United States
Department of
Agriculture

Forest Service
State and Private Forestry
Forest Health Protection
Intermountain Region
R4-OFO-Report 11-01

State of Utah Department
of Natural Resources
Division of Forestry, Fire,
and State Lands

UTAH
FOREST INSECT AND DISEASE CONDITIONS REPORT
2010

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*Photo taken on Powell Ranger District,
Dixie National Forest by Steve Munson

Utah Forest Health Conditions 2010

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August 2011

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Forest Health Conditions Summary

This report focuses only on the impacts of insects, diseases, and other disturbances on the various tree species of the state. Aerial detection surveys (ADS) conducted by the USDA Forest Service, Forest Health Protection offices are the means of collecting data that is 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. The number of acres flown in each county surveyed in 2010 is provided in Table 1. In 2010, over ten million acres were surveyed (Figure 1). Most of the area flown was on National Forest Service (NFS), Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), and National Park Service (NPS) lands, in addition to state, and private lands. Long- term insect trend data summarizes activity detected on all surveyed ownerships in Utah.

Table 1. Total number of acres aerially surveyed in each county during 2010.

County	2010
Beaver	146,709
Box Elder	150,788
Cache	486,970
Carbon	79,977
Daggett	245,346
Davis	49,468
Duchesne	1,036,588
Emery	252,811
Garfield	991,773
Grand	106,627
Iron	476,196
Juab	116,017
Kane	238,263
Millard	318,957
Morgan	273,061
Piute	282,468
Rich	136,691
Salt Lake	130,837
San Juan	544,877
Sanpete	404,998
Sevier	895,798
Summit	757,361
Tooele	0
Uintah	300,866
Utah	573,353
Wasatch	600,989
Washington	457,443
Wayne	187,586
Weber	232,100

Table 2. Trees killed and acres affected by several agents in Utah counties as detected by ADS in 2010.

2010	Mountain Pine Beetle[1]		Douglas-fir Beetle		Spruce Beetle		Pinyon Ips		Fir Engraver Beetle		Subalpine Fir Mortality Complex	
COUNTY	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres
Beaver	0	0	995	494	271	181	35	17	372	185	1,094	476
Box Elder	0	0	141	70	0	0	0	0	0	0	3,016	1,700
Cache	1,433	677	660	328	95	47	0	0	0	0	1,606	1,033
Carbon	0	0	90	39	0	0	0	0	170	85	85	53
Daggett	114,573	25,538	455	330	0	0	0	0	0	0	5	2
Davis	0	0	10	5	0	0	0	0	0	0	20	10
Duchesne	122,930	40,314	875	435	283	136	0	0	0	0	405	174
Emery	0	0	149	74	0	0	15	7	145	72	105	52
Garfield	0	0	3,513	1,711	715	335	40	20	301	150	210	104
Grand	0	0	10	5	0	0	0	0	140	70	85	42
Iron	0	0	2,820	1,777	10	5	193	96	203	101	145	72
Juab	0	0	60	30	392	281	0	0	0	0	10	5
Kane	0	0	12,971	6,607	0	0	0	0	125	62	60	30
Millard	0	0	315	157	15	7	25	12	250	124	150	75
Morgan	0	0	60	30	0	0	0	0	10	5	135	67
Piute	0	0	1,498	735	176	108	155	77	608	291	836	404
Rich	3,358	2,058	75	37	5	2	0	0	0	0	40	20
Salt Lake	0	0	15	7	294	146	0	0	145	143	1,693	798
San Juan	0	0	520	256	679	252	110	90	275	137	1,097	637
Sanpete	0	0	486	253	0	0	60	30	450	248	852	444
Sevier	0	0	2,568	1,754	11,326	7,135	485	241	655	321	720	330
Summit	1,467,186	146,557	738	406	1,024	688	0	0	100	50	1,462	806
Tooele	0	0	0	0	0	0	0	0	0	0	0	0
Uintah	1,247	987	575	286	10	5	0	0	0	0	80	40
Utah	0	0	425	211	1,959	957	0	0	660	320	958	479
Wasatch	6,046	2,767	1,935	948	28,593	11,840	0	0	110	55	2,423	1,278
Washington	0	0	130	65	20	10	146	72	1,647	781	0	0
Wayne	0	0	2,535	1,637	75	37	5	2	0	0	20	10
Weber	0	0	50	25	0	0	0	0	0	0	195	99
Total	1,716,773	218,899	34,674	18,712	45,942	22,174	1,269	665	6,366	3,198	17,507	9,240

[1]Although mountain pine beetle killed ponderosa, bristlecone, and limber pine throughout the state, the data are for lodgepole pine only.

Defoliators

Douglas-fir tussock moth (*Orgyia pseudotsugata* McDunnough) population levels remain at low levels in Utah. Western spruce budworm **(***Choristoneura occidentalis* Freeman) has been increasing in central and southern Utah for the past several years and is affecting tens of thousands of acres of mixed conifer forests.

Forest tent caterpillar (*Malacosoma disstria* Hubner) populations have been at endemic levels in Utah and locally defoliating aspen and other hardwood tree species.

Fall cankerworm (*Alsophila pometaria*), an early summer defoliator of oaks and other hardwood tree species, caused some defoliation of these species across northern Utah, mainly along the Wasatch Front in 2010.

Decline/Dieback

Aspen defoliation and dieback is due to multiple factors including drought, canker diseases, borers, bark beetles, past defoliation, and other agents and abiotic stresses. Further field investigation is needed to determine all active damaging agents. Dieback can lead to decline and the death of aspen clones under some conditions. Aspen decline and dieback has been mapped since 2003. It affected almost twenty thousand acres of aspen forest in 2010.

Figure 1. Surveyed Areas for the 2010 Aerial Insect and Disease Detection Survey.

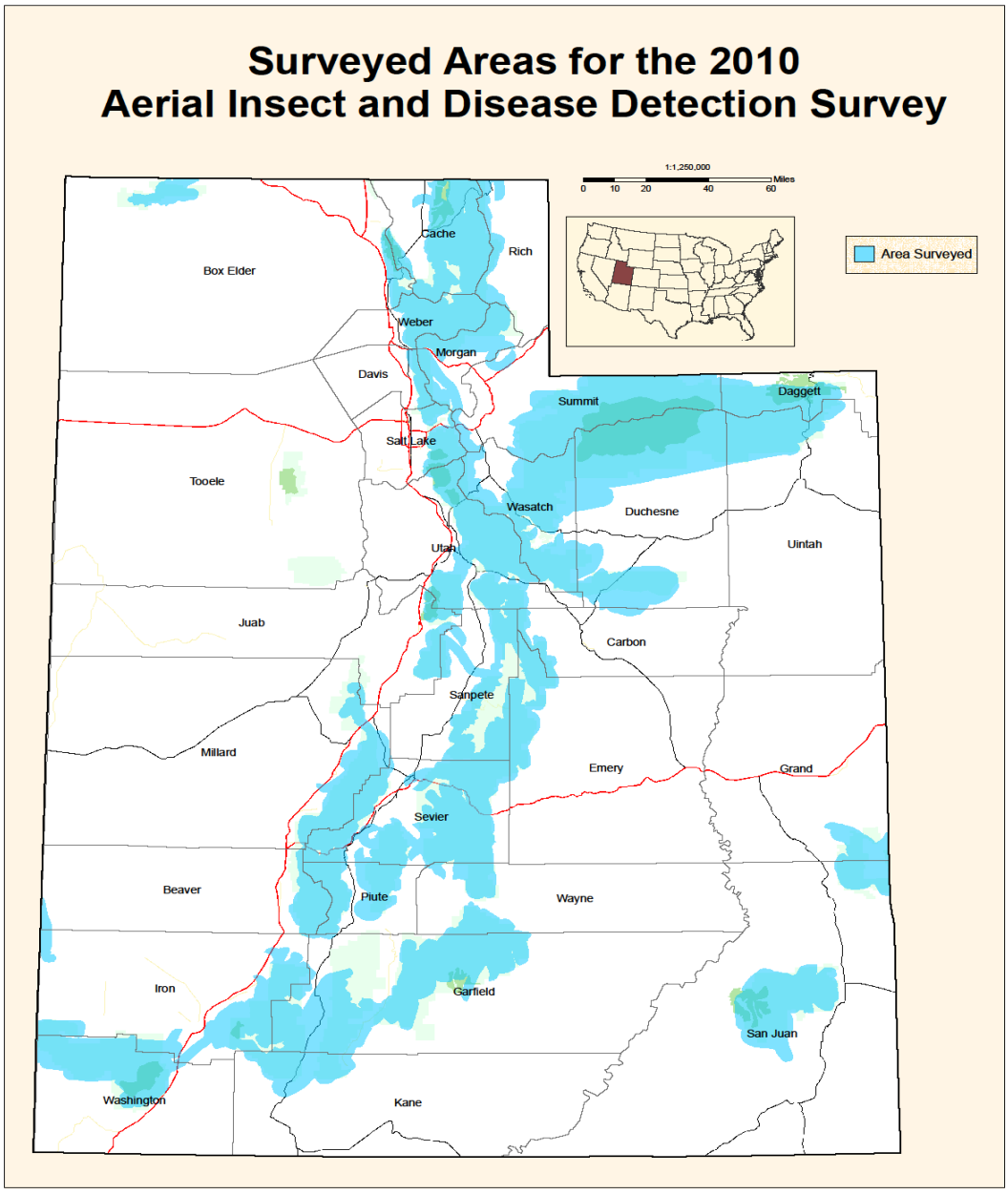

Table 3. Trees defoliated and acres affected by several agents in Utah counties as detected by ADS in 2010.

2010	Western Spruce Budworm	Unknown Aspen Defoliation	Aspen Decline/Dieback
County	**Acres**	**Acres**	**Acres**
Beaver	10,530	0	38
Box Elder	0	0	0
Cache	0	118	290
Carbon	0	0	81
Daggett	0	0	0
Davis	0	0	0
Duchesne	0	0	1,466
Emery	0	0	0
Garfield	63,068	0	4,448
Grand	0	0	256
Iron	3,519	0	2,549
Juab	0	0	9
Kane	10,911	0	244
Millard	0	0	99
Morgan	0	19	138
Piute	10,653	0	346
Rich	0	37	198
Salt Lake	0	0	0
San Juan	0	0	1,467
Sanpete	0	0	609
Sevier	16,098	0	1,850
Summit	0	80	138
Tooele	0	0	0
Uintah	111	0	1,844
Utah	0	0	210
Wasatch	0	14	2,894
Washington	0	0	102
Wayne	27,157	0	56
Weber	0	56	107
Total	142,046	323	19,436

STATUS OF INSECTS

Native Defoliators

Douglas-fir Tussock Moth
Orgyia pseudotsugata

Hosts: all true firs, Douglas-fir, and spruce

The Douglas-fir tussock moth (DFTM) is an important native insect capable of causing extensive defoliation. Caterpillars feed on the needles of trees which can lead to topkill, and after several seasons of defoliation, tree mortality. Outbreaks are cyclical due to natural controls, such as parasitic wasps, a virus, and weather conditions. The hairs on the caterpillars can cause allergic reactions in some individuals.

There were 24 acres of DFTM defoliation detected in Utah County in 2010 which occurred just south of Payson Canyon.


Figure 2. Douglas-fir tussock moth larvae. (Photo:D. McComb, Bugwood.org).

Western Spruce Budworm
Choristoneura occidentalis Freeman

Hosts: Douglas-fir, subalpine fir, white fir, blue spruce, Engelmann spruce

Western spruce budworm is the most widely distributed and destructive defoliator of coniferous forests in western North America. Trees may be extensively defoliated during outbreaks, resulting in stress that can directly kill the tree or make it susceptible to diseases and secondary insect pests, such as the Douglas-fir beetle.

Defoliation by western spruce budworm has increased in recent years and remains high in southern Utah. Most of the defoliation over the last few years has occurred on the high plateaus of Sevier, Piute, Wayne, Garfield, and Iron counties, but appears to be moving northward. Defoliation increased 51% statewide in 2010 from 2009. The increase included 25% in Iron County and nearly 45% in Beaver, Garfield, Piute, and Sevier counties. Kane County defoliation exploded from zero acres in 2009 to 10,911 acres in 2010 and Wayne County defoliation increased by nearly 70%. However; defoliation in Uintah, San Juan, and Utah counties decreased to zero.

Forest Tent Caterpillar
Malacosoma disstria

Hosts: aspen, willows, cherry, cottonwood, mountain mahogany, oak, alder, birch

The forest tent caterpillar is the most widely distributed and destructive tent caterpillar in North America. Aspen is the preferred host, but it will attack a wide range of deciduous trees and shrubs. Larvae do not build tents, instead they create a silken mat on leaves, branches, or trunks where they

congregate while at rest or during molt. Larvae are dark brown with bluish heads, reddish- brown stripes, and distinct white, keyhole-shaped markings down their backs. Western tent caterpillars, which are reddish-brown in color, make the large webs often found on chokecherry and other deciduous trees and shrubs. Outbreaks usually last 2 to 3 years in western states. Repeated defoliation and other stress factors may reduce growth rates of infested trees, kill trees, or predispose trees to other diseases or insect pests.

There was no defoliation mapped in 2010.

Fall/Spring cankerworm
Alsophila pometaria/ Paleacrita vernata

Host: various deciduous tree species

Fall and spring cankerworms (*Alsophila pometaria and Paleacrita vernata)* respectively, are early summer defoliators of oaks and other hardwood tree species. Populations of these geometrid moths have since declined to endemic levels and previously defoliated trees are recovering.

Needle Insects

Piñon Needle Scale
Matsucossus acalyptus

Host: Colorado piñon and singleleaf piñon

The piñon needle scale is a native sap-sucking insect that feeds on older needles of infested trees. Damage results in tip killing, branch flagging, stunted tree growth and needle injury. Crowns appear thin, retaining only current years needles. Insects in the first larval stage are hard to see on the needles but insects in the second larval stage resemble tiny black beans. Small trees may be killed outright and large trees may be seriously weakened after repeated infestations, rendering them susceptible to piñon engraver beetle. Most piñon seem to recover in a few years from light to moderate defoliation.

In 2010, most piñon needle scale defoliation occurred on the Dixie National Forest (28,900 acres) and BLM lands (14,100 acres) in the following counties – Iron (25,544 acres), Washington (15,354 acres) and Beaver (5,670 acres).

In Washington County infested trees were detected in the mountains east and west of Enterprise on the Dixie National Forest and over the border into Nevada. In Iron and Beaver Counties an infestation occurred in the White Rock Mountain Range located west of Hamlin Valley and spreading over into Nevada.

Native Bark Beetles

Fir Engraver Beetle
Scolytus ventralis

Hosts: true firs

Fir engraver beetle (FEB) is a major pest of true firs in western forests. It attacks trees over three inches in diameter at breast height. Tree stress due to drought, disease, and defoliation may incite outbreaks that cause severe tree mortality. This insect is often associated with other forest pests such as Douglas-fir tussock moth, spruce budworm, bark beetles, woodborers, and annosus root disease.

Mortality due to FEB decreased to 3,200 acres in 2010 from 6,100 acres in 2009. In 2010, FEB-caused tree mortality was mapped throughout the host trees in eighteen Utah counties, mostly from Salt Lake County south through central Utah to Washington County. Additional fir mortality attributed to this insect was also mapped in the mountains of San Juan County.

Mountain Pine Beetle
Dendroctonus ponderosae

Hosts: lodgepole, limber, bristlecone, 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 small diameter trees (4" diameter at breast height). Extensive mortality may alter large forest landscapes by converting pine ecosystems to grass and shrub landscapes for a period of 10-20 years. This conversion affects wildlife species, water yields and fuels. In 2010, MPB-caused tree mortality in lodgepole pine remained constant. An ongoing outbreak occurring in northern Utah killed 1.7 million lodgepole pine trees. This outbreak which began in 2003 has increased annually with most of mortality occurring on the Uinta-Wasatch-Cache National Forests. Substantial lodgepole pine mortality was also recorded on the Ashley National Forest (261,300 trees over 67,800 acres).

Douglas-fir Beetle
Dendroctonus pseudotsugae

Hosts: Douglas-fir

Douglas-fir beetle (DFB) typically kills small groups of trees, but during outbreak conditions 100 tree mortality centers are not uncommon. At endemic levels, DFB favors weakened, less vigorous trees, including windfalls, fire-injured trees, and trees with root disease or defoliation. Beetle populations can build rapidly in abundant, newly-fallen host material and spread to adjacent healthy, green standing trees.

In 2010, the acreage caused by DFB nearly doubled from 2009 (9,500 acres to 19,000). Most of the tree mortality was mapped on the Dixie (10,300 acres) and Fishlake National Forests (3,900 acres).

Spruce Beetle
Dendroctonus rufipennis

Hosts: Engelmann spruce, blue spruce

The spruce beetle is the most significant natural mortality agent of mature spruce. Endemic populations usually exist in weakened or windthrown trees, logging slash, and fresh stumps. Outbreaks typically occur when beetle populations build to high levels in concentrations of windthrown trees. Dispersing adults may infest standing live trees, initially preferring larger diameter trees.

In 2010, spruce mortality attributed to this insect occurred in Sevier, Summit, Wasatch, and Utah counties and increased more than 50% since 2009. However, during the same period, tree mortality in Garfield county decreased by nearly 90%. The spruce beetle outbreak still poses important management concerns for the heavily used recreation areas along the Wasatch Front.

Figure 3. Spruce mortality on Price Ranger District, Manti-LaSal National Forest. (Photo by Steve Munson)

Piñon Engraver Beetle
Ips confusus

Host: Colorado piñon and singleleaf piñon

Injured or stressed trees are preferred by the piñon engraver beetles. Mass attacks of this insect girdle and eventually kill piñons. Piñon engravers produce multiple generations each year and consequently

populations can build rapidly in slash and other stressed green trees and spread into healthy stands. As with other bark beetle species, piñon engravers carry a wood staining fungus into the tree which in combination with the feeding larva, kills the tree.

Historically, piñon pine was not aerially surveyed in Utah. Drought combined with increased piñon engraver populations contributed to considerable piñon pine mortality in 2001-2002. Piñon-juniper woodlands have subsequently been surveyed each year due to concerns over the loss of this valuable forest type.

In 2010, 665 acres of piñon pine mortality was mapped. This was a slight increase from 2009. Sevier County had the most piñon pine affected on 241 acres.

Western pine beetle
Dendroctonus brevicomis

Host: ponderosa pine

Western pine beetle kills ponderosa pine six inches in diameter at breast height or larger. This beetle usually targets weakened trees with reduced defenses. Such trees may be crowded in dense, overstocked stands; slow-growing, overmature ponderosa pine trees; or trees damaged by fire or lightning. When large numbers of trees are weakened across a landscape, western pine beetle populations may increase and kill hundreds of thousands of trees.

Mortality was observed in the following counties in 2010:

County	**Acres**	**Trees**
Beaver	7	15
Garfield	20	40
Grand	7	15
Kane	12	25
San Juan	57	115
Washington	28	57
TOTAL	133	267

Roundheaded pine beetle
Dendroctonus adjunctus

Hosts: ponderosa pine

Roundheaded pine beetle has periodic outbreaks that kill thousands of pine trees, but more commonly this beetle subsists in small groups of weaker trees, often in conjunction with other bark beetles (western pine beetle, mountain pine beetle or pine engravers). Roundheaded pine beetle may attack trees of any size but are usually found in trees greater than 20 inches diameter at breast height.

No mortality attributed to roundheaded pine beetle was observed during ADS in 2010.

Insects: Non-native

European Gypsy Moth
Lymantria dispar

Hosts: various deciduous tree species

Gypsy moth caterpillars have defoliated millions of acres in the northeastern United States since the late 1800's. The gypsy moth feeds on over 250 deciduous tree species and infestations can build rapidly causing widespread defoliation. Tree mortality may occur after successive years of heavy defoliation. Infested areas may be subject to quarantine to prevent the spread of the insect. The caterpillars can also be a nuisance to homeowners by crawling over homes, vehicles and outdoor furniture. Hairs found on the caterpillars can also cause allergic reactions in some individuals.

The gypsy moth was first detected in Utah in 1988 in Mount Olympus Cove, Salt Lake County. Being notorious hitchhikers they were probably transported into Utah from an infested area in the eastern U.S. Since then the Utah Department of Agriculture and Food, in cooperation with two USDA agencies, the Animal, Plant Health Inspection Service and the Forest Service, place detection traps throughout the state. Isolated single male moth catches are recorded almost annually. Eradication treatments have been used to treat over 73,000 acres since 1989. No aerial application projects have been conducted since 1999 within the state.

In 2010 delimiting pheromone traps were placed in the locations of the two male moth catches from 2008. The Orem grid consisted of 121 traps configured in a 500-foot grid. In Kamas, only 46 traps were placed in the grid due to private land access issues. No additional moths were caught in the traps.

In 2010, 2,217 detection and delimiting traps were deployed throughout the state. No gypsy moths were caught.

Between 2,000 and 2,500 traps will be placed statewide this year. The Kamas and Orem delimiting grid will be replaced with the standard detection trap grid.

Banded Elm Bark Beetle
Scolytus schevyrewi

Hosts: various deciduous tree species, primarily elm

The banded elm bark beetle is native to northern China, central Asia, and Russia. The beetle was first detected in the U.S. in April 2003 in Ogden, Utah, and Aurora, Colorado. Since then, the beetle has been detected in 28 states. Where and when it was introduced into the U.S. remains unknown, but it is thought to have arrived in solid wood packing material at U.S. ports. The beetle bores into branches and trunks of stressed or dead trees. Severe infestations can kill drought-stressed trees. The beetle may also carry the pathogen causing Dutch elm disease.

STATUS OF DISEASES

Stem and Branch Diseases

Dwarf Mistletoes
Arceuthobium spp.

Hosts: Douglas-fir, pines, true firs, and spruce

Dwarf mistletoes (DM) 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 in infected trees. Heavy dwarf mistletoe infections 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 infects trees of all ages, infection problems may exist in secondary growth and regeneration, as well as mature and overmature tree stands. Dwarf mistletoe on piñon pine can be found throughout the state, but it has never been comprehensively surveyed.

Piñon Blister Rust
Cronartium occidentale

Hosts: Colorado and singleleaf piñon

This native rust causes stem rust cankers and branch flagging on both Colorado piñon and singleleaf piñon in Utah. This disease kills small trees and causes branch flagging on larger or more resistant trees. These rust infections will commonly be associated with attacks by the pitch mass borer.

White Pine Blister Rust
Cronartium ribicola

Hosts: limber, bristlecone pine

This introduced disease is common throughout its hosts range in southern Idaho and western Wyoming. It is present in the Sierra Mountains of California and Nevada near Lake Tahoe and in the Jarbidge Mountains. No infected hosts have been found or reported in Utah, but the disease has been found one canyon to the north of the Utah border in southern Idaho. The disease has a complex life history requiring 2 hosts to survive. Thus it is not able to spread directly from pine to pine but must develop on intermediate hosts consisting of gooseberries or currants (*Ribes spp*.)

Damage includes mortality, topkill, branch dieback, and predisposition to attack by bark beetles.

Five-needled pine trees are of low occurrence and frequency in Utah. Often relegated to high alpine areas, these pines grow slowly but provide important ecosystem functions such as facilitating snow retention for maintaining watershed integrity, recreation, aesthetics, and food and habitat for wildlife. High levels of white pine blister rust have the potential to devastate these ecologically important high elevation, five-needled pines.

Sudden Oak Death
Phytophthora ramorum

Hosts: tanoaks, quercus spp., rhododendron spp.

Sudden Oak Death (SOD), a forest disease first reported in 1995, has been killing millions of tanoak and coast live oaks in the coastal areas of California, but is not known to exist in Utah. The disease is present only in California and southwestern Oregon. On coastal live oaks and tanoak, cankers form on the main stems which can lead to crown dieback and then death. Since SOD can infect rhododendron ornamentals there is the risk of the disease spreading to other states via nursery stock.

Root Diseases

When present, root diseases spread from the roots of one tree to another, and to a limited extent through the soil. Root diseases are often called "diseases of the site", indicating that once present in a forest they tend to persist throughout for the entire lifespan of the trees on that site. Susceptibility of the trees and virulence of the pathogens involved varies from one area to another. In Utah, root diseases are less damaging than in other areas with moister climates and forests that have been impacted by exotic pathogens. True "root disease centers", areas with a high concentration of root disease, are rare in the state. More commonly, evidence of root disease is scattered throughout many forests, with varying degrees of impact. Root diseases are intimately involved with populations of bark beetles, with endemic bark beetle populations often associated with root disease centers.

Several tree conditions are symptomatic of all root diseases. The symptoms can vary if the trees are killed rapidly or with size of the tree. The foliage of small trees that have been killed rapidly often turns red. On older trees many of these agents can act as butt or root decays without killing the tree. Trees that have a portion of their root system impacted by root diseases often exhibit several symptoms including thinning in the crown from the lowest part towards the highest, and from older foliage towards the younger. In general, the production of conspicuous fruiting bodies of root diseases is rare in Utah, occurring most often in relatively moist years. Several of these diseases can also act as saprophytes, decaying dead material.

Annosum Root Disease
Heterobasidion annosum

Hosts: Douglas-fir, subalpine fir

This disease can be found throughout the state, but frequently acts as butt decay or as a saprophyte on dead trees, stumps, and roots. It occurs in trees of all ages. The symptoms on larger trees include a thinning crown and fruiting bodies or conks that develop in decayed stumps and roots. The conks are woody to leathery looking with a dark brown upper surface and cream colored pore surface. Advanced decay in the root tissues looks white, stringy and somewhat laminate. (Figure 4).


Figure 4. Annosum conk at the base of a tree.

Armillaria Root Disease
Armillaria spp.

Hosts: Douglas-fir, Engelmann spruce, subalpine fir, white fir, ponderosa pine

Evidence of Armillaria root disease can be found throughout the state. It often functions as a weak parasite killing trees experiencing environmental stress. In southern Utah, it may act as a primary pathogen killing mature and immature ponderosa pine and mature fir and spruce on cool sites at higher elevations. It often acts as a thinning agent in young stands or in areas with shallow, poor soils. Symptoms of Armillaria include heavy resinosis at the root collar, and thick, fan-shaped mats of white fungus tissue under the bark where root and root collar tissue are dying. The fungus produces rhizomorphs that resemble black string like structures that can move through the soil a few feet to infect other roots. When present, mushroom-type fruiting bodies grow in clusters from the roots or at the base of the tree (Figure 5). The decay caused by the fungus is yellowish and stringy/spongy and often contains black lines called zone lines.

Figure 5. Armillaria fruiting bodies

Black Stain Root Disease
Leptographium wageneri

Hosts: piñon pine

Black stain root disease is an important disease of several hosts, but it is only found on piñon pine in Utah. It usually kills infected trees within a few years, and can result in groups of tree mortality several acres in size. Pockets of infected trees are preferred hosts for low-level populations of engraver beetles (*Ips confusus*). No new pockets of black stain root disease were observed during aerial survey in 2010.

Leaf and Needle Diseases

Aspen Leaf Spot
Marssonina populi
Host: aspen

Aspen leaf spot is the most common leaf disease of aspen in the West. Severe outbreaks may cause foliar browning in midsummer and nearly complete defoliation by early August. Regrowth usually follows in late summer and early autumn. Symptoms include small brownish spots on infected leaves in mid- to late-summer. The spots later enlarge and turn black in color. They will vary in size and appear irregular in shape with a yellowish border (Figure 6). Blight and leaf spot caused by this disease have been seen in the past throughout the host type, and although not indicated on ADS maps, it is likely a contributing factor to aspen decline.

Figure 6. Symptoms of aspen leaf spot.

DECLINES / COMPLEXES

Subalpine Fir Mortality Complex

Host: subalpine fir

The western balsam bark beetle (WBBB) is the most significant mortality agent in a complex of forest insects and diseases 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 the last year, the total acreage of subalpine fir affected by this mortality complex (SAFMC) decreased from 13,000 acres to 9,200 acres. Most of the mortality in 2010 was mapped in Box Elder, Salt Lake, and Wasatch counties.

Mortality occurred in Big Cottonwood Canyon south to the county line. Much of the mortality occurred on private land on the back side of the Wasatch Mountains. Numerous small (4-50 trees) mortality pockets were mapped throughout the forest type occurring in the Monte Cristo Range, north of Willard Peak and around Grizzly Peak, Black Mountain, and Willard Mountain. Several mortality pockets of 4-50 trees were also recorded on private land on Porcupine Ridge, Sharp Mountain and from Guilder Peak north to the Right Fork of the Ogden River's South Fork drainage. Further north, scattered pockets of 4-100 fading trees were mapped from Red Banks north into Idaho. Mortality pockets of 20 trees were detected from Brush Canyon south to Hodges Creek.

Figure 7. Subalpine fir mortality.

Aspen Decline

Host: aspen

A decrease in aspen forest acreage and healthy stands has been reported throughout the western U.S. since the 1970's. The two principle reasons associated with these observations are succession of aspen forests to other vegetation types due to fire exclusion, and heavy ungulate damage.

Aspen dieback has been noted for many years in Utah, and has been recorded by aerial survey since 2003. In 2006, Forest Health Protection established 38 monitoring plots in Utah to determine what was causing dieback symptoms. In the areas evaluated, moderate levels of mortality and moderate to heavy damage in trees over five inches diameter at breast height were observed. The most common insect and disease agents observed were canker diseases and insect borers often associated with trees under drought stress. There was also heavy ungulate browsing on the aspen seedlings.

In 2010 aspen dieback acreage remained constant with nearly 19,000 acres affected. Sevier, Garfield, Wasatch, Iron, and Uintah Counties have the highest acreages of aspen dieback and mortality.

ABIOTIC DAMAGE

Frost Damage

Hosts: maple, gambel oak, aspen, Douglas-fir, spruce

Freeze damage occurs when temperatures drop 2˚ to 5˚ below freezing after tree growth has started in the spring. The young branch tips of trees affected by freeze damage droop and turn brown. New shoots or needles of breaking buds are killed. This damage may result in branch dieback, stunted growth, and poor tree form.

No frost damage was aerially mapped in 2010.

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 was 794 acres of windthrow observed in Summit and Daggett Counties. In Summit County, a microburst occurred and blew down lodgepole and aspen on 771 acres just west of the East Fork Blacks Fork River south of Meeks Cabin Reservoir. In Daggett County, twenty-three acres of lodgepole and subalpine fir blew down near Pollen Lake.

Snow Avalanches/Mudslides

Like blowdown damage, snow avalanches and mudslides knock down trees and may provide an abundant, local food source for certain bark beetles, enabling populations to build. In 2010, 142 acres avalanched in Garfield and Iron County.

Drought or Other Dieback

Some mortality may be caused by harsh environmental conditions such as drought or may be caused by an unidentified environmental factor. In 2010, gambel oak dieback was observed in Utah County (29 acres). This mortality was very likely a combination of several factors including fall cankerworm, frost damage, and perhaps drought. In 2010, mountain mahogany dieback was recorded on 1,219 acres in Washington County northwest of New Harmony in the Pine Valley Mountains.

NOXIOUS WEEDS

Noxious weeds are a continuing problem for all Western states. They have the ability to aggressively colonize disturbed habitats thus displacing native plant species and altering ecosystems. Several state and federal agencies have the responsibility for monitoring and controlling noxious weeds. As of 2011, approximately 324 species of exotic aquatic and terrestrial plants infest lands in the State of Utah. Utah has declared 27 of these species as noxious weeds. These noxious weeds are grouped into one of three classes depending upon their management priority. "Class A" weeds have a sparse distribution throughout the State and/or generally low population levels with eradication being the primary management goal. Management strategies for Class A weeds typically include preventing new infestations, early detection, and rapid/ repeated treatment. "Class B" weeds are more broadly distributed and/or exist at moderate population levels. These weeds can largely be controlled using integrated management strategies. "Class C" weeds are generally established throughout the State at high population levels. Management of Class C weeds is limited to reducing spread by containing large infestations. Table 4 (pages 23 and 24) lists Utah's noxious weeds by class and indicates the counties infested. Most counties in Utah have listed additional noxious weeds that are of local concern.

Canada thistle, musk thistle, scotch thistle, hoary cress, and field bindweed are the most abundant and widespread noxious weed species in Utah, although other invasive weed species including Russian olive, bull thistle, and common mullein are as equally abundant and ubiquitous. The exact acreage of lands infested by noxious weeds is unknown; however, every county in Utah is infested by at least ten noxious weed species. Counties with the most noxious weed species reported include Cache, Box Elder, Utah, Weber, and Salt Lake. Counties with the least noxious weed species reported include Garfield, Piute, Wayne, Kane, and Washington (Table 4).

For more up-to-date information on Utah Noxious Weeds go to: **http://www.utahweed.org/weeds.htm**.

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

http://www.invasivespeciesinfo.gov/
This website is the gateway to federal, state, local, and international efforts concerning invasive species.

http://www.ipm.ucdavis.edu
University of California integrated pest management website has information on how to manage pests, educational resources, and research information.

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 western North America through education, by facilitating collaboration among researchers, educators, and land managers, concerned publics, 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 is a comprehensive database of exotic plant names and weed distribution records for five states in the northwestern United States**.** It is used as 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.

http://cdfa.ca.gov/phpps/ipc/encycloweedia/encycloweedia_hp.htm
California Department of Food and Agriculture has a very comprehensive webpage. Information includes description, biology, distribution, habitat, and management of plants and control methods. Pictures of the plants in various stages are just a click away.

http://www.nwcb.wa.gov
State of Washington's noxious weed control board webpage has information on buffalobur, goatsrue, houndstongue, johnsongrass, diffuse, Russian and spotted knapweed, purple loosestrife, silverleaf nightshade, yellow nutsedge, perennial pepperweed, puncturevine, leafy spurge, St. Johnswort, yellow starthistle, Canada thistle, musk thistle, scotch thistle, Dalmation toadflax, velvetleaf, and dyer's woad. 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.invasive.org/weedus/index.html
The website is a collaborative project between the National Park Service, The University of Georgia Center for Invasive Species and Ecosystem Health, the Invasive Plant Atlas of New England, and the Lady Bird Johnson Wildflower Center, that assists users with identification, early detection, prevention, and management of invasive plants.

Noxious Weeds

Table 4. The county locations of Utah noxious weeds grouped by priority class. Sources: Noxious Weed Field Guide for Utah (Belliston et al. 2010) and USDA National Plants Database (http://plants.usda.gov/index.html).

	Utah Counties																												
State Declared Noxious Weeds	Beaver	Box Elder	Cache	Carbon	Daggett	Davis	Duchesne	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan	Piute	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber
Class A Weeds (Early Detection, Rapid Response)																													
Black Henbane	x	x	x	x	x		x			x		x			x		x				x	x	x	x	x	x		x	
Diffuse Knapweed	x	x	x			x			x	x	x	x			x				x			x	x	x	x				x
Johnson grass	x	x		x								x	x					x	x	x		x			x		x		x
Leafy Spurge		x	x	x		x		x				x		x	x		x	x		x	x	x	x	x	x	x	x	x	x
Medusa head		x	x																			x			x				x
Oxeye Daisy			x		x	x																x							
Purple Loosestrife		x	x	x		x		x		x		x	x	x				x						x	x	x			x
St. Johnswort		x	x		x													x					x						x
Spotted Knapweed	x	x	x		x	x	x	x		x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Sulfur Cinquefoil			x																						x		x		x
Yellow Starthistle		x	x			x							x					x							x	x	x		x
Yellow Toadflax			x	x			x	x						x				x		x	x	x				x			x
Class B Weeds (Control)																													

State Declared Noxious Weeds	Beaver	Box Elder	Cache	Carbon	Daggett	Davis	Duchesne	Emery	Garfield	Grand	Iron	Juab	Kane	Millard	Morgan	Piute	Rich	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber
Bermuda grass		x	x			x		x		x				x	x			x				x		x	x		x		x
Dalmation Toadflax		x	x	x	x	x	x	x	x		x	x	x		x		x	x	x	x		x	x	x	x	x			x
Dyer's Woad	x	x	x	x	x	x					x	x		x	x		x	x	x	x	x	x	x	x	x	x			x
Hoary Cress	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Musk Thistle	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Perennial Pepper weed	x	x	x	x	x	x	x	x		x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x		x
Poison Hemlock	x	x	x	x	x	x	x	x		x	x	x	x	x		x	x	x			x		x	x	x	x			x
Russian Knapweed	x	x	x	x	x	x	x	x	x	x	x	x	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	x	x	x	x	x	x	x	x	x	x	x	x	x
Squarrose Knapweed			x									x		x	x				x	x			x		x	x			
Class C Weeds (Containment)																													
Canada Thistle	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Field Bindweed	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Hounds tongue	x	x	x	x	x	x	x	x		x	x	x		x	x	x	x	x		x	x	x	x	x	x	x		x	x
Quack grass	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Saltcedar	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x		x	x	x	x	x	x	x