United States
Department of
Agriculture

Forest Service
State and Private Forestry
Forest Health Protection
Intermountain Region

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

Utah Forest Insect and Disease Conditions Report 2019

Fall Colors: photo by Colleen Keyes (FFSL)

FOREST HEALTH SPECIALISTS

USDA Forest Service
Forest Health Protection
Ogden Field Office
4746 South 1900 East
Ogden, Utah 84403
Phone: 801-476-9720
Fax: 801-479-1477

Darren Blackford, Entomologist
email: darren.blackford@usda.gov

Maria Newcomb, Plant Pathologist
email: maria.newcomb2@usda.gov

Ryan Davis, Entomologist
email: ryan.davis@usda.gov

Daniel Ott, Entomologist
email: daniel.ott@fs.fed.us

Justin Williams, Biological Technician
email: justin.williams3@usda.gov

Ben Meyerson, Biological Technician
email: benjamin.meyerson@usda.gov

State of Utah
Department of Natural Resources
Division of Forestry, Fire, & State Lands
1594 West North Temple, Suite 3520
P.O. Box 145703
Salt Lake City, Utah 84114-5703
Phone: 801-538-5211
Fax: 801-533-4111

Colleen Keyes, Forest Health Coordinator
email: colleenkeyes@utah.gov

Utah Forest Insect and Disease Conditions Report 2019

Colleen Keyes
And
Forest Health Protection-Ogden Field Office Staff

December 2020

Table of Contents

List of Figures

List of Tables

FOREST HEALTH CONDITIONS SUMMARY

A healthy forest maintains the function, diversity, and ecological resiliency of all its components, and provides a framework for all essential ecosystem processes such as fish and wildlife habitat, for many native species, riparian areas, soils, rangelands, and economic potential, while providing for human needs now and in the future. This report focuses on the impacts of insect, disease, and abiotic disturbance agents on Utah's managed forested lands using ground level observations by Forestry, Fire and State Lands (FFSL) personnel and USDA Forest Service, Forest Health Protection (FHP) personnel and other verified information. Aerial detection surveys (ADS) conducted by FHP provides the 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 within affected acres are dead. The area of ADS coverage varies by year depending on need, resources, and flight restrictions.

In 2016, FHP changed the tree damage quantification methodology from "trees per acre" to "percent of trees affected" for large areas affected by insect and disease agents. Small affected areas are still recorded as points. Table 1 shows the new 5-level classification system used to describe damage levels. Damage is recorded as a point or polygon, and causal agent(s) are assigned to each feature (e.g., mountain pine beetle; Douglas-fir beetle; etc.). Depending upon feature type, damage intensity is recorded differently. For point data, trees affected are classified into one of 5 levels that correspond to the number of trees killed. For polygon data, damage is classified by the percentage of trees affected within the feature.

Table 1. Aerial detection 5-level tree damage classification system.

Point Class	Trees Affected		Polygon Class	Percent Trees Affected
1	1		1	1 to 3%
2	2 to 5		2	4 to 10%
3	6 to 15		3	11 to 20%
4	16 to 30		4	21 to 50%
5	>30		5	>50%

The number of acres flown/surveyed in each county in 2019 is provided in Table 2. Figure 1 shows areas that were surveyed in 2019. Over twelve million acres were surveyed primarily 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. Forests throughout much of Utah are composed of dense stands that are relatively uniform in age, composition, and structure resulting in poor forest health conditions. Unhealthy forests are conducive to insect and disease issues. In other words, insect and disease issues are often not the cause of poor forest health, but are the result. Some major factors contributing to a decline in forest health including: lack of active management, poor grazing patterns, fire exclusion, and

invasive weeds. Adequate precipitation and growing space is necessary to maintain tree vigor, thereby increasing tree resistance to insects and diseases. Increasingly hot drought conditions throughout the State continue to place additional stress on forests that are already in poor health.

Refer to Tables 3 & 4 for county-level ADS information on acres affected by bark beetles, and defoliators and other agents in 2019. Acres affected may be on federal, private, State parks,or State Institutional Trust Lands.

Summary

Mountain pine beetle (MPB) caused mortality increased by 54% from 2018 surveys. Summit County had a majority of the MPB-caused mortality in lodgepole and limber pine.

Douglas-fir killed by Douglas-fir beetle (DFB) decreased significantly in 2019, with only 1,773 acres affected statewide; in 2018 total acreage affected was 12,104. Nearly every county had some acres affected.

Spruce beetle-caused Engelmann spruce mortality is still being mapped, with a decrease of 60% in total acres affected in 2019. In 2018, a total of 92,832 acres were affected, whereas in 2019 a total of 36,634 acres were affected. The largest number of acres affected in 2019 occurred in Duchesne, Dagget, and Summit counties.

Fir engraver-caused mortality (primarily in white fir) decreased statewide in 2019 with 6,797 acres affected, down from 21,011 affected acres in 2018. Most counties have some damage mapped. The largest acreage affected in 2019 occurred in Millard, Sanpete, Sevier, and Juab counties.

Subalpine fir tree mortality complex decreased from 33,878 acres in 2018 to 15,056 acres in 2019. Subalpine fir mortality was mapped in nearly all counties in 2019

Balsam woolly adelgid (BWA) is a tiny non-native sucking insect, and was first confirmed in Utah in September 2017. In 2019, BWA was confirmed in Box Elder, Cache, Rich, Weber, Davis, Morgan, Salt Lake, Summit, Utah, and Wasatch counties, which added an additional 35,995 subalpine fir acres affected to those affected by subalpine fir mortality complex. The acres affected by BWA have increased from 2018, where 13,021 acres were affected. Much of the increase in acres affected is likely due to ground survey confirmation and the increased ability of the Aerial Detection Specialists in recognizing the signature of this pest.

Western spruce budworm (WSB) defoliation appears to have increased from 2018 by approximately 25%, with 104,011 acres affected in 2019. Most counties had some acres affected. Most WSB damage was noted in Garfield and Sevier counties.

Aspen dieback is largely caused by drought, a complex of tree pathogens, and insect borers. It also appears that insect and disease-caused defoliation play a role in some areas. Aspen dieback has been mapped since 2003. Approximately 1,224 acres were mapped as aspen dieback in 2018. In 2019, ADS did not map any acres affected as aspen dieback.

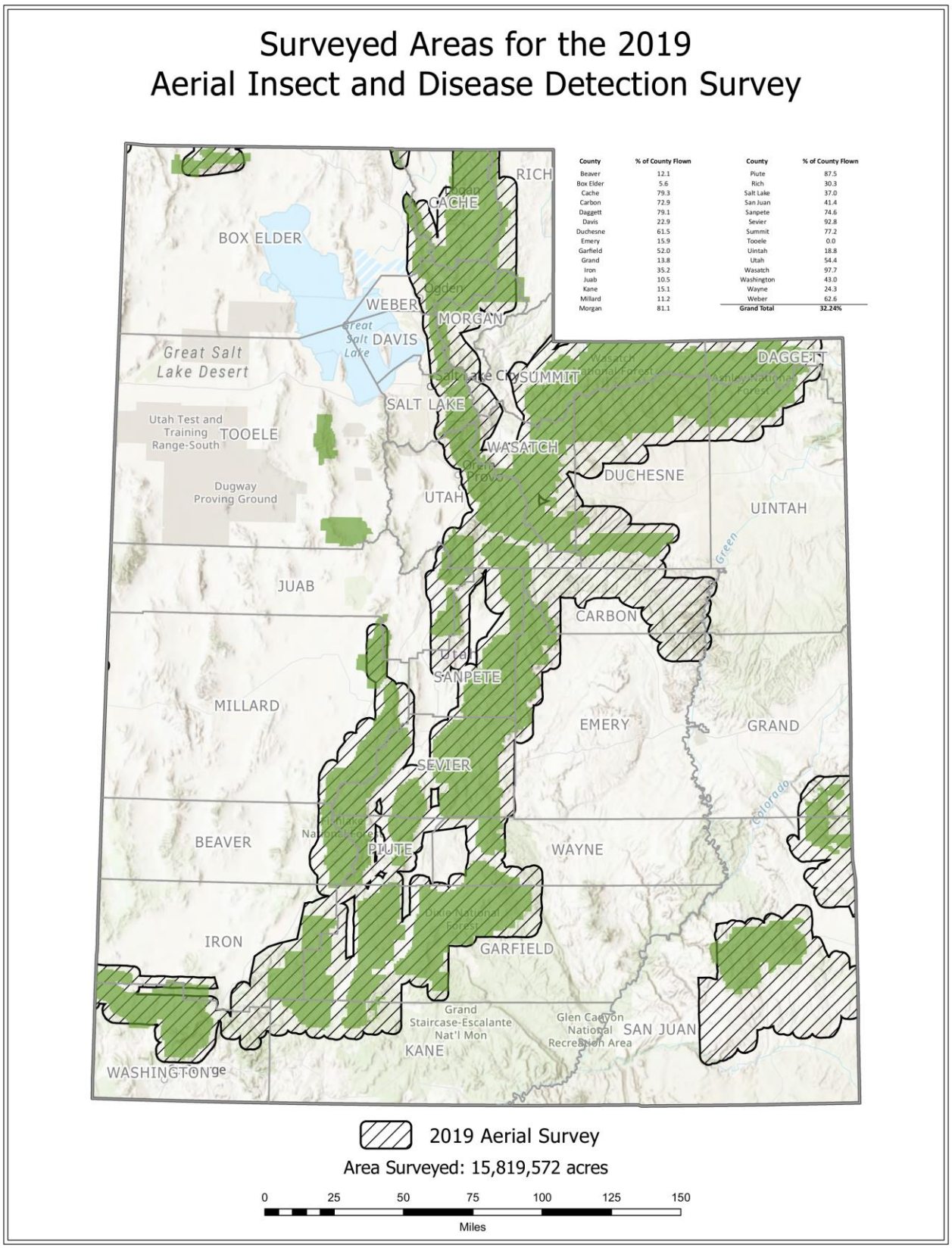
Aspen leaf spot (*Marssonina spp.*) was mapped in 2019, with a total of 11,887 acres affected, up from157 affected acres in 2018. This disease is more pronounced in years when spring weather is cool and wet during initial leaf formation, which was the case in 2019.

To view the survey maps go to: https://www.fs.usda.gov/detailfull/r4/forest-grasslandhealth/?cid=fseprd571329&width=full

Table 2. Total acres aerially surveyed in 2019, by county.

Aerial Detection Survey 2019		
County	Acres flown	% of County
Beaver	205,072	12.1
Box Elder	243,371	5.6
Cache	607,732	79.3
Carbon	718,487	72.9
Daggett	357,802	79.1
Davis	93,560	22.9
Duchesne	1,278,846	61.5
Emery	448,938	15.9
Garfield	1,736,706	52.0
Grand	324,221	13.8
Iron	741,707	35.2
Juab	233,087	10.5
Kane	393,325	15.1
Millard	484,112	11.2
Morgan	317,238	81.1
Piute	431,446	87.5
Rich	199,038	30.3
Salt Lake	187,866	37.0
San Juan	2,099,071	41.4
Sanpete	749,032	74.6
Sevier	1,143,456	92.8
Summit	928,390	77.2
Tooele	-	0.0
Uintah	544,975	18.8
Utah	755,375	54.4
Wasatch	761,572	97.7
Washington	660,154	43.0
Wayne	385,899	24.3
Weber	263,841	62.6
Total	17,294,321	32.2

Figure 1. Surveyed Areas flown for ADS in 2019



County	% of County Flown
Beaver	12.1
Box Elder	5.6
Cache	79.3
Carbon	72.9
Daggett	79.1
Davis	22.9
Duchesne	61.5
Emery	15.9
Garfield	52.0
Grand	13.8
Iron	35.2
Juab	10.5
Kane	15.1
Millard	11.2
Morgan	81.1

County	% of County Flown
Piute	87.5
Rich	30.3
Salt Lake	37.0
San Juan	41.4
Sanpete	74.6
Sevier	92.8
Summit	77.2
Tooele	0.0
Uintah	18.8
Utah	54.4
Wasatch	97.7
Washington	43.0
Wayne	24.3
Weber	62.6
Grand Total	**32.24%**

Table 3. Acres affected by bark beetles in Utah counties as detected by ADS in 2019.

2019	Mountain Pine Beetle[1]	Western Pine Beetle	Douglas-fir Beetle	Spruce Beetle	Piñon Engraver	Fir Engraver Beetle	Subalpine Fir Mortality
COUNTY	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Beaver					9	400	0
Box Elder			17				192
Cache	2		70				227
Carbon	5	1	24		14	77	1,896
Daggett	0	47	100	2,508	2		55
Davis						2	
Duchesne	174	0	131	14,896	2	1	1,157
Emery	18		6		1	2	287
Garfield		7	5	0	41	1	17
Grand		4	13		58	115	181
Iron	0	1	4		94	49	8
Juab			104			953	6
Kane		1	5			10	0
Millard		1	46		4	1,670	47
Morgan	13		23	0		2	12
Piute	0	7	1		291	198	81
Rich	0		1				609
Salt Lake				2		500	43
San Juan		70	445		9,379	334	1,094
Sanpete	5		315		89	1,211	1,700
Sevier	1	3	67		172	983	1,815
Summit	3,629		120	18,408		3	2,264
Tooele							
Uintah	3	0	8	820	13		53
Utah	4		133			256	65
Wasatch	2		131			9	2,953
Washington		7	1		42	17	0
Wayne					1		
Weber	-	-	5	-	-	6	294
Total	3,855	148	1,773	36,634	10,210	6,797	15,056

[1]Mountain pine beetle has killed several species of trees in Utah: lodgepole, ponderosa, and limber pine.

Table 4. Acres impacted by defoliators & other agents by County as detected by ADS in 2019.

2019	Western Spruce Budworm	Marssonina blight, Aspen	Balsam Woolly Adelgid
County	**Acres**	**Acres**	**Acres**
Beaver	4,129		
Box Elder			678
Cache	4,618	2,626	2,885
Carbon	1,779	1,793	
Daggett	288		
Davis			1,318
Duchesne	99	455	
Emery	786	21	
Garfield	38,732		
Grand	808		
Iron	1,852		
Juab		28	
Kane	152		
Millard	55		
Morgan		13	5,339
Piute	7,003		
Rich	2,333	50	1,372
Salt Lake			5,222
San Juan	2,661		
Sanpete	4,667	7	
Sevier	14,591		
Summit		163	8,677
Tooele			
Uintah	6,594	17	
Utah	2,742	5,032	3,145
Wasatch	2,896	1,614	4,417
Washington			
Wayne	7,228		
Weber	-	68	2,902
Total	104,011	11,887	35,955

INSECT STATUS NATIVE INSECTS

Defoliators

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

Douglas-fir Tussock Moth
Orgyia pseudotsugata McDunnough

Hosts: all true firs, Douglas-fir, blue spruce and Engelmann 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/or tree mortality if damage occurs in multiple years at the same location. Outbreaks are cyclical due to natural controls such as parasitic wasps, a virus, and weather conditions. The hairs on caterpillars can cause allergic reactions in some individuals.

No DFTM defoliation was detected by ADS in Utah in 2019.

Western Spruce Budworm
Choristoneura freemani Freeman

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

Western spruce budworm (WSBW) is the most widely distributed and destructive defoliator of coniferous forests in western North America. Trees may be extensively defoliated during outbreaks, resulting in growth/productivity reduction or stress that can directly kill the tree or make it susceptible to diseases and secondary insect pests, such as bark beetles. WSBW is particularly damaging to understory host trees.

Over the last few years, defoliation of subalpine fir, white fir, Douglas-fir, and Engelmann spruce has increased significantly in the high plateaus statewide, with most counties having some damage. Western spruce budworm defoliation increased in 2019 to 104,011 acres affected, up from 83,372 acres in 2018. Most defoliation occurred in Beaver, Cache, Garfield, Piute, Rich, San Juan, Sanpete, Sevier, Uinta, Utah, Wasatch, and Wayne counties. Damage in Garfield and Sevier counties made up more than 50% of the acres affected statewide. Most damage in Cache and Rich counties runs between the county lines from the Idaho state line south to just before Temple Fork.

In Beaver and Piute counties, most defoliation starts north of the South Fork, North Creek and runs across the lines between the two counties south to the Iron County line. Then is scattered throughout the Tusher Mountains with moderate to heavy defoliation starting east of Jim Reed Creek in Beaver County and across into Piute County east to Gold Gulch area.

In Sevier, Wayne, and Garfield counties, there is moderate to heavy defoliation over Zedds Mountain, with large areas of moderate to heavy defoliation west and south of Fishlake Hightop Plateau and surrounding Fish Lake, then south over Mytoge Mountan Range. There are large areas of moderate to heavy defoliation going north and east of Tidwell Slopes and southeast of Foy Bench, into Wayne County; then south to and surrounding Hens Hole Peak, with a heavy defoliated patch west of Flat Top. There are also, heavy to moderate large areas around Boulder Mountain and then going southwest past the Garfield County line, through Dark Valley, Hey Lakes, Big Swell, Coyote Hollow, and Mud Lake Flat, then spreading south to and throughout the Escalante Mountains, then northeast from Wide Hollow, and north back around to Boulder Mountain.

Piute County has many large patches of defoliation around Dry Canyon, Big Table, Bean Hill, Langdon Mountain, and Dyches Draw. There is also many large, light to heavy patches of defoliation throughout the Tushar Mountains. Most of which run east and west along the Piute and Beaver county line, and then running north from North Fork Cottonwood Creek south to Circleville Mountains.

Western & forest tent caterpillars

Malacosoma californicum (WTC)
M. disstria (FTC)

Hosts: Quaking aspen, Cottonwood, willow, birch, chokecherry, mountain mahogany, oak, alder, and other

In Utah, two tent caterpillar species commonly defoliate trees and understory vegetation. The WTC is more common, but less destructive than the FTC. Quaking aspen is the preferred host for WTC, but they will also feed on plants present in the understory when populations are high. The first noticeable sign indicating WTC is dense white silken tents formed in branch crotches, while FTC typically produces small silken mats, or no tents at all. The lack of tents for FTC may make it difficult to diagnose, but the two species are readily separated by the pattern on the back of the caterpillar (Figs. 2 & 3). Outbreaks, usually last two to three years in the western states. Repeated defoliation and other stress factors may reduce growth rates of infested trees, result in top kill or tree mortality, or predispose them to other diseases or insect pests. Western tent caterpillars are often confused with fall webworms, which are rather hairy and reddish–brown in color. The fall webworm makes large diffuse webs that encase entire branches, and are often found on chokecherry and other deciduous trees and shrubs.

Figure 3. Western tent caterpillar on tent. Photo: Ryan Davis, USDA Forest Service, Forest Health Protection.

Figure 4. Forest tent caterpillar. Photo: Ryan Davis, USDA Forest Service, Forest Health Protection.

No tent caterpillars were mapped using ADS in 2019, but several counties had some acres affected in 2018, with the most damage seen in San Juan County; near Woodenshoe Rd/Elk Mtn, which is north of Bears Ears. The timing of ADS survey can affect acreage delineated as FTC/WTC as trees can develop new foliage by mid-summer.

Needle Insects

Piñon Needle Scale

Matsucoccus acalyptus Herbert

Hosts: Colorado and singleleaf piñon pine

The piñon needle scale is a native sap-sucking insect that feeds on older needles of piñon pine trees. Damage results in tip kill, branch flagging, stunted tree growth, needle injury or tree death. Thin crowns cause a ghostly "see-through" appearance, with trees retaining only current year's needles. Insects in the first nymphal stage are hard to see on the needles, but insects in the second nymphal stage resemble tiny black beans or insect eggs. 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 after light to moderate defoliation. No pinyon scale was mapped by ADS in 2018. However, in 2019 damage was noted in two counties - 294 acres in Carbon County and 74 acres in Iron County.

Black Pineleaf Scale

Nuculaspis californica Coleman

Hosts: *Pinus spp.* especially Scotch/Scots and Austrian pines

Figure 5. Black pineleaf scale on Austrian pine (Photo: C. Keyes; UT, DNR, FFSL).

The black pineleaf scale attacks several pine species and on rare occasions Douglas-fir and white fir. The insect generally overwinters as a partially developed scale. Eggs and immature nymphs (crawlers) appear in June or July, depending upon temperature (earlier for southerly locations). Cell death due to scale insect infestations may cause yellow spotting, yellowing/browning or wilting of needles, stunting of the needles, needle mortality, and defoliation. Defoliation often leaves the tree with just the new growth at the tips of the branches. Infested needles sometimes look dull and light green to yellow-gray in color. Heavy infestations over several years may lead to death of all, or portions of the tree. Black pineleaf scale outbreaks have been associated with stressful growing conditions of the host tree, including drought, soil compaction, root injury, and other factors that affect plant

health. Additional stress associated with scale infestation may result in other insects and/or diseases attacking the tree.

Since 2008, black pineleaf scale populations have increased throughout urban and rural areas, mostly in Utah, Salt Lake, Davis, and Weber counties. It appears to have peaked in 2010/2011., As of 2019 many trees in urban and rural areas are still infested throughout the state

Native Bark Beetles

Fir Engraver Beetle

Scolytus ventralis LeConte

Hosts: true firs

Fir engraver beetle (FEB) is a major pest of true firs throughout the West. It attacks trees of any size. In Utah, it prefers white fir, but can attack subalpine fir. 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, western spruce budworm, balsam woolly adelgid, woodborers, and annosus root disease.

Mortality due to FEB decreased significantly, from 21,011 acres affected in 2018, to 6,797 acres affected in 2019. Most counties had some affected acres. Sevier, Millard, Sanpete, and Juab counties had the largest number of acres affected.

Juab County has scattered, small-to-medium-sized patches of light-to-moderate damage around the Red Cliffs area and west of Rees Valley.

Sanpete County has scattered patches of light to moderate damage around Quaking asp hollow, Balsam Grove Ridge, Burnt Hill, and a large patch of very light damage east of Bald Mountain.

Sevier and Millard counties; Sevier County had a few larger areas near Steves Mountain with light damage and small to large patches scattered across Bull Valley Mountain and a large patch of very light damage on Chokecherry Hill. Millard County has many small to moderate patches lightly affected west of Scipio Lake/Round Valley area and small to medium sized pockets scattered southward across the Pavani Range, then south to Sunset Canyon.

Mountain Pine Beetle

Dendroctonus ponderosae Hopkins

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 (low population) levels, MPB favors weakened, less vigorous trees, and older larger diameter trees. During epidemics (high population levels), beetles may also attack small diameter trees ($\geq$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.

MPB-continues to kill lodgepole and limber/five needle pines in Utah. Affected acres have increased in 2019 (3,855 acres), up from 1735 acres in 2018.

Current MPB activity is occurring primarily in Summit and Duchesne counties and near the Utah-Idaho state line where large-to-small patches of light to moderate damage were recorded. There is one large patch west of North Slope Rd. There are several small to large patches of light to moderate damage west and northwest of China Lake to just east of Mckenzie Creek,

Douglas-fir Beetle

Dendroctonus pseudotsugae Hopkins

Host: Douglas-fir

Douglas-fir beetle (DFB) typically kills single and small groups of trees, but during outbreak conditions, pockets of 100 or more trees are fairly common. At endemic (low) levels, DFB favors stressed and damaged trees such as those broken or wind thrown, wounded or fire–injured, and trees with root disease or defoliation. DFB populations can build rapidly in newly-fallen green trees and spread to adjacent healthy standing trees.

In 2019, DFB-induced tree mortality decreased to 1,773 acres affected statewide, down from 12,104 acres in 2018. Most counties had some acres affected.

Spruce Beetle

Dendroctonus rufipennis Kirby

Hosts: Engelmann spruce and rarely blue spruce

The spruce beetle (SB) is the most significant natural mortality agent of mature spruce. Endemic populations usually exist in weakened or wind thrown trees, logging slash, and fresh stumps. Outbreaks typically occur when beetle populations build to high levels in concentrations of green wind thrown or downed trees. Dispersing adults may infest standing live trees, initially preferring larger diameter trees and sometimes utilizing smaller diameter hosts during outbreaks. Much of the mature spruce in Utah has been killed over the last 20+ years by spruce beetle. Spruce beetle-caused mortality continues to impact mature spruce stands.

In 2019, SB-caused tree mortality decreased to 36,634 acres affected, compared to 92,832 acres affected in 2018. Most damage was noted in Dagget, Duchesne, Summit, and Uinta counties. Damage was observed in large- to-small pockets scattered throughout the four counties.
In Uinta County, a moderate-sized patch with light damage was noted near Marsh Peak and a couple of moderate sized patches with very light damage was found near Lakeshore Basin. Two large patches of moderate damage was mapped southwest of Lonesome Park.

In Daggett County small-to-large pockets of damage was noted along the Uinta/Daggett county line, running west of Lonesome Park to just east of Deep Creek. Then several patches of damage

was noted Northwest of Potter Lake surrounding Dagget Lake and near the Summit/Dagget county line east of Spirit lake, with a fairly large patch of moderate damage just north of Sheep Creek Resevoir.

In Summit and Duchesne counties there are small to large patches of light to severly damaged areas starting near the Dagget County line and running west along and across the Summit/Duchesne county lines, from just below the Idaho/Utah State lines, southwest to nearly Brown Duck Basin in Duchesne County. In Summit County, the patches run west to Bull Park and southwest of China Medows.

Piñon Engraver Beetle

Ips confusus LeConte

Hosts: Colorado and singleleaf piñon

Injured or stressed trees are preferred by piñon engraver beetles. Piñon engravers produce multiple generations each year and consequently populations can build rapidly in slash and stressed green trees. Beetles can then 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 ecologically valuable forest type.

Pinyon engraver-induced mortality increased from 199 acres affected statewide in 2018, to 10,210 acres in 2019. Most of the damage was seen in the northeast corner of San Juan County where 9,379 acres were affected. The rest of the 831 acres affected are scattered across many counties statewide.

Western Pine Beetle

Dendroctonus brevicomis LeConte

Host: ponderosa pine

Western pine beetle (WPB) can kill ponderosa pine that are six inches in diameter at breast height or larger. This beetle usually targets weakened trees with reduced defenses, such as trees growing in crowded, dense, overstocked stands, slow-growing, older 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.

In 2019, a total of 148 acres were affected which is a slight decrease from 2018 where 177 acres were affected statewide. Eleven counties had some noted damage with Daggett and San Juan accounting for 47 and 70 acres affected, respectively.

In San Juan County there are scattered small patches of severe to very severe damage just south of Jackson Ridge and around Duckett Ridge.

Roundheaded Pine Beetle

Dendroctonus adjunctus Blandford

Host: 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 usually trees greater than 20 inches diameter at breast height.

No mortality attributed to roundheaded pine beetle was observed by ADS in 2019 or 2018. However, it is possible that this beetle, and/or a complex of other beetles, contributed to the ponderosa pine mortality accredited to the Western Pine beetle.

Pitch Mass Borer

Dioryctria spp.

Hosts: piñon pine, ponderosa pine, lodgepole pine, Austrian pine, Scots pine, and occasionally Douglas-fir and true firs

Pitch moths attacks appear as large, oozing masses of soft, light-pink sap that forms in response to larval feeding beneath the bark. Repeated attacks can seriously weaken trees and kill branches. Heavily damaged branches and trunks are often more susceptible to breakage. The most severe damage is usually to trees less than 20 feet tall.

Pitch moths may be attracted to trees that are under stress due to drought, over-irrigation, soil compaction, root injury, improper pruning cuts, mechanical damage, or other injuries. Infested trees may also be more susceptible to attack by pine engraver beetle. This borer has been seen in many counties in 2019, mostly in pinyon pine

Figure 6. Pitch mass borer (Photo Eric R. Day, Bugwood.org).

INSECTS: NON-NATIVE/INVASIVE

Invasive species are non-native insects which may become established, spreading rapidly, causing significant economic and ecological impacts to forest and urban trees.

European Gypsy Moth (GM)

Lymantria dispar

Hosts: various deciduous tree species

Since the late 1800's, gypsy moth caterpillars have defoliated millions of acres in the northeastern United States. 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 at 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 United States Forest Service, place detection traps throughout the state using the GMWest model BioSIM to determine areas of highest risk of introduction and establishment. This model integrates climate and elevation data to predict the probability of GM establishment. 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 and no GM have been caught in traps between 2008 and 2015.

The 2016 Utah Gypsy Moth Program placed 1,823 detection traps in areas of highest risk of introduction and establishment. These trapping efforts resulted in the detection of one gypsy moth in Davis County. In 2017, the program placed a delimiting grid of traps around the detection site to determine if other moths were present in the area and if so, to what extent. No additional moths were captured in 2017. No moths have been detected since 2016. In 2019, 2,120 traps were placed with zero moths detected.

Emerald ash borer (EAB)

Agrilus planipennis

EAB is native to Asia, and was introduced through wood packing material used to ship cargo from Asia to Michigan in 2002. EAB continues to spread rapidly to states and provinces in and around the Great Lakes region in Canada and the USA. EAB quickly killed many millions of ash trees (*Fraxinus spp.*) in these areas, and can now be easily spread from infested areas by transporting infested trees and logs (especially firewood). In its native ecosystem, this insect exists in balance with competitors, natural predators, and pathogens. It does not cause economic damage in

Figure 7. Emerald ash borer adult. bugwood.org

this setting. However, in North America, without these balancing factors, EAB has caused rapid tree mortality affecting all *Fraxinus* species (ash) it attacks. Symptoms of infestation begin with crown dieback, which is followed by epicormic shoots, splitting bark, increased woodpecker damage, serpentine galleries, and D-shaped exit holes. These symptoms progress until the tree is dead. In addition to Utah's many ornamental ash trees in urban landscapes, there are two native ash species that are part of the forest ecosystem (singleleaf and velvet ash). All of these species would be vulnerable to EAB attack, causing economic and aesthetic losses in urban areas and ecological impacts in natural settings.

In 2016, APHIS PPQ placed 69 baited traps throughout 10 counties, targeting high-risk ash trees. UDAF Plant Industry and Conservation also placed traps in trees that members of the public reported had symptoms associated with EAB infestation. No EAB were detected from either federal or state efforts. Traps were placed again in 2017 and no EAB were detected. In 2018, 40 EAB traps were placed in areas with ash trees throughout the state, no EAB were detected. In 2019, 51 traps were placed in the 10 counties, and no EAB were detected. Traps will again be placed in 2020. For more information contact the Utah Department of Agriculture and Food. *https://ag.utah.gov/wp-content/uploads/2020/03/2019-Insect-Report-V1.1-1.pdf*

Balsam Woolly Adelgid, (BWA)

Adelges piceae (Ratzeburg)

BWA is a tiny sucking insect that was introduced to North America from Europe and is a damaging insect of true fir. In Utah, subalpine fir (*Abies lasiocarpa*) is a highly susceptible host tree; white fir (*A. concolor*) is also a host, but is more tolerant. Although we attribute BWA as the insect that is the mortality agent, this may not be the case, as generally BWA is a constant stress factor that makes the infested tree more vulnerable to other insects. Therefore, actual mortality may be a complex of several insects and diseases.

Figure 8. Balsam woolly adelgid gouting; photo USU

Figure 9. BWA white woolly masses on tree

In September 2017 BWA was confirmed in Utah. It has now been confirmed in Box Elder, Cache, Rich, Weber, Wasatch, Davis, Morgan, Salt Lake, Utah, and Summit counties. In 2018, BWA was mapped with aerial detection surveys showing 13,021 total acres affected. In 2019, ADS mapped 35,955 total acres affected. The large increase in acres affected may partially be attributed to ground survey confirmation and the increased ability of the Aerial Detection Specialists in recognizing the signature of this insect.

It appears that BWA is located in the northern counties wherever there is subalpine fir. It is extensive throughout these counties. BWA has been confirmed in multiple areas west of the Mirror Lake Highway, and from Strawberry Reservoir north to the UT/ID border. Because this insect is wind dispersed, infestations, and infestation severity, are patchy. The most severe damage occurs along the Morgan/Davis County line with small to large patches of moderate to very severe damage. Small to large patches of very severe damage continues along the Morgan/Salt Lake County line. Then small to large patches from light to moderate along the Morgan/ Salt Lake/Summit/Wasatch/Utah County lines the damage continues south then is not mapped south of Aspen Grove in Utah County

DISEASE STATUS

Stem and Branch Diseases
(typically not detectable by ADS)

Figure 10. Southwestern dwarf mistletoe (Photo: Maria Newcomb; FHP, OFO).

Dwarf Mistletoes
Arceuthobium spp.

Hosts: Douglas-fir, pines, and true firs

Dwarf mistletoes (DM) are the single most damaging parasitic agent of coniferous trees. These parasitic flowering plants are the most widely distributed forest pathogen in the state and across the western forests. Dwarf mistletoe infection causes re-allocation of growth in host trees resulting in obvious distortions including profusely branched, dense masses of host branches called "witches brooms". Heavy dwarf mistletoe infection: reduces growth, predispose trees to insects and other diseases, can kill trees, affects the forest canopy structure, lowers resistance to drought, influences wildlife habitat, recreation and aesthetics. Since dwarf mistletoe infects trees of all ages, infection may exist in secondary growth and regeneration, as well as young and old forests.

In Utah, dwarf mistletoe is so extensive throughout the state that it is not practical to describe heavily infected areas in this publication. Different species of dwarf mistletoe are host specific and are often seen on Douglas fir, lodgepole pine, ponderosa pine, and pinyon pine. It is rarely seen on white fir or subalpine fir.

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 can kill small trees and cause branch dieback and dead tops in host trees of all age classes. These rust infections are commonly associated with attacks by the pitch mass borer and tend to be more abundant in areas where the alternate host (primarily *Ribes spp*, currants and gooseberries) are located.

Figure 11. Piñon blister rust branch canker (Photo: Maria Newcomb; FHP, OFO).

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 the lifespan of the trees on that site and even across generations in some situations. Susceptibility of the trees and virulence of the pathogens involved varies among root diseases and regions. In Utah, root diseases tend to be 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 weaken trees and are intimately associated with bark beetles. Endemic bark beetle populations are often associated with and maintained in root disease centers and scattered trees impacted by root diseases.

Several tree conditions are symptomatic of all root diseases. The symptoms can vary if trees are killed rapidly or with size of the tree. The foliage of small trees that have been killed rapidly often turn 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 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 disease pathogens is rare in Utah, occurring most often in relatively moist years. Several of these diseases can also act as saprophytes, which induce decaying of dead material.

Annosum Root Disease

Heterobasidion occidentale and H. irregulare

Most common hosts: Douglas-fir, pines, spruce, and subalpine fir

This disease can be found throughout the state and on a wide range of tree hosts, but is most commonly as *H. occidentale* acting 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 with a dark brown upper surface and cream colored pore surface (Figure 11). Advanced decay in the root tissues looks white, stringy, and somewhat laminate.

Figure 12. Annosum conk at the base of a tree (Photo: John Guyon; FHP, OFO)

Armillaria Root Disease

Armillaria spp.

Hosts: Douglas-fir, Engelmann spruce, subalpine fir, white fir, and pines

Figure 13. Armillaria fans on the Ashley National Forest (Photo: John Guyon; FHP, OFO).

Evidence of Armillaria root disease can be found throughout the state and on a wide range of tree hosts. It often functions as a weak parasite killing trees experiencing environmental stress. It may act as a primary pathogen killing trees of all size class in several host species. In recent years this disease seems to be increasing in prevalence in central and south central Utah. 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 (Figure 12). The fungus produces rhizomorphs, black string-like structures that can move through the soil a few feet to infect other roots. When present, Armillaria fruiting bodies grow in clusters from the roots or at the base of the tree. The decay caused by the fungus is yellowish and stringy/spongy and often contains black lines called zone lines.

Black Stain Root Disease

Leptographium wageneri

Hosts: Colorado and singleleaf piñon pine

Black stain root disease is an important disease of several hosts, but it is only found on piñon pine in Utah. It often 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 piñon engraver beetles (*Ips confusus*). There are very likely pockets of black stain root disease amongst the acres affected by pinyon *Ips* beetle, which was mentioned earlier in this report.

Leaf and Needle Diseases

Aspen Leaf Spot

Marssonina populi and M. brunnae

Host: aspen

Aspen leaf spot is the most common leaf disease of aspen in the West. Severe outbreaks may cause foliar browning (leaf tissue necrosis) in midsummer and nearly complete defoliation by early August. Re-growth of new leaves usually follows in late summer and early autumn. Symptoms include small necrotic spots on infected leaves in mid- to late-summer. The spots later enlarge and often coalesce. They will vary in size and appear irregular in shape with a yellowish border (Figure 13). Blight and leaf spot caused by this disease have been seen in the past throughout the host type, and in years when the disease is severe is detectable by ADS. While direct mortality from this disease is rare, trees weakened by consecutive years of defoliation are more susceptible to other damage agents and stresses.

Figure 14: Aspen leaf spot. Photo John Guyon; FHP.OFO.

In 2018, only157 acres were affected statewide. However in 2019, spring weather conditions were very favorable for aspen leaf spot. ADS mapped 11,887 acres affected by this disease. These numbers may be lower than the actual acres, as sometimes it is difficult to discern foliar damage from the air. Most of the damage was mapped in Cache, Carbon, Utah, and Wasatch counties.

DECLINES / COMPLEXES

Subalpine Fir Mortality Complex

Host: subalpine fir

The western balsam bark beetle (WBBB) is thought to be one of the most significant mortality agents in a complex of forest insects and diseases causing subalpine fir mortality. Endemic populations can 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. Root diseases, woodborers, Balsam Wooly Adelgid, and several species of smaller bark beetles are likely involved in this complex. Environmental stress, due to drought or overcrowding, may also have a role in widespread subalpine fir mortality.

In 2018, the name of this complex changed from SAF Mortality Complex to "Root Disease & Beetle Complex (SAF mortality)". Using this name change, the ADS mapped 38,878 total acres affected statewide. In 2019, the name was changed again to "subalpine fir decline", and the ADS mapped 15,056 acres affected. In 2019, areas affected by subalpine fir decline were reported in nearly every county.

Aspen Dieback

Host: aspen

Aspen dieback mapped by aerial detection survey in 2018 encompassed 1,224 acres affected. In 2019 ADS did not map any acres affected. The recorded acres affected by aspen dieback peaked in 2007 at 126,057 acres affected across the state. Aspen dieback has been attributed to a number of factors including: drought, grazing, poplar borer (*Saperda calcarata*), bronze poplar borer (*Agrilus liragus*), Cytospora canker (*Valsa sordida*) and sooty bark canker (*Encoelia pruinosa*). The borers and Cytospora canker disease agents are commonly considered secondary pests. Sooty bark canker is usually considered a disease of older stands.

In recent years, aspen bark beetles (*Trypophloeus populi* and *Procryphalus mucronatus*) have been associated with damage. Aspen bark beetles are now common in many Utah stands with dieback and decline symptoms. Field observations indicate that *Trypophloeus spp.* attack trees that still have a large component of "green bark", while *Procryphalus spp.* is found in trees in which the bark is almost entirely dead. Aspen mortality caused by bark beetles, borers, and canker diseases increased as a result of significant drought periods during the last decade. In most of the Intermountain Region, aspen stands tend to have at least some suckering and do not show the symptoms of sudden aspen decline reported in other Regions such as Colorado.

ABIOTIC DAMAGE

Frost Damage

Hosts: Hardwoods like maple, gambel oak, and aspen are impacted during years with late frosts. All conifers can be affected, but Douglas-fir and spruce are more susceptible.

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

There were no reported acres affected in 2019.

Blowdown

Areas of concentrated, high velocity winds can cause trees to blow-over, often referred to as blowdown. Blowdown occurs in groups or as scattered trees within forested landscapes. 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. Epidemic beetle populations may then attack and kill standing live trees, most often adjacent to the blowdown.

In 2019, there was no blowdown mapped in Utah.

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.

There were 121 acres affected by avalanches noted in Utah in 2019. There was 45 acres affected in San Juan County and 76 acres in Utah County.

Drought

Drought can influence insect and disease activity as well as directly impact forest health. Trees stressed by drought are less able to resist insect or disease, which may allow beetle and borer populations to build to outbreak levels. Drought- related damage was not mapped in 2017 or 2018. The pinyon and Juniper forest type in the southeast corner of Utah and throughout the Four Corners area experienced extreme drought conditions during late 2017 through 2018. The result of this continuing drought in southern Utah was mapped through ADS in 2019 as 34,028 total acres affected. There were 77 acres affected in Grand County and 33,951 acres affected in San Juan County.

Flood

There were 77 total acres affected in 2018. There was no flood damage reported in 2019.

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. Early in 2016 the Utah Department of Agriculture and Food updated the noxious weed list, increasing the list from 27 to 54 weeds. Additionally noxious weeds have been newly classified into the following five categories:

1A= Not known to exist in Utah. Significant risk of invasion.
1B= Limited distribution in Utah. EDRR (Former A Class)
2= Widely distributed in Utah, considered controllable (Former B Class)
3= Widely distributed in Utah, considered beyond control, control expansion (Former C Class)
4= Present in Utah. Prevent distribution through Seed law

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

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

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 educational resources, and research information, as well as information on how to identify and manage pests.

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, additional information on common weeds, and links to more information.

https://www.cdfa.ca.gov/plant/ipc/encycloweedia/encycloweedia_hp.html
California Department of Food and Agriculture has a very comprehensive website on weeds. The site has information including botanical description, biology, distribution, habitat, and management of weed. 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 website has information on numerous weeds. Topics include identification, why it's a noxious weed, geographic distribution, reproduction, and control options such as mechanical, herbicide, cultural, and biocontrol.
http://www.invasiveplantatlas.org

The Invasive Plant Atlas of the United States 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. The atlas assists users with identification, early detection, prevention, and management of invasive plants.

EDDMapS 2016- Early Detection and Distribution Mapping System. University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at: **http://www.eddmaps.org/**.

Nondiscrimination Notice

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, sex, religion, age, disability, sexual orientation, marital status, family status, status as a parent (in education and training programs and activities), because all or part of an individual's income is derived from any public assistance program, or retaliation. (Not all prohibited bases apply to all programs or activities.)

If you require this information in alternative format (Braille, large print, audiotape, etc.), contact the USDA's TARGET Center at (202) 720-2600 (Voice or TDD).

If you require information about this program, activity, or facility in a language other than English, contact the agency office responsible for the program or activity, or any USDA office.

To file a complaint alleging discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call toll free, (866) 632-9992 (Voice). TDD users can contact USDA through local relay or the Federal relay at (800) 877-8339 (TDD) or (800) 845-6136 (in Spanish). USDA is an equal opportunity provider, employer, and lender.

You may use USDA Program Discrimination Complaint Forms AD-3027 or AD-3027s (Spanish) which can be found at: http://www.ascr.usda.gov/complaint_filing_cust.html and http://www.ascr.usda.gov/es_us/sp_complaint_filing_cust.html or upon request from a local USDA office.

Declaración de política de no discriminación de USDA

El Departamento de Agricultura de los Estados Unidos (USDA por sus siglas en ingles), prohíbe la discriminación en sus programas y actividades ya sea por raza, color, nacionalidad, sexo, religión, edad, incapacidad, orientación sexual, estado civil, estado familiar, su estado como padre o madre (en programas de educación y adiestramiento), ya sea que todo o parte de los ingresos provengan de cualquier programa de asistencia pública de las personas, o por represalias. (No todas las prohibiciones se aplican a todos los programas o actividades).

Si usted necesita la información de este anuncio en un formato diferente (Braille, letras grandes, o por medio de sonido, etc.), llame al Centro TARGET del Departamento de Agricultura al teléfono 202-720-2600 (voz y TDD).

Si usted necesita información sobre este programa, actividad o instalaciones en un idioma diferente del inglés, llame a la agencia del Departamento que maneja este programa o actividad, o a cualquier oficina del Departamento de Agricultura.

Para someter una queja de discriminación, escriba al USDA, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, o llame gratis at 1-866-632-9992 (voz). Para llamadas TDD, llame al USDA al número 1-800-877-8339 (TDD) o (800) 845-6136 (en Español). Usted puede usar la forma de discriminación AD-3027 o AD-3027 en Español, la cual se puede encontrar en: http://www.ascr.usda.gov/es_us/sp_complaint_filing_cust.html o puede obtener en cualquier oficina local del Servicio Forestal. El Departamento de Agricultura ofrece oportunidades de programas y de empleo libres de discriminación.