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Department of
Conservation and
Natural Resources
Division of Forestry,
Western Region

Nevada

Forest Insect and Disease

Conditions Report

2002 - 2003



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NEVADA FOREST INSECT AND DISEASE CONDITIONS

2002 - 2003

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Forest Health Conditions Summary

Forest health is a complicated topic. In an effort to simplify, this report focuses only on the effects of insects, diseases, and weather on trees in Nevada. Within that realm, 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: flushing attacking bark beetles with pitch or growing more foliage to replace that eaten by defoliating insects. Without adequate precipitation, tree resistance is significantly reduced. The western states, including Nevada, have been experiencing drought since 1998. The effects of drought and increased insect activity are noticeable throughout the Intermountain Region states of Nevada, Utah, and Idaho.

In 2003, a multi-state effort was made to survey the extent of *Ips confuses*-caused pinyon pine mortality. Of the estimated 11.9 million acres of single-leaf pinyon pine in Nevada, approximately 3.0 million acres were surveyed. Within the last three years, nearly 260,800 acres of surveyed pinyon pine experienced mortality caused by this insect affecting over 3.1 million trees. Counties with the highest numbers of tree mortality were Lincoln, Douglas, Carson City, and Nye.

Fir engraver beetle-caused tree mortality, affecting primarily white fir, increased from four counties and 5,300 acres in 2001 to seven counties and 18,650 acres affected in 2003. For the third consecutive year, White Pine County had the highest rate of tree mortality affecting over 24,000 trees on 14,000 acres in 2003. Fir mortality in Clark County increased from 35 acres in 2002 to nearly 2,000 acres in 2003.

Subalpine fir mortality increased in Elko County. In 2001, 885 acres of tree mortality was reported in Elko County. Affected acreage increased in 2002 to 2,537 acres and in 2003 to 5,214 acres on the Mountain City and Jarbidge Ranger Districts of the Humboldt-Toiyabe National Forest.

Douglas-fir tussock moth defoliation affecting true fir and Douglas-fir decreased in 2002 to 810 acres from 4,059 acres reported in 2001. In 2003, defoliation increased to 7,906 acres. Most of the defoliation occurred in Elko County on the Mountain City and Jarbidge Ranger Districts of the Humboldt-Toiyabe National Forest.

Mountain pine beetle-caused mortality in whitebark/limber pine continued to increase. White Pine, Elko and Nye Counties experienced the heaviest mortality out of the seven counties where mortality had been recorded. In 2002, 5,277 trees were killed within 2,831 acres in six counties. In 2003, 3,594 trees were killed within 2,233 acres in seven counties.

In the Intermountain Region, Jeffrey pine is only found along the Sierra Nevada and a few smaller ranges of western Nevada. In 2002, 758 trees were recorded as Jeffrey pine mortality over 377 acres and in 2003, 92 trees were mapped within 55 acres in Washoe, Douglas, and Carson City Counties.

Ground verification checks in 2001 identified forest tent caterpillar defoliation on quaking aspen. In 2002 nearly 6,900 acres were affected across six counties. In 2003, aspen defoliation/dieback occurred on 9,000 acres primarily in Humboldt, Nye, and Elko Counties. Additional ground checks in 2004 determined the dieback to be caused by borers, drought, and cytospora canker; forest tent caterpillar activity was not found. Forest Health Specialists suspect most of the 2003 symptoms were caused by cytospora canker not forest tent caterpillar.

Table 1. 2002 Bark Beetle Mortality by County.

County**	Mountain Pine Beetle ¹		Fir Engraver Beetle		Jeffrey Pine Beetle		Pinyon Ips Beetle		Subalpine Fir Complex	
	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres
Carson City	--	--	--	--	14	7	16,343	3,485	--	--
Clark	--	--	70	35	--	--	230	103	--	--
Douglas	--	--	60	30	363	181	149,726	31,088	--	--
Elko	2,122	852	--	--	--	--	--	--	6,351	2,537
Eureka	160	48	--	--	--	--	240	150	--	--
Lander	570	360	--	--	--	--	137,677	15,560	--	--
Lincoln	20	10	--	--	--	--	50	25	--	--
Lyon	--	--	--	--	--	--	4,929	1,491	--	--
Nye	1,318	1,046	1,130	653	--	--	78,808	9,606	--	--
Washoe	--	--	--	--	381	190	--	--	--	--
White Pine	1,087	516	5,899	2,748	--	--	4,198	2,853	--	--
Total	5,277	2,832	7,159	3,466	758	378	392,201	64,361	6,351	2,537

¹ Mountain pine beetle-caused mortality in whitebark and limber pines only.

Table 2. 2002 Insect Defoliation by County.

County**	Forest Tent Caterpillar	Douglas-fir Tussock Moth
	Acres	Acres
Elko	759	810
Humboldt	2,637	--
Lander	734	--
Nye	2,530	--
Washoe	77	--
White Pine	154	--
Total	6,891	810

**Note: Churchill, Esmerelda, Mineral, Pershing, and Storey Counties were not surveyed in 2002.

Table 3. 2003 Bark Beetle Mortality by County.

County**	Mountain Pine Beetle ¹		Fir Engraver Beetle		Jeffrey Pine Beetle		Pinyon Ips Beetle		Subalpine Fir Complex	
	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres
Carson City	5	3	100	50	17	9	196,965	9,120	--	--
Clark	34	17	4,337	1,969	--	--	65,435	7,530	--	--
Douglas	--	--	46	23	63	40	572,867	38,728	16	10
Elko	1,526	918	--	--	--	--	15	8	11,114	5,214
Eureka	95	47	--	--	--	--	1,754	1,321	--	--
Humboldt	5	3	--	--	--	--	--	--	--	--
Lander	205	170	--	--	--	--	18,096	5,186	--	--
Lincoln	--	--	3,360	472	--	--	2,024,337	165,246	--	--
Lyon	--	--	--	--	--	--	89,783	5,425	--	--
Nye	821	658	6,762	1,338	--	--	117,099	24,496	--	--
Storey	--	--	--	--	--	--	270	112	--	--
Washoe	16	8	1,083	441	12	6	6,186	323	--	--
White Pine	887	409	24,219	14,354	--	--	16,133	3,279	--	--
Total	3,594	2,233	39,907	18,647	92	55	3,108,940	260,774	11,130	5,224

¹ Mountain pine beetle-caused mortality in whitebark and limber pines only.

Table 4. 2003 Insect Defoliation by County.

County**	Forest Tent Caterpillar	Douglas Fir Tussock Moth
	Acres	Acres
Elko	1,675	7,806
Eureka	375	--
Humboldt	4,102	--
Lander	435	--
Nye	2,354	--
Washoe	86	--
White Pine	--	100
Total	9,027	7,906

**Note: Churchill, Esmerelda, Mineral, and Pershing Counties were not surveyed in 2003.

STATUS OF INSECTS

Insects: Native

Defoliators

Douglas-fir Tussock Moth

Orgyia pseudotsugata

Nevada Hosts: Douglas-fir, true firs, Engelmann and Colorado blue 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 topkill 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.

In **2002**, DFTM defoliation ranging from light to heavy was detected in Nevada on 810 acres. This was a significant reduction from the previous year's 4,059 acres.

- **Elko County** –810 acres; heavy defoliation was observed in Jarbidge and Camp Creeks, Mary's River, and the west fork of Pine Creek drainages. Light to heavy defoliation occurred in Draw, Wildcat, and Sun Creek drainages near the Wildcat Guard Station. Heavy defoliation was also observed in the Merritt Mountain area, which included the upper third of McDonald Creek, Vicenti Canyon and Telephone Creek drainages.

In **2003**, DFTM defoliation ranging from light to heavy was detected on 7,906-acres in Nevada.

- **Elko County** – 7,806 acres; light to heavy defoliation occurred in the Jarbidge Mountains, predominantly in the Jarbidge Wilderness.
- **White Pine County** – 100 acres; one area of light defoliation was recorded in the upper portion of Ferrys Canyon in the Kern Mountains on the Nevada-Utah border.



Figure 1. Douglas-fir tussock moth larvae.

Forest Tent Caterpillar

Malacosoma disstria.

Nevada Hosts: Alder, aspen, birch, maple, oak, and willow

In 2001, ground checks by Nevada State employees in the Santa Rosa Mountains identified forest tent caterpillar (FTC) causing defoliation in quaking aspen. In 2002 and 2003, thin crowns and defoliation were attributed to continued FTC activity. In 2004, subsequent ground checks in the East Humboldt and Jarbidge Mountains failed to identify FTC activity; instead, the signatures of no leaves, dead tops, or sparse crowns previously attributed to FTC was actually a combination of factors including: borers, cytospora canker and drought stress. Nevada State Forest Health Specialists speculate that some of the defoliation attributed to FTC in 2002 and nearly all of the defoliation in 2003 can be attributed to cytospora canker and borer activity. Refer to the cytospora canker section for additional information.

Bark Beetles

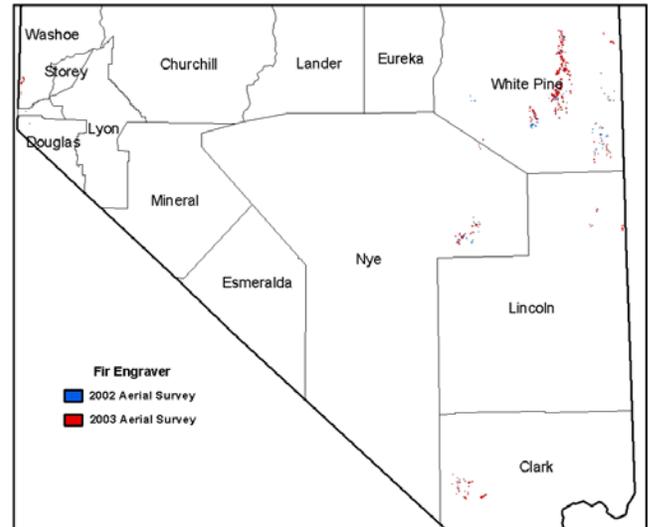
Fir Engraver Beetle

Scolytus ventralis

Nevada Hosts: red fir, subalpine fir, white fir

Fir engraver is a major pest of true firs in western forests. It attacks pole to mature sized trees. Tree stress caused by drought, disease, or defoliation may incite outbreaks causing significant tree mortality.

In **2002**, four Nevada counties had fir engraver beetle-caused tree mortality on 3,466 acres (7,159 trees).



- **Clark County** - 35 acres, 70 trees; tree mortality was observed in McFarland and Wallace Canyons in the Spring Mountains.
- **Douglas County** - 30 acres, 60 trees; tree mortality was observed in the vicinity of Genoa Peak and Spooner Lake along the Carson Mountain Range, on the eastern edge of the Tahoe Basin.
- **Nye County** - 653 acres, 1,130 trees; tree mortality was detected in the Quinn Canyon Range in Hooper Canyon, Little Cherry Creek, Bruno Creek and in the Grant Range in the vicinity of Troy Peak and Scofield Canyon.
- **White Pine County** - 2,748 acres, 5,899 trees; the majority of fir engraver beetle-caused tree mortality occurred in White Pine County. In the Egan Range, areas of tree mortality were observed in Sawmill Canyon, Eph and Rowe Creek drainages. In the Schell Creek Range, areas with tree mortality include Steptoe Creek, Success Summit, and Boneyard Canyon. Also affected were Sage Hen, Silver, Gilford, McDonald, and Worthington Canyons; and Second, Third, Piermont, Berry, Cleve and Silver Creeks. In the Snake Range, large, scattered groups of tree mortality were observed in Burnt Mill, Coyote and Horse Canyons in addition to Smith, Strawberry, Baker, Lehman and Henry Creeks.

Other infested sites include Horse Heaven, north fork of Big Wash, Box Canyon, Single and Willard Creeks. In the White Pine Range, large areas of tree mortality were mapped near Pogonip Ridge and Hamilton.

In **2003**, seven counties in Nevada reported fir-engraver beetle-caused tree mortality for a total of 18,647 acres affecting 39,907 trees.

- **Carson City, Douglas, and Washoe Counties** – 514 acres, 1,229 trees total; mortality occurred along the Carson Range just east of Lake Tahoe from Highway 80 south to Highway 207.
- **Clark County** - 1,969 acres, 4,337 trees; in the Spring Mountains west of Las Vegas. Two noteworthy areas are a 3.7 mile long, 889 acre strip on La Madre Mountain affecting one tree per acre and the area east of Mahogany Grove picnic area where over 1,400 trees were killed on 329 acres.

Fir Engraver Beetle (Continued):

- **Lincoln County** – 472 acres, 3,360 trees; mortality was confined to three areas on the Wilson Creek Range. Those areas include Mt. Wilson (1,060 trees on 104 acres), White Rock Peak (1,100 trees on 266 acres), and Willow Tub Peak (1,200 trees on 102 acres).
- **Nye County** - 1,338 acres, 6,762 trees. Most of the mortality is located around Little Cherry Creek in the Quinn Canyon Range with scattered mortality continuing north to Timber Mountain in the Grant Range. In the White Pine Range, which spans both **White Pine** and **Nye** Counties, 600 trees were killed on 99-acres.
- **White Pine County** - 14,354 acres, 24,219 trees. Most of the mortality occurred in the Schell Creek Range east of Ely. There was light scattered mortality in the Snake Range, the Egan Range, and the Kern Mountains.

Jeffrey Pine Beetle

Dendroctonus jeffreyi

Nevada 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 overmature trees, and trees struck by lightning. In the Intermountain Region, Jeffrey pine is only found along the Sierra Nevada Mountains of western Nevada.

In **2002**, a combination of Jeffrey pine beetle attacking the boles of the tree and pine engraver (*Ips pini*) attacking the tops of the trees killed 758 trees on 378 acres.

- **Carson City County** -7 acres, 14 trees: two pockets of 7 trees each were in the drainages of Clear Creek and upper Slaughterhouse Canyon.
- **Douglas County** - 181 acres, 363 trees; scattered pockets of mortality were observed east of Glennbrook and in the lower elevations of both the east- and west-side of the Carson Range.
- **Washoe County** - 190 acres, 381 trees were mapped in scattered pockets between Thomas and Davis Creek, and drainages in Little Valley.

During **2003**, Jeffrey pine beetle-caused tree mortality decreased significantly affecting 92 trees on 55 acres. All of the mortality was confined to the Carson Range as scattered individual trees or 2-10 tree pockets.

- **Carson City County**– 9 acres, 17 trees; tree mortality occurred in four pockets from Kings Canyon north to Combs Canyon.
- **Douglas County**– 40 acres, 63 trees. All mortality occurred on the east side of the Carson Range. The largest pocket of mortality (30 acres, 50 trees) was mapped in Jobs Canyon on the Nevada/California border with 10 acres and 16 trees killed in Douglas County. A concentration of mortality pockets occurred along Highway 207 in Haines Canyon. Additional small pockets were located west of Jacks Valley.
- **Washoe County** – 6 acres, 12 trees; one ten-tree spot occurred in Browns Creek and two single tree spots occurred in Franktown Creek near Little Valley.

Mountain Pine Beetle

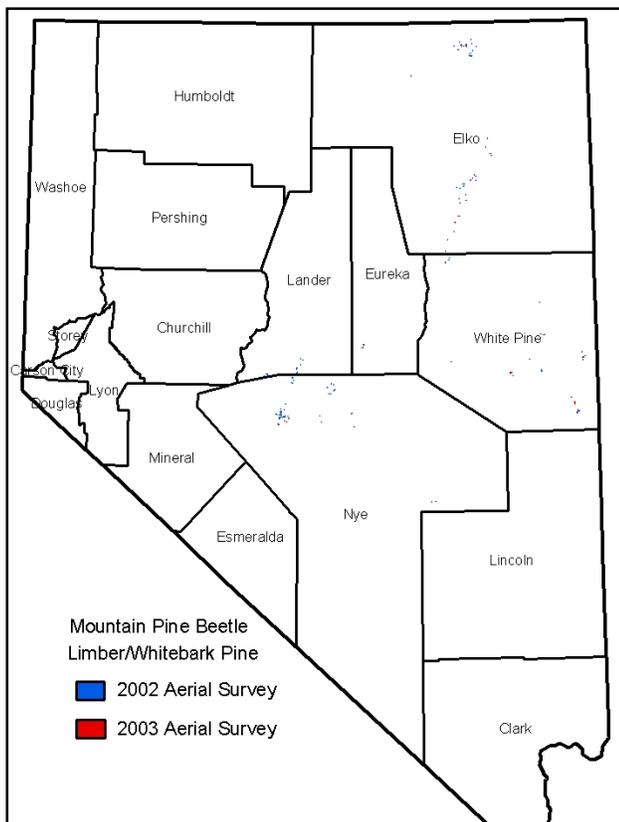
Dendroctonus ponderosae

Nevada Host: whitebark, limber, lodgepole, sugar, and ponderosa pine

Mountain pine beetle (MPB) can kill thousands of trees a 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 ecosystem to grass and shrub landscapes for a period of 10-20 years. This conversion affects wildlife species, water yields and fuel loading.

Limber/Whitebark Pine:

In 2002, mountain pine beetle-caused limber and whitebark pine mortality increased from 4,022 trees killed on 1,645 acres in 2001 to 5,277 trees killed on 2,832 acres.



- **Elko County** - 852 acres, 2,122 limber pine trees were killed by mountain pine beetle. Mortality was scattered throughout the Jarbidge Mountains (579 acres, 1,412 trees). Dead trees were mapped in the Ruby Mountains (273 acres, 710 trees) from Soldier Creek to Lamoille Creek, in Lime Kiln Canyon, and in the vicinity of Fort Ruby Spring.
- **Eureka County** - 48 acres, 160 trees were recorded in two pockets in the Monitor Range between Summit Mountain and Antelope Peak.
- **Lander County** - 360 acres, 570 trees were observed in the Carsely Creek, Cottonwood and Globe Canyons drainages in the Toiyabe Range and near North Shoshone Peak in the Shoshone Mountains.
- **Lincoln County** - 10 acres, 20 trees were detected in Little Water Canyon drainage.
- **Nye County** - 1,046 acres, 1,318 dead trees were mapped in the

vicinities of Arc Dome, South Toiyabe Peak, Peavine Mtn and Toiyabe Dome in the Toiyabe Range. Mortality was also mapped near Whiterock Mountain, Wildcat Peak, and Mt. Jefferson in the Toiyabe Range, Little Water Canyon in the Quinn Canyon Range, and Sawmill Creek in the White Pine Range.

- **White Pine County** - 516 acres, 1,087 trees were mapped in Dry Canyon on the Quinn Canyon Range, Lopez Spring and Seligman Canyon drainages on the White Pine Range, North Fork Sawmill Canyon and Pine Spring drainages on the Egan Range, Mosier and North Mosier Spring drainages, Siegal Creek and Cove Mountain on the Schell Creek Range, Mt. Moriah, Granite Creek drainage and Williams Canyon on the Snake Range.

Mountain Pine Beetle – Limber/Whitebark Pine (Continued)

In 2003, mountain pine beetle-caused whitebark and limber pine mortality decreased by nearly one-third to 3,594 trees on 2,233 acres.

- **Carson City County** - 3 acres, 5 trees in one pocket near Spooner Summit.
- **Clark County** – 17 acres, 34 trees within three small pockets were mapped, one in Clark Canyon, one near Griffith Peak and the third just north of Fletcher Canyon.
- **Elko County** - 918 acres, 1,526 trees, most of which were recorded in the Ruby Mountains (718 acres, 1,125 trees) from Lindsay Creek to Soldier Creek. The largest infested areas in the Ruby Mtns. were located in Colonel Moore Creek (107 acres, 100 trees) and Mayhew Creek (85 acres, 50 trees). Mortality was also scattered throughout the Jarbidge Mountains (182 acres, 365 trees) in 39- two to ten acre spots averaging two trees per acre. Eighteen pockets were mapped in the East Humboldt Range east of Humboldt Creek and north of Greys Peak, and two pockets in the Independence Mountains (12 acres, 25 trees).
- **Eureka County** – 47 acres, 95 trees in the Monitor Range between Summit Mountain and Antelope Peak.
- **Humboldt County** - five trees were killed on one 3-acre spot near Paradise Peak in the Santa Rosa Range.
- **Lander County** - 170 acres, 205 trees in 15 pockets were reported in the Toiyabe Range from S. Toiyabe Peak to the Toiyabe Range Peak in Nye County. The largest infested area (93 acres, 50 trees) was located in the upper portion of Cottonwood Canyon along Kingston Creek. No mortality was observed in the Shoshone Mountains.
- **Nye County** – 658 acres, 821 dead trees were concentrated in three areas. In the Toiyabe Range most of the mortality occurred near Peavine Mountain and North Twin River on the east side of the Range with two larger infested sites on Peavine Mountain and Arc Dome. In the Toiyabe Range light scattered mortality occurred between the South Fork of Pine Creek and Moores Creek north to Stoneberger Basin and Masket Peak. In the Monitor Range, scattered mortality occurred between Morgan Creek and Green Monster Canyon around Table Mountain. A 25-acre, 50-tree spot was located in the Quinn Canyon Range in the upper portion of Deep Creek.
- **Washoe County** - 8 acres, 16 trees encompassing four small pockets near Mt. Rose.
- **White Pine County** – 409 acres, 887 trees were observed in pockets of scattered mortality between Mount Washington and Granite Peak and near Ward Mountain in the Egan Range; adjacent to Mt. Moriah in the Snake Range; and from Cave Mountain to Centerville in the Schell Creek Range.

Mountain Pine Beetle in Ponderosa Pine

In **2002**, ponderosa pine mortality (342 trees) attributed to mountain pine beetle was mapped over 250 acres.

- **Clark County** - 10 acres, 20 trees were detected near Wallace Canyon Falls.
- **White Pine County** - 240 acres, 322 trees; small pockets of mortality were detected in the McDonald Creek drainage located in the Schell Range and the Trail Canyon drainage in the Snake Range. A larger area of mortality (159 ac., 159 trees) was mapped southeast of Pyramid Peak in the Snake Creek drainage also in the Snake Range.

In **2003**, MPB activity continued in both counties killing 111 trees over 120 acres.

- **Clark County** - 113-acres, 104 trees recorded in Rainbow Canyon (103-acres, 77 trees) on State Route 157 and one infested area in Lee Canyon.
- **White Pine County** – 4 acres, 7 trees were reported in the Snake Range in the upper portion of Snake Creek.

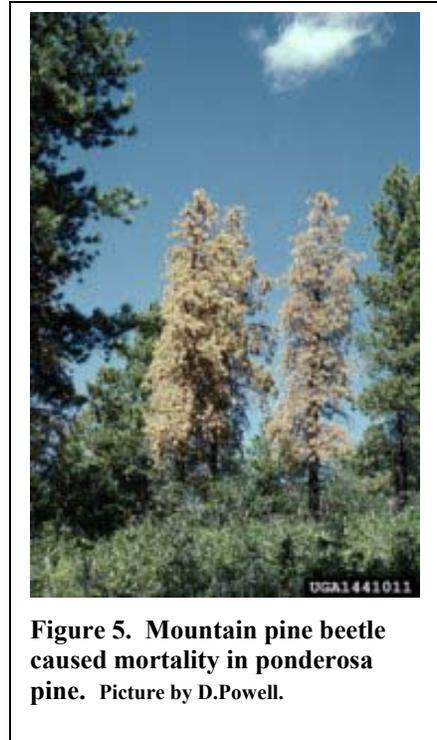


Figure 5. Mountain pine beetle caused mortality in ponderosa pine. Picture by D.Powell.

Western Pine Beetle

Dendroctonus brevicomis

Nevada Host: Ponderosa pine

The western pine beetle (WPB) can cause mortality of ponderosa pine. Endemic populations are generally associated with overmature trees or trees weakened by lightning, drought, fire or root rot. WPB has 2 to 4 generations per year. During epidemics, all size classes of susceptible ponderosa pine are attacked and killed by this insect.

In **2002**, two small spots of western pine beetle-caused ponderosa pine mortality were reported.

- **Lander County** - 46-acres, 100 trees were mapped in Peterson Creek in the Shoshone Mountains.
- **Lyon County** - 10 acres, 20 trees were mapped in the Sweetwater Mountains near East Sister.

In **2003**, no western pine beetle-caused mortality was recorded during aerial or ground surveys.

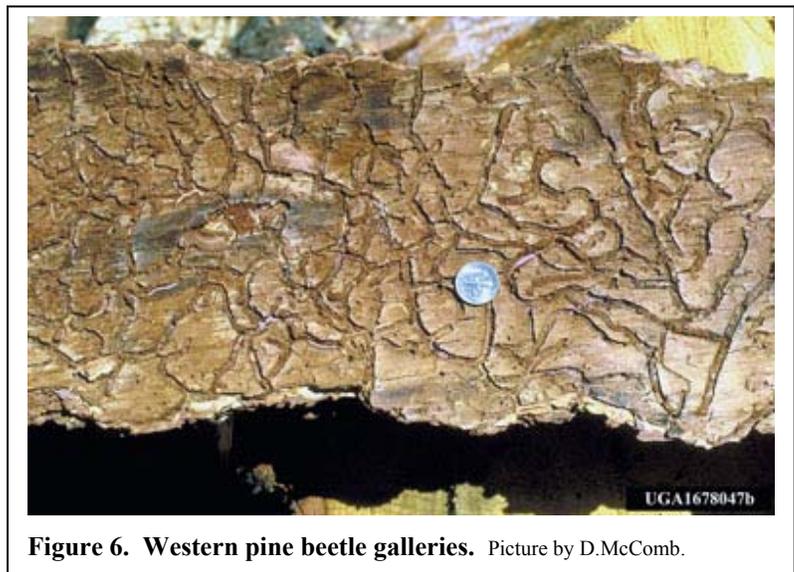


Figure 6. Western pine beetle galleries. Picture by D.McComb.

Pinyon Engraver Beetle

Ips confusus

Nevada Hosts: Single leaf pinyon

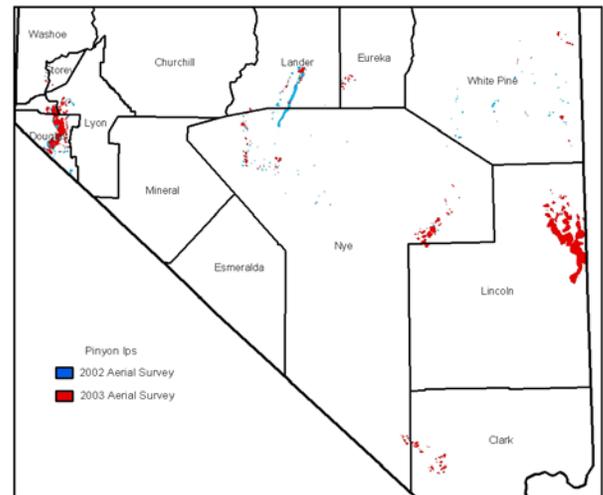
The pinyon engraver is an increasing problem in pinyon-juniper ecosystems often affecting valuable home landscape trees. Continued drought conditions have increased tree stress, predisposing trees to *Ips* attack. Because the insect produces multiple generations each year, populations can build and spread rapidly.

In 2002, pinyon pine was occasionally surveyed in areas that were adjacent to traditionally surveyed areas. In 2003, in response to increasing concern of pinyon pine mortality, a multi-state effort was made to survey the extent of *Ips confusus*-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. Reported *Ips*-caused mortality of single leaf pinyon has increased overall, primarily due to increased survey coverage of the pinyon pine type. Within the surveyed area, approximately 3,108,940 dead pinyon trees on 260,775 acres were recorded during this recent outbreak.

Gail Durham, Forest Health Specialist for Nevada Division of Forestry, conducted additional ground surveys of some areas not covered by aerial survey. She identified high amounts of mortality occurring on BLM and private land in **Lincoln County** on both sides of the Highland and Chief Ranges directly west of Pioche and Caliente, and in **Churchill County** in the western Desatoya Mountains and west central Clan Alpine Mountains. The amount of mortality per acre in these areas is similar to the Wilson Creek Range in **Lincoln County** and the Pinenut Range in **Douglas County**, but the areas are smaller.

For more clarity, results of the **2002 and 2003** aerial surveys follow:

- **Carson City County** - 9,660 acres, 213,309 trees; heavy mortality was recorded in the Pine Nut Range from McTarnahan Hill west of Brunswick Canyon east to the county line, including Eldorado Canyon.
- **Clark County** - 7,632 acres, 65,668 trees; large areas of mortality were recorded in and around Wheelers Wash from Clark Canyon to Mt. Stirling in Nye County, Kyle, Lovell, and Trout Canyons.
- **Douglas County** - 52,190 acres, 722,595 trees; heavy mortality was recorded in the Pine Nut Mountain Range from the California border north into Lyon County.
- **Elko County** - 7 acres, 15 trees; mortality occurred in two small spots, one located in the North Fork of Indian Creek and the other east of Sherman Mountain.
- **Eureka County** - 1,471 acres, 1,995 trees; scattered mortality was limited to the Monitor Range from Antelope Peak to the Nye County border.
- **Lander County** - 20,061 acres, 153,032 trees; most of the mortality occurred in the Toiyabe Range from the Nye County border north to Simpson Peak Canyon. Small pockets of mortality were reported in the Toquima Range from the Nye County border to Rutherford Canyon. Pockets of scattered mortality also occurred in the Shoshone Mountains with the largest area located in Park Creek.



Pinyon Engraver Beetle (Continued)

- **Lincoln County** - 165,271 acres, 2,020,066 trees. The largest concentration of pinyon mortality in Nevada was reported in the Wilson Creek Range from Atlanta south to Sheep Spring Draw just south of State Highway 15. One other large spot (3,758 ac., 14, 104 trees) was mapped in the Quinn Canyon Range between the South Fork of Cottonwood Creek and the upper portion of Barton Creek. Additional mortality identified in the Highland and Chief Ranges during ground surveys are not included in the acre and trees figure.
- **Lyon County** - 6,176 acres, 94,708 trees; most of the heavy mortality is a continuation of the Douglas and Carson City Counties mortality in the northern Pine Nut Mountains.
- **Nye County** - 32,908 acres, 195,910 trees; scattered pockets of mortality occurred throughout the Sunrise and Shoshone Mountains and Grant, Monitor, Toquima, Toiyabe and White Pine Ranges. Most of the mortality occurred in the Quinn Canyon Range from Burnt Canyon south to the Lincoln County border. A large area of mortality was observed skirting the hills west of Big Smokey Valley in the Toiyabe Range.
- **Storey County** - 112 acres, 270 trees; mortality was mapped in the Virginia Range around Flowery Peak with a few smaller areas in Lousetown Creek.
- **Washoe County** - 323 acres, 6,186 trees; mortality was mapped in the Virginia Range in the upper portion of Bailey Canyon, east of Steamboat.
- **White Pine County** - 6,112 acres, 20,330 trees. Scattered mortality was mapped in the Kern Mountains, Snake, Egan, Schell Creek and White Pine Ranges. Larger areas of mortality occurred in the Snake Range between Strawberry and Mill Creeks, in the Egan Range southwest of Ward Mountain Ski Hill, at Red Mountain in the White Pine Range, and along the western side of the Kern Mountains from Tungstonia to Moffitt Flat.



Figure 7. Pinyon Mortality at Buckeye Creek in the Pine Nut Mountains.

Spruce Beetle

Dendroctonus rufipennis

Nevada Hosts: Engelmann spruce

The spruce beetle is the most significant native insect affecting mature spruce. Endemic populations usually inhabit windthrown trees, logging slash, and fresh stumps, but may also attack weakened trees. Outbreaks typically occur when beetle populations increase in downed host material. In susceptible stands, dispersing adult beetles will infest standing live trees if no suitable down host material is available. The adult beetles prefer the larger diameter hosts but will attack smaller diameter trees (3-4 inches) during outbreaks.

In **2002**, no spruce beetle-caused mortality was reported.

In **2003**:

- **White Pine County** - 27 trees were killed on 14 acres in the Snake Range in the upper portions of Snake Creek and Deep Canyon by Mount Moriah.

Pitch Mass Borer

Dioryctria sp.

Nevada Host: Singleleaf pinyon, ponderosa pine, Jeffrey pine

In the caterpillar stage, species of *Dioryctria* bore into the cambium of the trunk, branches, and shoots. This borer kills lateral branches and treetops of singleleaf pinyon pine. With prolonged drought, this injury has weakened pinyon trees sufficiently to allow pinyon engraver beetle to successfully attack and kill the smaller sized pinyon pines. Pitch mass borer is found throughout the state of Nevada in most counties where singleleaf pinyon occurs although the heaviest concentrations seem to occur in western Nevada where it also affects Jeffrey and ponderosa pine.

Pinyon Needle Scale

Matsucossus acalyptus

Nevada 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.

Western Pineshoot Borer

Eucosma sonomana

Nevada Host: Ponderosa pine, Jeffrey pine, lodgepole pine and Engelmann spruce

Western pineshoot borer's principal host is ponderosa pine. It also feeds on Jeffrey and lodgepole pine and Engelmann spruce. The larvae bore down through the center of the terminal shoots, stunting and sometimes killing them. Tree height is significantly retarded and excessive branching may result. Most often, the borer is found on the east slope of the Sierra Nevada Mountains in regenerating stands of Jeffrey and ponderosa pine.

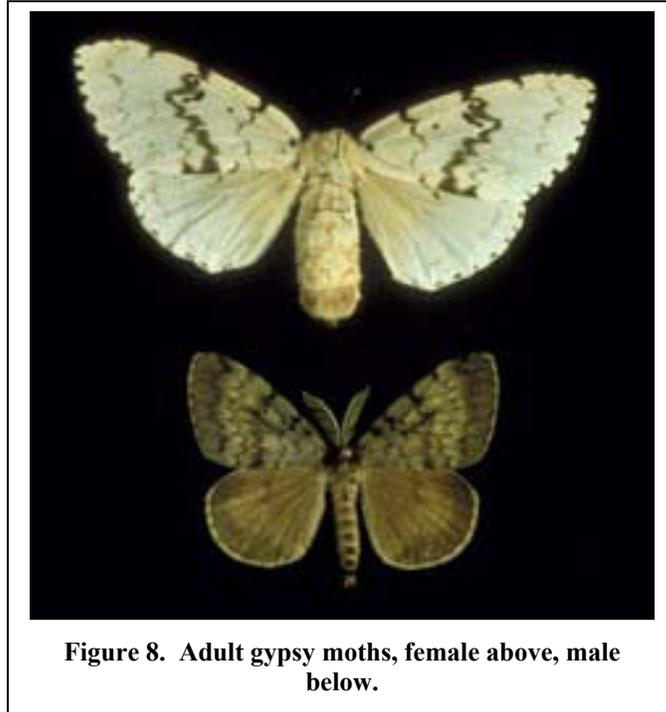
Insects: Non-native

European Gypsy Moth

Lymantria dispar

Nevada Host: Various deciduous species

Statewide detection surveys conducted by Nevada State Department of Agriculture and APHIS (Animal and Plant Inspection Service) using pheromone attractants resulted in no male moth captures in 2002 or 2003. The last identified egg masses were discovered in an RV park in Winnemucca in 1999.



STATUS OF DISEASES

Diseases: Native

Stem and Branch Diseases

Dwarf Mistletoes

Arceuthobium spp.

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

Dwarf mistletoes 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. The percentage of infection by major host species in Nevada is estimated as follows: lodgepole pine 17%, ponderosa pine 35 %, and Douglas-fir 25% infected. These numbers represent the percentage of host stands having some level of infection from a 1978-79 survey. A survey of the Bridgeport and Carson Ranger Districts in 1990 showed the following levels of infection: Jeffery pine, 16.5%, ponderosa pine 31%, and true fir 0.4% (red and white fir combined).

Dwarf mistletoe on pinyon pine can be found throughout the state, but it has never been comprehensively surveyed. 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 this beetle’s attacks.

White Pine Blister Rust

Cronartium ribicola

Nevada Hosts: White pines including 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 and Ruby Mountains. Forest Health Protection is funding an extensive survey of white pine sites in eastern Nevada in 2004 to determine if the rust is present in other areas.

Cytospora Canker

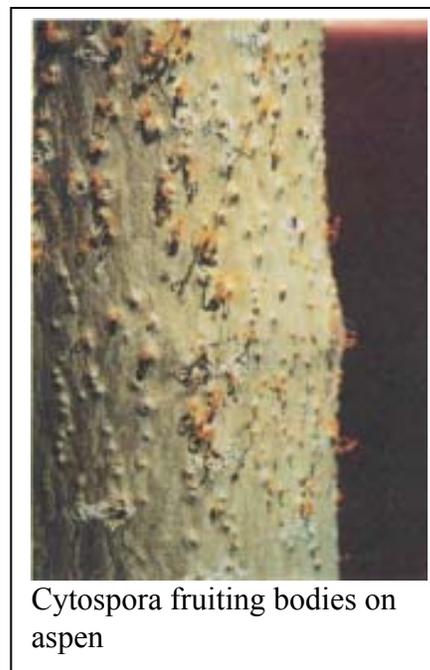
Cytospora spp.

Nevada Hosts: 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; however, vigorous trees can limit the disease and are rarely killed. Cytospora canker has been identified through ground checks and highlighted in the county summaries below. Activity from this pathogen is most likely a symptom of several years of drought or defoliation from other insects or diseases. Symptoms associated with this disease are similar to forest tent caterpillar defoliation and were mistakenly identified by aerial observers as forest tent caterpillar defoliation in 2002 and 2003.

In **2002**, aspen dieback was observed on 6,891 acres in six counties.

- **Elko County** - 759 acres; light to heavy dieback occurred NE of Tennessee Mountain. Heavy dieback was observed in the Jarbidge Mountains in Wickiup, Coon, and Sanovia Creek drainages, and the upper drainage of Pole Creek. In the Ruby Mountain Range, areas with heavy dieback were mapped in portions of the following drainages: the South Fork of Cold, Murphy, and Lutts Creeks.
- **Humboldt County** - 2,637 acres; heavy dieback was detected in most aspen stands throughout the Santa Rosa Range.
- **Lander and Nye Counties** – 734 and 2,530 acres respectively; light to heavy dieback was observed along streamside stands of aspen in the Toiyabe and Toiyabe Ranges, and the Shoshone Mountains.
- **Washoe County** - 77 acres; heavy dieback was mapped in the Thomas Creek and Thomas Meadows areas.
- **White Pine County** -154 acres; light dieback occurred in portions of Worthington Canyon in the Schell Creek Range, and in the vicinity of Bald Mountain in the White Pine Range.



In **2003**, 9,027 acres of aspen dieback were mapped in six counties.

- **Elko County** - 1,675 acres; light dieback was reported in the Jarbidge Mountains at Jarbidge and in Coon and Sun Creeks. Light dieback was reported north and NW of Tennessee Mountain. Light to heavy dieback occurred throughout the Ruby Mountain and East Humboldt Ranges from the White Pine County line to Star Valley.
- **Humboldt County** - 4,102 acres; light to heavy aspen dieback occurred throughout the Santa Rosa Mountains.
- **Eureka, Lander, and Nye Counties** – 375, 435, and 2,354 acres respectively; dieback was mapped on the Toiyabe Range (1,179 acres) and on the Monitor Range (1,449 acres). In the Toiyabe Range of Nye County, 504 acres were mapped. No dieback was noted in the Shoshone Range.
- **Washoe County** – 86 acres; one spot of heavy dieback was mapped in the Carson Range near Bronco Creek.

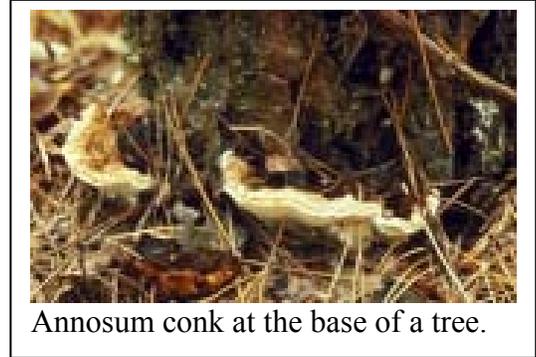
Root Diseases

Annosum Root Disease

Heterobasidion annosum

Nevada Hosts: Bitterbrush, chokecherry, 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.



Armillaria Root Disease

Armillaria spp.

Nevada Hosts: Douglas-fir, grand fir, pines, spruce, subalpine fir and incense cedar



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.

Black Stain Root Disease

Ophiostoma wagneri

Nevada Hosts: single leaf pinyon, Jeffrey pine and ponderosa pine

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 2002 or 2003, but the current outbreak of engraver beetles probably obscures any current activity by the disease.

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 2002 or 2003. *Marssonina* and other foliage diseases were identified on aspens in Nevada during ground surveys. Damage is minor, mainly because of the deciduous nature of the host.



Figure 9. Symptom of aspen leaf spot

DECLINES / COMPLEXES

Subalpine Fir Mortality Complex

Nevada 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.

During **2002**, mortality from WBBB in conjunction with other agents increased from 925 acres to 2,537 acres.

- **Elko County** - 2,537 acres, 6,351 trees were mapped in the Jarbidge Mountains along the drainages of Canyon, Buck, Deer, Jack, Slide, and Smith Camp Creeks, the Jarbidge River drainage, and in the vicinity of Deer Mountain.

In **2003**, mortality caused by WBBB more than doubled to 5,224 acres.

- **Douglas County** – 10 acres, 16 trees is part of a larger area of 50 trees killed on 30 acres spanning the Nevada/California border in Jobs Canyon.
- **Elko County** - 5,214 acres, 11,114 trees of large scattered mortality polygons were mapped throughout the Jarbidge Mountains including the Jarbidge Wilderness.

Additional mortality was reported in the Independence Mountains northeast of McAfee Peak.

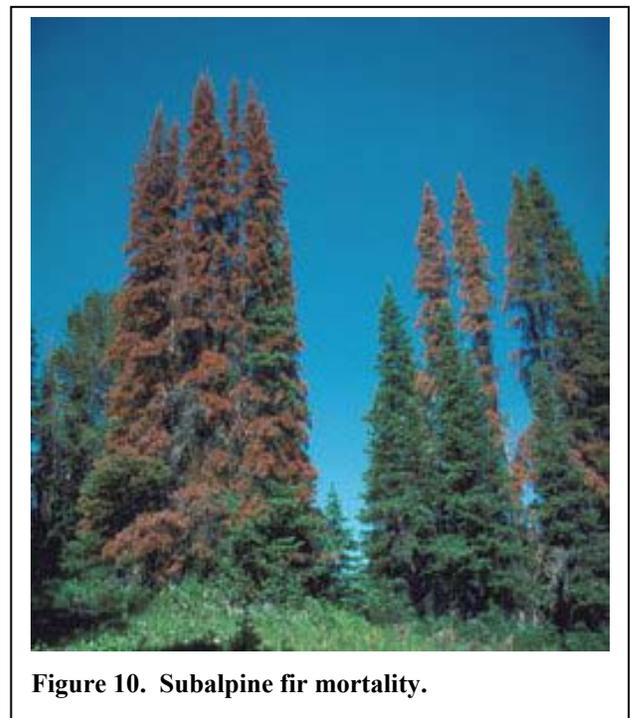


Figure 10. Subalpine fir mortality.

Aspen Decline

Nevada Host: Aspen

Aspen decline is a phenomenon that has been observed throughout the western US for many years. No new pockets of aspen decline were observed by aerial survey in 2002 or 2003. In the declining clones several types of canker diseases and heavy borer activity may be responsible for mortality. However, the primary forces involved in aspen decline are fire suppression, encroachment by other species into aspen forests, and grazing pressure. Many clones with heavy mortality and general decline have little or no reproduction.

ABIOTIC DAMAGE

Frost Damage

Nevada Hosts: maple, gambel oak, aspen

In 2002:

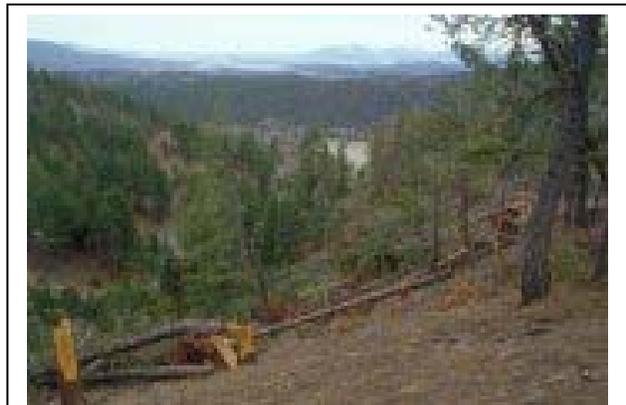
- **Elko County** – 90 acres of maple foliar browning located on the southeastern edge of the Ruby Mountain Wilderness, Humboldt-Toiyabe National Forest. Frost damage also contributed to aspen leaf discoloration.

No frost damage was reported during the 2003 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.

The 2001 aerial detection survey mapped a total of 77 acres of blowdown in mixed conifer in White Pine County within Great Basin National Park, southeast of Wheeler Peak, near the source of Snake Creek. No blowdown was reported in 2002 or 2003. However, in 2002, a 159-acre, one tree per acre mountain pine beetle-caused mortality spot was reported in the same area. In 2003, a 31-acre, 60-tree fir engraver beetle-caused mortality spot was reported in the same area. It is unknown whether the blowdown contributed to the subsequent mortality.



Ponderosa pine blowdown.

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 2 is the list of plants declared noxious weeds by the State of Nevada or specific counties.

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

http://pi.cdfa.ca.gov/weedinfo/winfo_table-commname.htm

California Department of Food and Agriculture has a very comprehensive webpage. The only weeds not mentioned are buffalobur, goatsrue, poison hemlock, houndstongue, blue-flowering lettuce, western whorled milkweed, Russian olive, and velvetleaf. Information includes description, distribution, habitat, and control methods. Pictures of the plants in various stages are just a click away.

http://www.nwcb.wa.gov/weed_info/contents_common.html

State of Washington's noxious weed control board webpage has information on black henbane, buffalobur, camelthorn, 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 webpage has information on bermudagrass, field bindweed, yellow nutsedge, and yellow starthistle. Topics include identification and management through cultural and chemical control options.

<http://www.ext.colostate.edu/pubs/natres/pubnatr.html>

Colorado State University Cooperative Extension webpage in the Range section has factsheets on musk thistle, leafy spurge, Canada thistle, toadflaxes, and diffuse, Russian, and spotted knapweeds. Information includes description, distribution, phenology, and management options such as cultural, chemical and biological.

<http://www.nps.gov/plants/alien/common.htm>

The National Park Service hosts the Plant Conservation Alliances weed webpage. Currently they have information on Canada thistle, leafy spurge, musk thistle, purple loosestrife, Russian olive, and spotted knapweed. Information includes native range, description, ecological threat, distribution, habitat, background, methods of reproduction and dispersal, and current management approaches.

<http://www.fs.fed.us/pnw/bmnri/weeds.htm>

The Blue Mountain Natural Research Institute for the USDA Forest Service website focuses on control and identification. Invasive plant species included are diffuse, Russian, and spotted knapweed, purple loosestrife, perennial pepperweed, puncturevine, medusahead, rush skeletonweed, yellow starthistle, Canada thistle, musk thistle, scotch thistle, dalmatian toadflax, St. Johnswort, leafy spurge, hoary cress (whitetop) and dyer's woad.

<http://www.agri.state.id.us/animal/weedlist.htm>

State of Idaho has expanded their webpage. It has good pictures and control information on black henbane, Canada thistle, Dalmatian toadflax, diffuse knapweed, Dyer's woad, hoary cress, johnsongrass, leafy spurge, musk thistle, perennial pepperweed, poison hemlock, puncturevine, purple loosestrife, rush skeletonweed, Russian knapweed, scotch thistle silverleaf nightshade, spotted knapweed, yellow starthistle, and yellow toadflax.

<http://weedcenter.org/info/weedlist.html>

An interagency website housed at the Montana State University. It has information on field bindweed, bull thistle, Canada thistle, Dalmatian toadflax, diffuse knapweed, leafy spurge, Mediterranean sage, musk thistle, poison hemlock, puncturevine, purple loosestrife, rush skeletonweed, Russian knapweed, spotted knapweed, squarrose knapweed, St. Johnswort, sulfur Cinquefoil and yellow starthistle. Topics include biology, distribution, habitat, and history.

<http://www.dcr.state.va.us/dnh/invlist.htm>

The Virginia Department of Conservation and Recreation webpage has fact sheets on Russian olive, Canada thistle, Johnsongrass, purple loosestrife, and spotted knapweed. Information is in PDF format with line drawings of the plant with description, distribution, and control.

The following webpages have links to other sites with information on invasive and noxious weeds.

<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. The plants not covered are blue-flowering lettuce, western whorled milkweed, and yellow nutsedge.

<http://www.invasivespecies.gov/profiles/main.shtml#terplants>

National Biological Information Infrastructure website has links to other websites with information on leafy spurge, musk thistle, Russian knapweed, Russian olive, scotch thistle, spotted knapweed, and yellow star thistle.

APPENDIX A

Table 6. 2002 Acres Surveyed by County.

County	2002 Acres Surveyed	Total Acres in County	% Surveyed
Carson City	55,395	103,627	53.5
Clark	183,675	5,176,843	3.6
Douglas	282,387	478,562	59.0
Elko	873,424	10,976,960	8.0
Eureka	138,339	2,662,027	5.2
Humboldt	208,847	6,216,605	3.4
Lander	253,465	3,531,611	7.2
Lincoln	24,856	6,783,631	0.4
Lyon	90,795	1,310,421	6.9
Nye	1,326,302	11,678,796	11.4
Washoe	120,130	4,235,444	2.8
White Pine	1,173,344	5,677,536	20.7
Total	4,730,959	58,832,063	8.0

Table 7. 2003 Acres Surveyed by County.

County	2003 Acres Surveyed	Total Acres in County	% Surveyed
Carson City	50,636	103,627	48.9
Clark	264,241	5,176,843	5.1
Douglas	228,005	478,562	47.6
Elko	602,466	10,976,960	5.5
Eureka	129,383	2,662,027	4.9
Humboldt	150,699	6,216,605	2.4
Lander	215,936	3,531,611	6.1
Lincoln	514,900	6,783,631	7.6
Lyon	42,633	1,310,421	3.3
Nye	1,681,373	11,678,796	14.4
Storey	15,468	167,832	9.2
Washoe	144,527	4,235,444	3.4
White Pine	965,236	5,677,536	17.0
Total	5,005,503	58,999,895	8.5

Table 8. 2002 Bark Beetle Aerial Detection Survey Results by Ownership.

Ownership	Acres Surveyed	Mountain Pine Beetle		Douglas-fir Beetle		Pinyon Engraver Beetle		Fir Engraver Beetle		Subalpine Fir Mortality Complex		Jeffrey Pine Beetle	
		Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres
Humboldt-Toiyabe National Forest	4,239,629	5,347	2,465	0	0	228,613	28,517	5,587	2,050	6,140	2,271	1,075	586
Carson R.D.	348,553	50	20	0	0	1,689	569	409	114	0	0	985	496
Bridgeport R.D.	321,815	330	125	0	0	10,010	1,273	186	94	0	0	90	90
Austin R.D.	788,151	1,289	715	0	0	211,809	23,374	0	0	0	0	0	0
Tonopah R.D.	628,021	716	771	0	0	744	351	0	0	0	0	0	0
Las Vegas R.D.	165,183	20	10	0	0	230	78	70	25	0	0	0	0
Mtn. City R.D.	316,393	20	10	0	0	0	0	0	0	130	50	0	0
Ruby Mtn. R.D.	333,589	803	194	0	0	0	0	0	0	0	0	0	0
Jarbidge R.D.	152,586	1,361	365	0	0	0	0	0	0	6,010	2,221	0	0
Ely R.D.	1,027,981	758	255	0	0	4,131	2,872	4,922	1,817	0	0	0	0
Santa Rosa R.D.	157,357	0	0	0	0	0	0	0	0	0	0	0	0
Bureau of Indian Affairs	1,853	0	0	0	0	70	14	0	0	0	0	0	0
Bureau of Land Management	554,298	14	10	0	0	62,807	14,192	875	243	0	0	0	0
Great Basin National Park	76,465	507	269	0	0	120	30	770	257	0	0	0	0
Private	218,251	160	40	0	0	104,828	21,674	468	260	216	143	281	90
State of Nevada	17,929	0	0	0	0	0	0	0	0	0	0	42	30
US Fish & Wildlife	653	0	0	0	0	0	0	0	0	0	0	0	0

Table 9. 2003 Bark Beetle Aerial Detection Survey Results by Ownership.

Ownership	Acres Surveyed	Mountain Pine Beetle		Douglas-fir Beetle		Pinyon Engraver Beetle		Fir Engraver Beetle		Subalpine Fir Mortality Complex		Jeffrey Pine Beetle		Spruce Beetle	
		Trees	Ac.	Trees	Ac.	Trees	Ac.	Trees	Ac.	Trees	Ac.	Trees	Ac.	Trees	Ac.
Humboldt-Toiyabe National Forest	3,780,676	3,377	2,591	110	35	217,986	41,597	13,845	4,280	10,479	4,685	129	240	20	10
Carson R.D.	410,074	141	160	0	0	4,120	274	1,876	1,234	0	0	99	175	0	0
Bridgeport R.D.	259,544	268	280	0	0	0	0	558	508	0	0	30	65	0	0
Austin R.D.	764,939	443	298	0	0	22,759	9,656	0	0	0	0	0	0	0	0
Tonopah R.D.	723,772	628	638	0	0	6,891	2,517	0	0	0	0	0	0	0	0
Las Vegas R.D.	272,614	103	78	0	0	78,193	8,683	3,443	934	0	0	0	0	0	0
Mtn. City R.D.	87,274	35	20	0	0	0	0	0	0	1,535	667	0	0	0	0
Ruby Mtn. R.D.	326,859	1,078	831	0	0	35	25	0	0	0	0	0	0	0	0
Jarbidge R.D.	152,131	350	225	0	0	0	0	0	0	8,944	4,018	0	0	0	0
Ely R.D.	650,565	326	56	110	35	105,988	20,442	7,968	1,604	0	0	0	0	20	10
Santa Rosa R.D.	132,904	5	5	0	0	0	0	0	0	0	0	0	0	0	0
Bureau of Indian Affairs	1,147	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bureau of Land Management	1,001,476	0	0	0	0	2,435,336	186,589	4,218	1,327	0	0	0	0	0	0
Great Basin National Park	77,052	287	65	0	0	2,099	999	861	184	0	0	0	0	7	5
Private	274,370	102	91	0	0	421,971	28,126	140	58	629	316	31	45	0	0
State of Nevada	77,115	0	0	0	0	3,200	160	49	50	0	0	2	10	0	0
US Fish & Wildlife	285	0	0	0	0	0	0	0	0	0	0	0	0	0	0