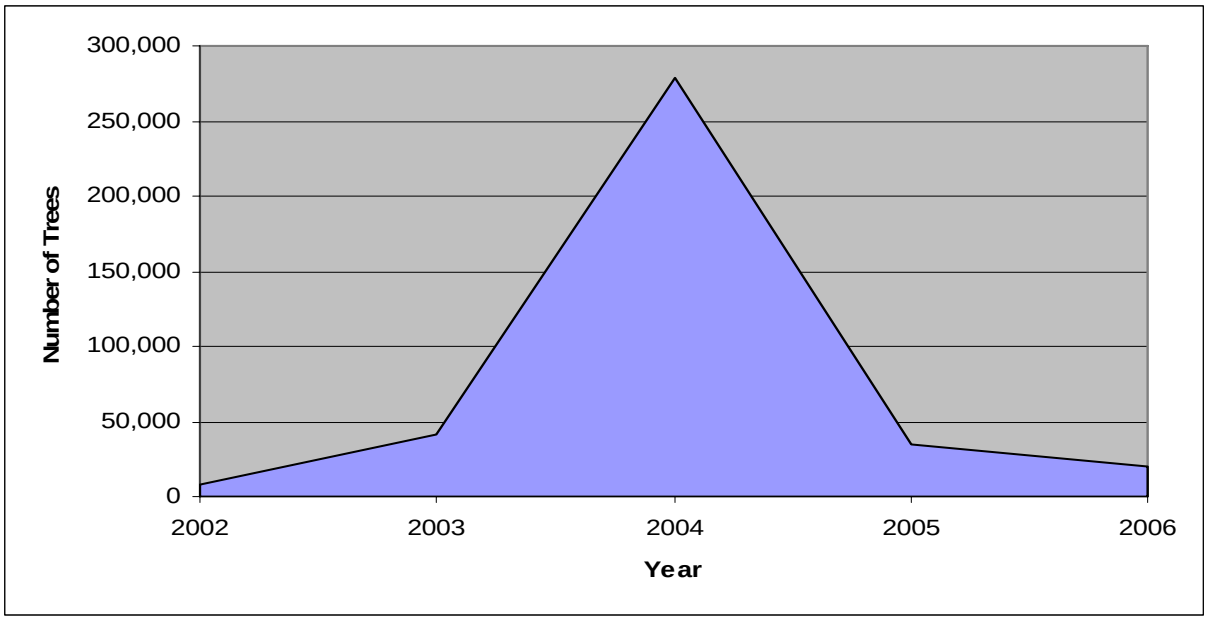


Figure 6. Tree mortality affected acreage caused by the fir engraver beetle in Nevada during five years (2002-2006).

Carson City County – Mortality decreased to less than 20% of 2005 levels for this county in 2006, with approximately 20 trees on approximately 10 acres, mostly in two spots on the hillside south of Marlette Lake and on the lower north slope of Ash Canyon..

Clark County- Mortality decreased to about 20% of last year's levels. Some of this may be attributed to poor survey conditions for the Spring Mountains in 2006. More than 320 trees on 352 acres were mapped as mortality in 2006. Scattered pockets were mapped throughout the upper elevations of the Spring Mountains with large polygons in Kyle Canyon above the Rainbow subdivision and one above and to the east of the community of Kyle.

Douglas County – Mortality increased 250% from 2005 with 245 trees on 120 acres killed. The mortality was found in the Carson Range on scattered spots on the west slope above Lake Tahoe, and two large polygons in the Heavenly Valley Ski Resort upper north facing slopes.

Elko County- Mortality increased about 275% (3,318 trees killed) from 2005 in the number of trees over about the same number of acres This represents a significant increase in this county because the bulk of last year's mortality was in the Spruce Mountains and Cherry Creek Range which were not surveyed this year. In 2006, much of the mortality was in the Jarbidge area where subalpine fir is the dominant fir. This mortality was mapped previously as Subalpine Fir Mortality Complex with Western Balsam Bark Beetle as the main causal agent.

Lincoln County –There was no survey of true fir done in this county in 2006. Field checks on the ground still show FEB active in the Wilson Range and other areas of the county, but none was surveyed due to budget constraints.

Lyon County – There were 5 trees on 2 acres surveyed just west of East Sister Mountain in the northern Sweetwater Mountains.

Nye County – There was nearly a 500% increase in FEB acres and mortality in this county surveyed even though only one-third the acreage was surveyed in 2006 as compared to 2005. Most of this mortality was in small spots in the Quinn Canyon Range, the southern and central portion of the Grant Range and the southern White Pine Range. There were some larger affected areas northwest of Cherry Creek Summit in the Quinns, near the top of Rimrock and Scofield Canyons in the Grants as well as northwest and northeast of Timber Mountain in the Grants, and just north of Broom Canyon in the White Pine Range.
Washoe County – Approximately 130 trees on 194 acres were mapped, an 80% decrease compared to 2005. Most of the mortality appeared as scattered spots throughout the Carson Range with a 50 tree polygon up on the north face of the middle of Whites Creek.
White Pine County – This county accounted for most of the mortality in Nevada –11,426 trees on 12,186 acres. This is a decrease in acres and mortality, but this could be due to lack of survey of the mortality in the Cherry Creek Range in 2006. The majority of the 2006 FEB activity was found throughout the Schell Creek Range, the southwestern area of the White Pine Range, Ward Mountain, Snake Range, and Great Basin National Park.

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 along the Sierra Nevada Mountains. A check on 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 flat head borers.

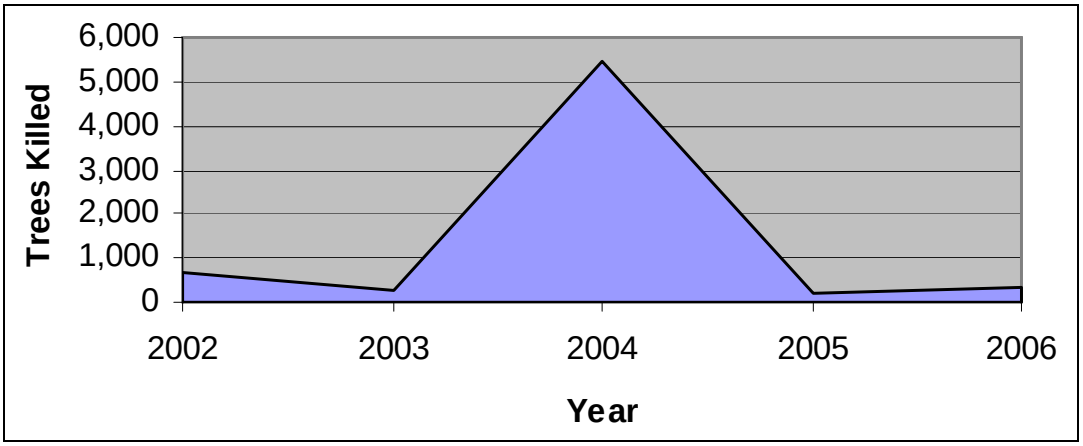


Figure 7. Jeffrey pine mortality in Nevada and in two California counties (Alpine and Mono) during five years (2002-2006).

In 2006, Jeffery pine beetle-caused tree mortality increased 150% over 2005 affecting 325 trees on 162 acres in Nevada (Figure 6). The mortality was divided nearly equally among Washoe, Douglas and Carson City Counties.

Carson City County – 120 trees killed on 60 acres in scattered spots in the headwaters of Ash Canyon and a large 50 tree area north of North Kings Canyon.
Douglas County – 90 trees killed over 45 acres scattered throughout the Carson Range especially on the west slope above Lake Tahoe.
Washoe County – 115 trees killed were scattered in small spots near the headwaters of Gray Creek and on the south facing slope northwest of Incline Village.

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" 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 2006, MPB-caused mortality in whitebark/bristlecone pine increased five fold but mortality in limber, lodgepole, and western white pine decreased to half or less the number of trees reported in 2005. This increase in upper elevation whitebark pine mortality occurred mostly in Elko county with a slight increase in Carson City county (Figure 8).

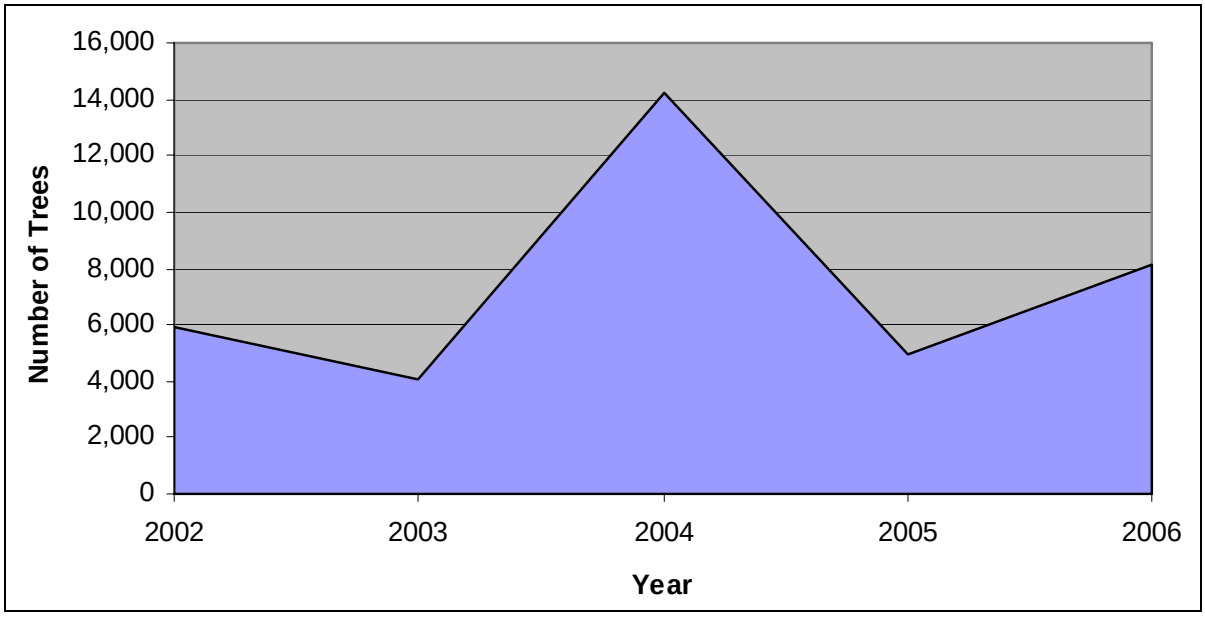


Figure 8. Number of whitebark, limber, and bristlecone pine trees killed by mountain pine beetle in five years (2002-2006).

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

In 2006, mortality of limber pine caused by MPB decreased overall from 2005 to 41% of the acreage and 26% of the tree mortality at 552 acres and 1,065 trees. Most of the mortality occurred as small spots of up to 5 trees on top of the mountain ranges surveyed. Whitebark, bristlecone and western white pine mortality in 2006 increased over 500% overall in the state, mostly from large increases in Elko County in the Jarbidge area.

Carson City County – 3 acres, 7 western white pine trees in two spots at the headwaters of Ash Canyon and just south of Marlette Lake.
Clark County – 15% of 2005 numbers with 5 Limber pine on 2 acres in one spot north of Trout Creek and 15 bristlecone pine trees on 7 acres in the Spring Mountains at the headwaters of Lovell Canyon and south and east of Griffith Peak. Flight conditions during the aerial survey at the higher elevations of the Spring Mountains were poor in 2006.
Douglas County – 17 acres, 35 western white pine trees in the Heavenly Ski area east of the old wildfire burned area.
Elko County – 460 limber pine trees on 251 acres, and 5,137 whitebark pine trees on 2,780 acres. Most of the mortality was scattered in small pockets at higher elevations in the Ruby Mountains and the East Humboldt Range as well as throughout the Cooper Mountains and in the north end of the Independence Mountains. A couple of spots occurred in the Bull Run Mountains and in the Jarbidge mountains. There were large areas of whitebark pine mortality throughout the higher elevations of the Jarbidge mountains.
Humboldt County - Ten limber pine trees were killed at the headwaters of Buffalo Canyon and Morey Creek in the southern Santa Rosa Range on 5 acres.
Lyon County – Ten white pine trees on five acres in a group on the north face of East Sister Peak in the Sweetwater Mountains.
Nye County – 20 acres, 40 dead trees. A few small spots of limber pine mortality mapped with one spot at the top of Water Canyon on top of the Quinn Canyon range and a number of spots north and west of Timber Mountain in Grant Range.
Washoe County - 118 acres, 59 western white pine and whitebark pine trees scattered throughout the higher elevations of the Carson Range.
White Pine County – 247 acres with 550 limber pine trees killed were observed in small spots of scattered mortality along the tops of the southern end of the White Pine Range, along the top ridgeline of Ward Mountain in the Egan Range, and throughout the Snake Range, the Schell Creek Range. Scattered mortality was also reported in Great Basin National Park, especially on the western slope and along the ridgeline north of Snake Creek. Also there were 20 to 25 limber tree areas at the headwaters of Lexington and Big Wash canyons. There were also 95 bristlecone pine trees killed on 47 acres along the ridgelines in Great Basin National Park, on Mt. Moriah in the Snake Range, and along the top northern end of Ward Mountain in the Egan Range.

Mountain Pine Beetle in Lodgepole Pine
In 2006, MPB activity in Nevada decreased to nearly half of 2005 numbers with 280 dead trees on 176 acres.

Douglas County – 4 acres over 15 trees in two small spots at the headwaters of Lincoln Creek and Burke Creek in the Lake Tahoe Basin watershed.
Washoe County – 172 acres, 265 trees scattered throughout the Carson Range with one large 50 tree polygon on the headwaters of the northeast fork of Bronco Creek.

Mountain Pine Beetle/Western Pine Beetle in Ponderosa Pine
In 2006, bark beetle activity decreased compared to 2005 and was found in three counties killing 55 trees over 27 acres.

Clark County – 15 acres, 30 trees in small spots on the east facing slope of Lee Canyon and just west of the Hilltop Campground on the road between Kyle and Lee Canyon.
Nye County – 10 acres, 20 trees in three spots on the east side drainages of the Quinn Canyon range and one spot on a hillside southwest of Troy Peak.
White Pine County – 2 acres, 5 trees were reported in the Snake Range in the southwest end below Great Basin National Park east of the Silver Bell Mine.

Figure 9. Mountain pine beetle caused mortality in ponderosa pine. Picture by D.Powell.

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 10. Mortality caused by pinyon ips on Pinenut Mountain 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, with 3,093,165 dead trees on 259,212 acres.. 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, a dramatic decrease of pinyon mortality was seen within the surveyed area, in twelve counties.

In 2006 approximately 4,033 acres were infested by pinyon ips, affecting over 5,466 trees. This was a 76% decrease from 2005's survey (Figure 11). For a second year, Douglas County had the majority of tree mortality by both acres (91.5%) and number of trees killed (87.4%).

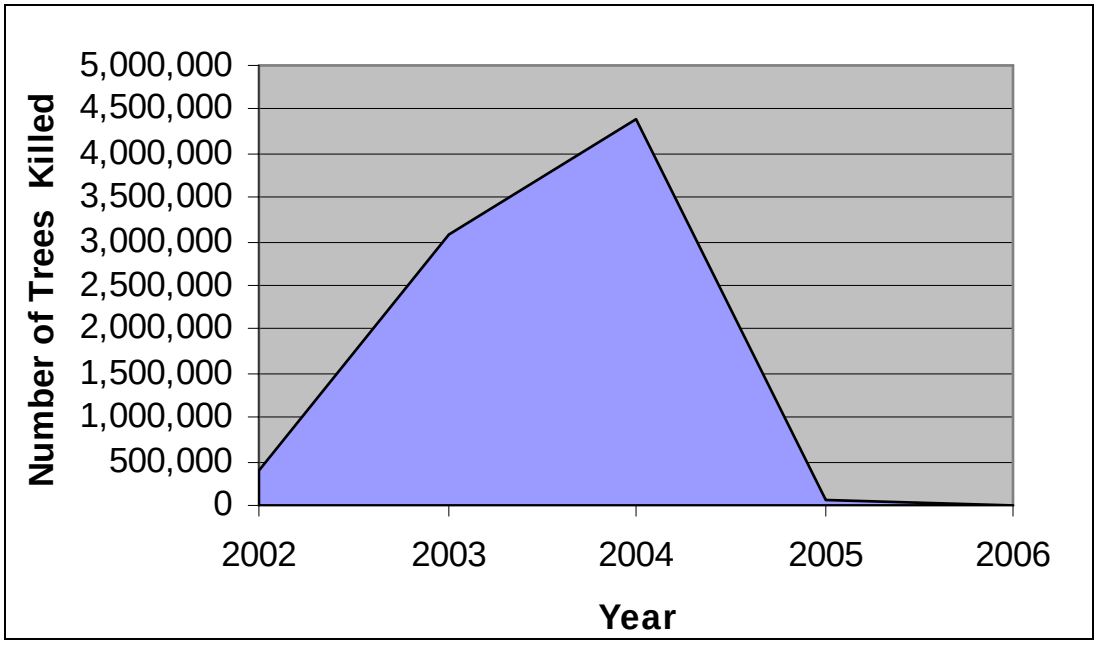


Figure 11. Number of pinyon pine killed by pinyon ips in Nevada and two California counties (Alpine and Mono) during five years (2002-2006)**.**

A special survey was done in 2006 to determine past and present pinyon mortality both in two mountain ranges: the north end of the Stillwater Range in Pershing County and Mount Potosi in the Spring Mountains of Clark County. No new pinyon mortality was mapped in these ranges, but significant older pinyon mortality was mapped.

Carson City County - 47 acres 95 trees; small spots and one area with 50 trees of mortality were recorded in the Pine Nut Range from Bull Run Spring East of Brunswick Canyon south to the county line, including Brunswick Canyon where the larger 50-tree area was found.
Clark County – No new mortality in this county, but 600 older dead pinyon trees on 416 acres were detected on the north side of Mount Potosi on the south end of the Spring Mountains.
Douglas County - 3,691 acres, 4,776 trees, a substantial reduction (24% of the acres and 10% of the trees from 2005). Mortality was recorded in the Pine Nut Mountain Range from the CA border north into Lyon/Carson City Counties. Large areas of mortality still exist in Pinenut Valley north into Mineral Valley with a moderate-sized pocket on the southwest footslope of Mineral Peak. Small spots were scattered south, east and west of these mortality centers. In the winter of 2006-2007, Dr. Gary Bloomquist conducted a search of the Pinenut Mountains looking for live pinyon ips beetles. Many dead beetles in all life stages were found, but no live beetles were found.
Lincoln County - There were 15 trees on 7 acres occuring in small spots at the lower end of the Quinn Canyon Range
Lyon County - 62 acres, 125 trees. Most of this light mortality is a continuation of the mortality in the northern Pine Nut Range east of El Dorado Canyon. This is less than 15% of the 2005 mortality.
Nye County -75 acres, 150 trees. This represents about 26% of 2005 levels but Nye county was not surveyed as extensively in 2006. Scattered spots of mortality occurred throughout the Grant Range, especially on the south end.

Pershing –16,100 trees on 7,575 acres of older pinyon pine mortality was mapped in the north end of the Stillwater Mountains.
Storey County - 12 acres, 25 trees. Approximately 22% of the mortality in 2005 was mapped in the Virginia Range north of Geiger Summit with one spot near the top of Flowery Peak
Washoe County - 92 acres, 185 trees. Mortality was mapped in the western portion of the Virginia Range. This represents an increase of 124% in this county in 2006.
White Pine County - 47 acres, 95 trees. Small pockets of scattered mortality in the White Pine range, with one spot on the northwest footslope of Ward Mountain. Two spots of mortality occurred in the Snake Range south of Hendrys Creek Road and north of Murphy's Wash. This represents an approximately 250% increase from 2005, even though significantly less pinyon pine area was mapped in 2006 in this county.

Figure 12. Pitch mass borer on pinyon pine infected with pinyon blister rust.

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 the smaller 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 12). The rust and borer were found extensively across the state.

Needle Insects

Pinyon Needle Scale
Matsucossus acalyptus

Host: Singleleaf pinyon

The pinyon needle scale causes tip killing, branch flagging, stunted growth and needle injury. Small trees may be killed outright and large trees may be seriously weakened after repeated infestations, rendering them susceptible to pinyon engraver beetle. Pinyon needle scale is found throughout Nevada wherever singleleaf pinyon occurs. No large outbreaks have been noted in recent years but have been noted in past years.

Figure 13. Giant conifer aphid (*Cinara spp*) on pinyon pine in the Virginia Highlands in 2006.

Giant Conifer Aphid
Cinara spp.

Host: singleleaf pinyon, Jeffrey pine

Substantial populations of giant conifer aphid (Figure 13) were found on pinyon pine on private land in the Virginia Highlands of Storey County and in spots on BLM land north of Eureka Nevada on the east side of the Mountain Boy Range east of Whistler Mountain. It was also noted on Jeffrey pine in small areas on the east shore of Lake Tahoe on Nevada State Park land at Sand Harbor State Park and Spooner State Park in Washoe County and in North Canyon in Carson City County, respectively.

INSECTS: NON-NATIVE

European Gypsy Moth
Lymantria dispar

Hosts: various deciduous species

Statewide detection surveys conducted by Nevada State Department of Agriculture and Animal and Plant Health Inspection Service (APHIS) using pheromone attractants resulted in no male moth captures in 2006. The last identified egg masses were discovered in an RV park in Winnemucca in 1999.

Figure 14. Adult gypsy moths, female above, male below.

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 from Washoe (2003), Pershing, White Pine, Douglas, Lyon and Elko counties.

Figure 15. Banded elm bark beetle (*Scolytus schevyrewi* Semenov) from Forestry Images (http://www.forestryimages.org).

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

Nevada Dept. of Agriculture placed 12 Lindgren traps around Clark County in 2005 along with 35 in the rest of the state for MPE and RPBB and did not capture any. No beetles have been found in Clark county to date. Steve Seybold and Jana Lee of USFS/UC Davis checked for these beetles in Las Vegas in March 2007 and found none in their prime habitats.

STATUS OF DISEASES

STEM AND BRANCH DISEASES

Dwarf Mistletoes
Arceuthobium spp.

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

Dwarf mistletoes (DMT) are the single-most damaging agent 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 typically observed. Heavy dwarf mistletoe infestation can predispose trees to insects and other diseases, reduce incremental growth, affect the forest canopy structure, lower resistance to drought, 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 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. Jeffrey pine beetle and pine engraver are impacting severely DMT infected Jeffrey pines in the western portion of the state as well as adjacent eastern California areas in 2006.

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 16) and causes branch flagging on larger more resistant trees. Many of the rust infections were attacked by pitch mass borer.

Figure 16. 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 known to exist in western Nevada on the east side of the Sierra Nevada Mountains for several years. 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 known to exist 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 2004 and 2005 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 17. Annosum conk at the base of a tree.

Armillaria Root Disease
Armillaria spp.

Hosts: All trees

Figure 18. 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.

Black Stain Root Disease
Ophiostoma wageneri

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

Figure 19. Blackstain 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 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 2006.

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, but were not observed in aerial surveys in 2005.

Figure 20. Symptoms of aspen leaf spot.

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 2006, mortality caused by WBBB decreased 90% from 19,670 trees in 2005 to 1,709 trees in 2006 (Figure 21). The acreage affected in 2006 (1,079 acres) was also less than 10% of 2005 acreage (13,680 acres). Part of this decrease may be due to much of it being mapped in 2006 as fir engraver beetle in the Jarbidge Mountains (see Fir Engraver Beetle – Elko County). Most of this subalpine fir mortality was on the Mountain City and Jarbidge Ranger Districts of the Humboldt-Toiyabe National Forest.

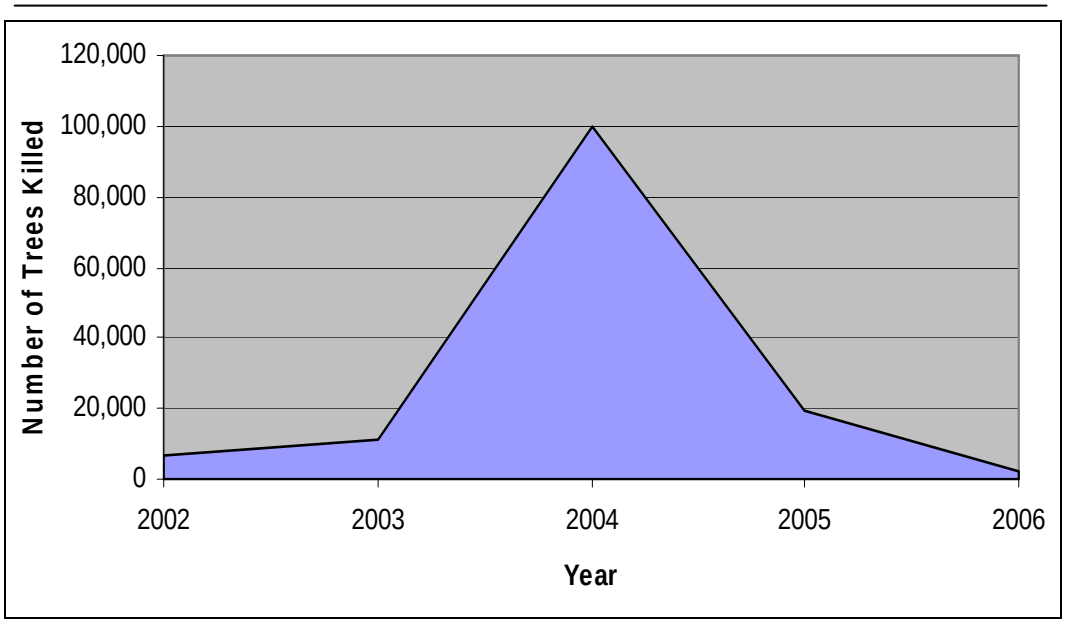


Figure 21. Number of subalpine fir killed in Nevada during five years (2002-2006).

Figure 22. Subalpine fir mortality.

Elko County – Over 1,709 trees in scattered mortality were mapped in the northwest Jarbidge Mountains, including the Jarbidge Wilderness. Additional mortality was reported in the Independence Mountains, the Bull Run Mountains, the northern Independence Mountains, Tennessee Mountains and The Mahoganies.

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.

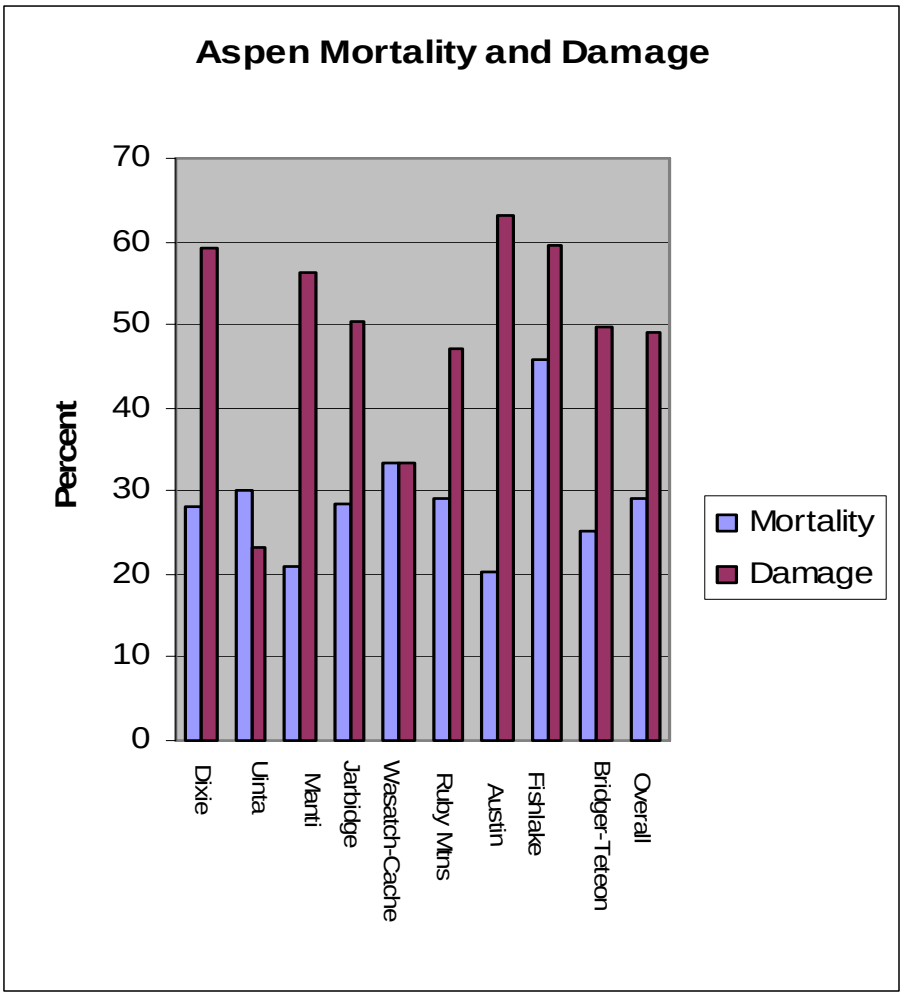


Figure 23. Percent of aspen damaged and killed in National Forests/Ranger Districts.

Data analysis of these plots is ongoing but a few trends were evident from an early review of the data. In the areas we evaluated, we observed high levels of mortality and moderate to heavy damage in the trees over 2 in diameter at breast height (Figure 23). The most common agents involved were canker diseases and insect borers. In the aspen regeneration, trees per acre were 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. Aspen regeneration on National Forests (NF)/Ranger Districts (RD).

Forest (District)	Trees per acre	Percent Damaged
Dixie NF	2300	57.4
Uinta NF	416	5.2
Manti NF	5600	25.4
Wasatch-Cache NF	4300	11.6
Humboldt-Toiyabe NF (Jarbidge RD)	3360	36.9
Humboldt-Toiyabe NF (Rubies RD)	1450	47.8
Humboldt-Toiyabe NF (Austin RD)	1813	68.9
Fishlake NF	3550	47.9

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, dieback due to cytospora canker looks similar to dieback by forest tent caterpillar defoliation. The dieback was mistakenly identified by aerial observers as forest tent caterpillar defoliation in 2002 and 2003. Further field study is needed to determine all the dieback causes.

In 2006, 7,477 acres of aspen dieback/decline were mapped in seven counties. This is a significant drop from 2005's figures of 21,020 acres (Figure 24). There were decreases in some counties such as Elko, Humboldt and Nye, but significant increases in Washoe and White Pine counties.

Douglas County – 130 acres dieback in the southern and northeastern Pinenuts with about the same acreage as 2005.
Elko County - 5,620 acres dieback was reported in the Jarbidge, Tennessee, Bull Run Mountains, Independence Mountains, and around the Mahoganies. Light to heavy dieback occurred throughout the Ruby Mountain and East Humboldt Ranges.
Humboldt County - 455 acres; light to heavy aspen dieback occurred throughout the Santa Rosa Mountains in small pockets. This is 22% of the acreage of 2005. This is the second year in a row that the acreage of aspen decline has reduced dramatically in the Santa Rosa Mountains.

Nye Counties – 38 acres respectively. Dieback was mapped in a single spot in the middle of the Grant Range Much of the Nye County acreage surveyed in 2005 was not surveyed in 2006, making any statement on activity trends very difficult.
Washoe County – A more than 500% increase from 2005 at 173 acres scattered in small pockets along the front range west of Reno in Whites, Thomas and Galena Creeks, as well as a small pocket on the west side of Marlette Lake.,
White Pine County – A more than 500% increase from 2005 at 1026 acres. Most of the dieback was from the small patches scattered throughout the Schell Creek range and Ward Mountain. There were also a few spots on the northwest side of the Snake range and White Pine range.

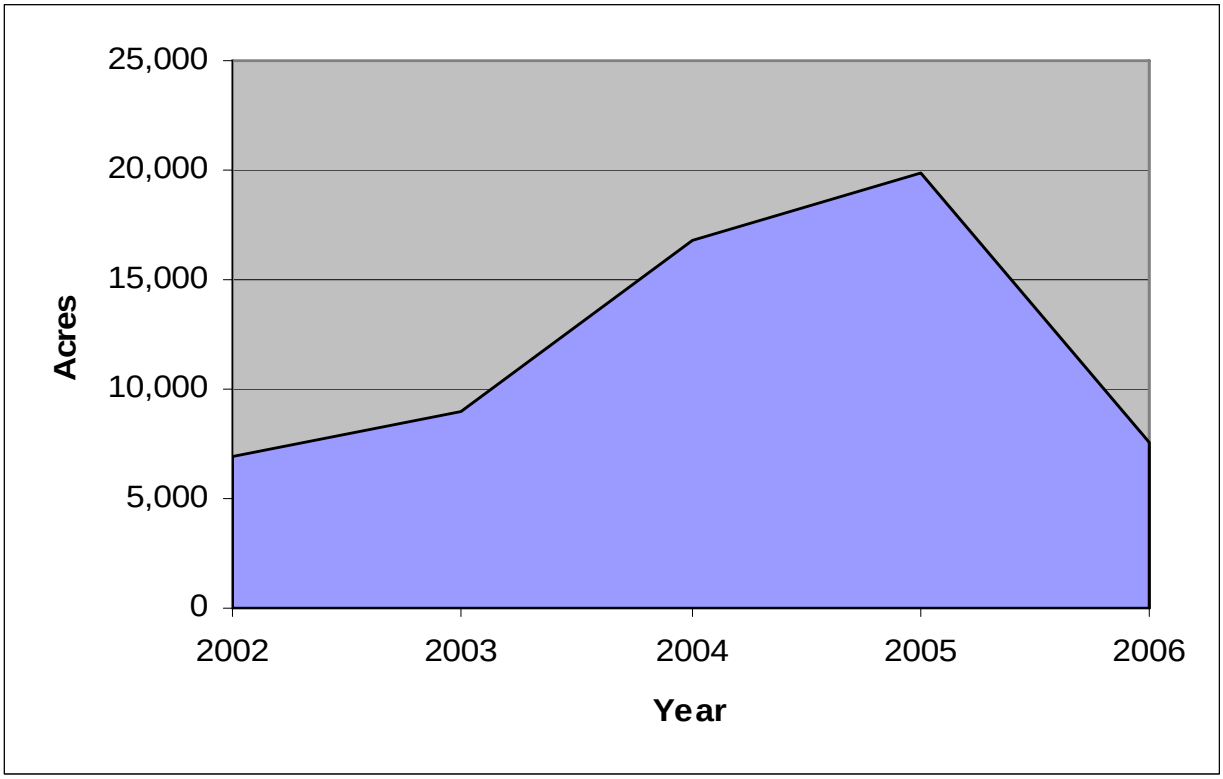


Figure 24. Acres with aspen decline in Nevada during five years (2002-2006).

ABIOTIC DAMAGE

Frost Damage

Hosts: maple, gambel oak, aspen

No frost damage was reported during the 2006 survey.

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. There were 174 acres of aspen blowdown surveyed in the northwestern corner of the Jarbidge Mountains in 2006.

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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. Two new species were added in 2006: African Mustard (*Brassica tournefortii)* and Giant Reed (*Arundo donax)*. The NDOA in coordination with the Nevada Department of Conservation and Natural Resources' Natural Heritage Database Program has hired a Weed GIS Mapping Coordinator which will significantly help with monitoring weed populations in Nevada. 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.**

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.