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Utah
Forest Insect and Disease Conditions Report 2022

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

North Slope Uinta Mountains: photo by Colleen Keyes (FFSL)

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Utah Forest Insect and Disease Conditions Report 2022

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FOREST HEALTH CONDITIONS SUMMARY

Introduction

A healthy forest maintains the function, diversity, and ecological resiliency of all its components, and provides for all essential ecosystem processes such as fish and wildlife habitat, riparian areas, soils, rangelands, economic potential, and 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, provide the data used to describe forest pest status and trends in the state from year to year, when appropriate. Mortality trends are described in terms of "Area Mapped" (acres) and "Damage Area" (acres). Mapped acres is the raw number of acres where a particular damage agent was recorded. Damage acres is the mapped acres adjusted for the level of tree mortality within a mapped area. Damage acres is a more accurate statistic of the total acres of dead trees due to damage agents.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd696759.pdf

The area of ADS coverage varies by year depending on need, resources, and flight restrictions. In Utah, due to COVID-19 protocols and travel limitations, ADS data was not captured in 2020 and only partially in 2021. In 2022 a full flight was competed. Due to the discrepancy in ADS coverage in 2020, 2021, and 2022, trends in insect, disease, and abiotic issues can not be calculated.

The number of acres surveyed in each County in 2022 is provided in Table 2. Figure 1 shows areas that were surveyed in 2022. Nearly 12 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 include lack of active management, poor grazing patterns, fire exclusion, and invasive weeds. Adequate precipitation and growing space are necessary to maintain tree vigor, thereby increasing tree resistance to insects and diseases. Increasing hot and dry conditions throughout the State continue to place additional stress on forests that are already in poor health.

Refer to Tables 2 & 3 for county-level ADS information on mapped acres by bark beetles, and defoliators and other agents in 2022. Mapped acres and damage area may be on federal, private, State parks, or State Institutional Trust Lands.

Summary

Mountain pine beetle (MPB)-caused mortality: approximately 2,479 acres mapped. Summit and Dagget counties had majority of the MPB-caused mortality in lodgepole and limber pine.

Douglas-fir beetle (DFB)-caused Douglas-fir mortality: 3,258 acres mapped.

Spruce beetle-caused Engelmann spruce mortality: 8,893 acres mapped, mainly in Duchesne, Dagget, Summit, and Uinta counties.

Fir engraver-caused mortality (primarily in white fir): 30,121 acres mapped. Nearly every county had some acreage mapped.

Subalpine fir decline (formerly mapped as subalpine fir tree mortality complex) is believed to be due to multiple potentially interacting factors, including pathogens, bark beetles, and environmental stresses especially drought. The primary insects contributing to subalpine fir mortality are western balsam bark beetle, and western spruce budworm. Balsam woolly adelgid is also causing extensive damage in subalpine fir trees and is reported separately. Diseases caused by fungal pathogens that affect subalpine fir include Heterobasidion root disease, Armillaria root disease, and Cytospora canker. Subalpine fir decline had over 26,889 acres mapped. Nearly every county had some acreage mapped.

Balsam woolly adelgid (BWA) is a tiny non-native sucking insect and was first confirmed in Utah in September 2017. As of 2019, BWA was confirmed in Box Elder, Cache, Rich, Weber, Davis, Morgan, Salt Lake, Summit, Utah, and Wasatch counties. In 2022, mapped acres by BWA added an additional 28,750 subalpine fir mapped acres to those mapped by subalpine fir decline. Some of the BWA acreage may be misclassified within the ADS dataset. Areas of possible misclassification will be ground verified in 2023.

Western spruce budworm (WSB) defoliation:19,452 acres mapped.

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

Table 1. Total acres aerially surveyed in 2022, by county.

Aerial Detection Survey 2022					
County	Acres flown	% of County	County	Acres Flown	% of County
Beaver	150,163	9.1%	Piute	322,946	65.9%
Box Elder	105,866	2.5%	Rich	162,724	23.4%
Cache	531,311	70.8%	Salt Lake	169,680	32.8%
Carbon	121,210	12.8%	San Juan	844,246	16.6%
Daggett	82,758	17.9%	Sanpete	707,829	68.8%
Davis	60,435	14.9%	Sevier	1,037,794	84.5%
Duchesne	151,604	7.3%	Summit	752,317	62.5%
Emery	295,189	10.3%	Tooele	NA	0.0%
Garfield	1,471,043	44.1%	Uintah	48,007	1.7%
Grand	142,969	6.1%	Utah	711,088	51.8%
Iron	701,475	33.2%	Wasatch	643,111	83.3%
Juab	196,856	9.0%	Washington	839,497	54.0%
Kane	505,358	19.2%	Wayne	278,209	17.6%
Millard	407,993	9.3%	Weber	247,174	58.6%
Morgan	263,511	67.4%	-	-	-
Total Acreage =11,952,364 / 22%					

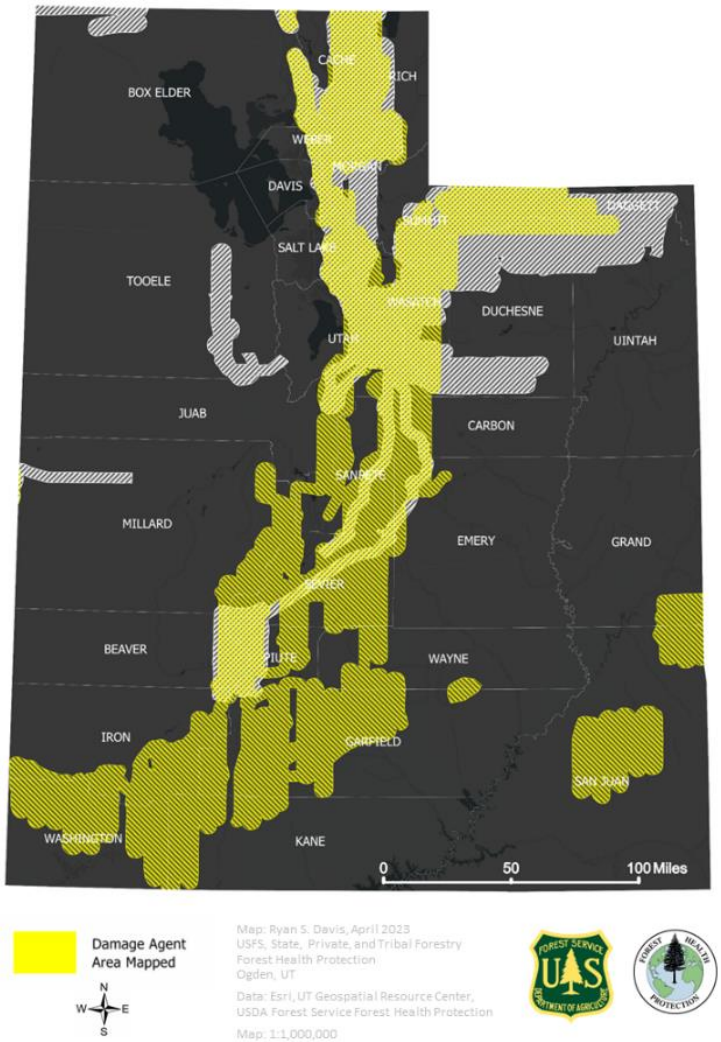

Figure 1. Aerial detection survey coverage for 2021 and 2022. Gray hashed fill shows coverage for 2021. Yellow hashed fill shows coverage for 2022.

Table 2. Bark beetle and subalpine fir decline mapped acres and damage area for Utah counties, 2022.

	Mountain Pine Beetle[1]		Western Pine Beetle		Douglas-fir Beetle		Spruce Beetle		Piñon Engraver		Fir Engraver Beetle		Subalpine Fir Decline	
County	**Acres Mapped**	**Damage Acres**	**Acres Mapped**	**Damage Acres**	**Acres Mapped**	**Damage Acres**	**Acres Mapped**	**Damage Acres**	**Acres Mapped**	**Damage Acres**	**Acres Mapped**	**Damage Acres**	**Acres Mapped**	**Damage Acres**
Beaver	-	-	511	61	-	-	-	-	63	12	384	39	86	7
Box Elder	-	-	-	-	0.3	0.02	-	-	1	0.01	0.3	0.02	-	-
Cache	0.3	0.02	-	-	33	11	-	-	-	-	0.3	0.02	1,288	104
Carbon	-	-	-	-	4	1	-	-	1	0.08	86	13	2,772	290
Daggett	522	40	-	-	-	-	1,588	176	-	-	-	-	101	8
Davis	0.3	0.02	-	-	24	4	-	-	-	-	119	9	-	-
Duchesne	1	0.3	-	-	0.3	0.02	2,054	170	-	-	-	-	198	15
Emery	2	0.1	0.3	0.02	7	1	-	-	49	4	682	101	1,304	105
Garfield	1	0.08	178	18	9	1	0.3	0.02	4,314	1,465	627	116	556	102
Grand	-	-	4	0.3	12	5	-	-	95	7	-	-	1,577	637
Iron	-	-	8	1	0.3	0.02	8	1	753	345	2,798	1,354	47	8
Juab	-	-	-	-	378	105	-	-	-	-	1,456	191	230	20
Kane	-	-	7	1	38	3	-	-	7	1	1,189	316	4	1
Millard	-	-	-	-	11	3	-	-	372	161	4,632	720	162	12
Morgan	-	-	-	-	39	3	-	-	-	-	29	2	3	0.2
Piute	0.3	0.02	1	0	20	2	0.3	0.02	728	61	938	154	1,074	142
Rich	-	-	-	-	0.3	0.02	-	-	-	-	-	-	1,289	110
Salt Lake	0.3	0.02	-	-	-	-	-	-	-	-	1,786	196	19	1
San Juan	-	-	31	2	338	86	0.5	0.04	6,024	1,230	62	5	2,695	419
Sanpete	4	0.3	-	-	1,388	267	-	-	279	37	6,284	940	8,204	682
Sevier	0.3	0.02	1	0.06	86	7	-	-	3,511	553	3,917	1,512	3,506	524
Summit	1,944	151	-	-	99	19	1,629	125	-	-	136	16	759	88
Tooele	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uintah	0.2	0.02	-	-	-	-	3,613	319	-	-	-	-	-	-
Utah	1	0.08	-	-	654	174	-	-	1	0.04	3,286	443	316	40
Wasatch	1	0.1	-	-	111	28	-	-	-	-	240	46	534	91
Washington	-	-	51	13	0.3	0.02	-	-	-	-	1,343	335	1	0.04
Wayne	1	0.08	1	0.06	1	0.06	0.3	0.02	746	164	2	0.15	124	39
Weber	-	-	-	-	6	1	-	-	-	-	126	10	51	4
Total	**2,479**	**192**	**282**	**96**	**3,260**	**721**	**8,893**	**791**	**16,944**	**4,040**	**30,123**	**6,518**	**26,900**	**3,449**

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

Table 3. Mapped acres and damage acres by western spruce budworm, marssonina leaf blight, and balsam woolly adelgid by Utah county; 2022 aerial detection survey data.

2022	Western Spruce Budworm		Marssonina Leaf Blight		Balsam Woolly Adelgid	
County	Acres Mapped	Damage Acres	Acres Mapped	Damage Acres	Acres Mapped	Damage Acres
Beaver	853	819	-	-	-	-
Box Elder	-	-	-	-	508	47
Cache	2,816	1,884	-	-	3,828	471
Carbon	163	163	-	-	-	-
Daggett	-	-	-	-	-	-
Davis	73	73	-	-	256	20
Duchesne	-	-	-	-	-	-
Emery	992	442	-	-	-	-
Garfield	637	468	-	-	-	-
Grand	625	476	-	-	-	-
Iron	-	-	-	-	-	-
Juab	-	-	-	-	-	-
Kane	-	-	-	-	-	-
Millard	-	-	-	-	-	-
Morgan	-	-	17	17	1,427	113
Piute	81	81	31	31	-	-
Rich	1,153	1,153	-	-	554	72
Salt Lake	33	33	-	-	1,515	126
San Juan	2,526	2,219	90	90	-	-
Sanpete	9,147	5,645	-	-	-	-
Sevier	353	329	93	93	-	-
Summit	-	-	192	192	3,470	439
Tooele	-	-	-	-	-	-
Uintah	-	-	-	-	-	-
Utah	-	-	-	-	2,460	224
Wasatch	-	-	34	34	12,642	1,590
Washington	-	-	-	-	-	-
Wayne	-	-	-	-	-	-
Weber	-	-	-	-	2,091	170
Total	**19,452**	**13,785**	**457**	**457**	**28,750**	**3,272**

Defoliators

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, though recorded outbreaks in Utah are limited. 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.

Table 4. Douglas-fir tussock moth trap catch from 1991 to 2022 on the Logan and Ogden Ranger Districts, Uinta-Wasatch-Cache National Forest.

DFTM Early Warning Trap Counts by Site by Year, UWC NF							
	Logan		Ogden				
Year	Beaver Creek (7,400 ft.)	Stump Hollow (7,045 ft.)	Cox Spring (7,445 ft.)	Red Spur (8,731 ft.)	Running Water Spring (8,481 ft.)	Arb's Basin (8,422 ft.)	Total
1991	0	0	8	-	-	-	**8**
1992	-	0	0	-	-	-	**0**
1993	-	0	0	-	-	-	**0**
1994	-	0	0	-	-	-	**0**
1995	-	0	0	-	-	-	**0**
1996	-	1	0	-	-	-	**1**
1997	-	0	0	-	-	-	**0**
1998	-	0	0	-	-	-	**0**
1999	-	-	0	-	-	-	**0**
2000	-	-	0	-	-	-	**0**
2001	-	-	0	-	-	-	**0**
2002	-	-	-	-	-	-	**0**
2003	-	-	-	-	-	-	**0**
2004	-	-	-	-	-	-	**0**
2005	-	-	-	-	-	-	**0**
2006	0	-	0	0	0	-	**0**
2007	0	4	0	0	3	0	**7**
2008	0	0	1	0	0	0	**1**
2009	0	0	0	0	0	0	**0**
2010	0	0	0	0	0	0	**0**
2011	0	0	0	0	0	0	**0**
2012	0	1	0	0	0	0	**1**
2013	0	1	0	0	0	0	**1**
2014	0	0	0	0	0	0	**0**
2015	0	0	0	0	0	0	**0**
2016	-	-	-	-	-	-	**0**
2017	-	-	-	-	-	-	**0**
2018	0	0	0	0	0	0	**0**
2019	0	0	0	0	0	0	**0**
2020	0	0	0	0	0	0	**0**
2021	5	7	0	0	0	0	**12**
2022	152	154	42	36	29	32	**445**

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

No DFTM defoliation was detected by ADS in Utah in 2022; however, Early Warning System DFTM trapping transects yielded significant increases in adult male DFTM moths caught in 2022 – 445 total moths compared to 12 in 2021 and zero in 2020 (Table 4). The last DFTM outbreak in northern Utah occurred in the early 1990's and understory/regeneration class subalpine fir were the primary host tree affected in the outbreak area.

Forest health specialists will conduct larval and egg mass surveys in 2023, in addition to adding more trapping locations to help delineate the extent of the population.

Western Spruce Budworm
Choristoneura freemani Freeman

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

Western spruce budworm (WSB) 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. WSB is particularly damaging to understory host trees.

Figure 3. Western spruce budworm larva (William M. Ciesla, Forest Health Management International, Bugwood.org).

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. Defoliation was noted in many counties, but especially in Beaver, Cache, Garfield, Grand, Rich, San Juan, Emery and Sanpete counties. Sanpete County has 9,147 acres mapped, by far the largest area of WSB damage in the State in 2022. There are very large and medium-sized pockets of very severe to severe damage around Powerhouse Ridge and east and south to just before Big Horseshoe. Several small-to-very-large pockets of very severe damage from just south of Toms Hole and running slightly east and south down to Trail Ridge. Then severe to very severe damage in very large to medium-sized pockets just north of Harmonica Point and south to Heliotrope Point.

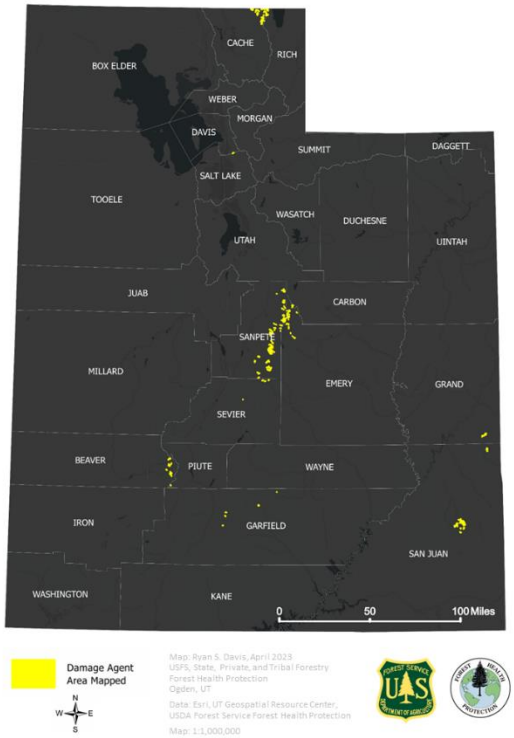

Figure 4. Western spruce budworm area mapped, 2022.

Cache and Rich counties ADS shows medium to very large pockets that range from lightly to very severely damaged areas. These mapped areas run from the Idaho state line west in Cache County to Crescent Lake Canyon and east to the edge of the forest west of Bear Lake, and then running south between the two county lines to just before West Hodges Creek

San Juan County has very large to medium sized pockets of very light to very severe damage scattered across the Abajo Mountains, around Horsehead Peak.

Western & Forest Tent Caterpillars
Malacosoma californicum (WTC)
M. disstria (FTC).

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

Figure 6. Western tent caterpillar on tent (Ryan Davis, USDA Forest Service, Forest Health Protection).

Figure 6. Forest tent caterpillar (Ryan Davis, USDA Forest Service, Forest Health Protection).

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. 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.

The timing of ADS survey can affect acreage delineated as FTC/WTC as trees can develop new foliage by mid-summer. Because of this timing issue FTC/WTC defoliation was not noted by the 2022 survey. However, approximately 3,000 acres of bigtooth maple (*Acer grandidentatum*) and aspen were defoliated at the base of the Wellsville Mountains (Cache County) and south through Wellsville Canyon to Mantua. The outbreak started in 2020 and is starting to subside in the epicenter with more recently infested areas following suit.

Scale 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 infested trees. Damage results in tip killing, branch flagging, stunted tree growth, and needle injury. Crowns appear thin, retaining only current year's 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 2022, ADS noted a very large pocket (163 acres) that is very severely affected by piñon needle scale in Iron County, south of Showalter Mountain and north of Middle Canyon.

Bark Beetles

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 (≥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. Current MPB activity is occurring primarily in Summit and Dagget counties near the Duchesne and Uinta county lines where small to very large pockets of f very-light to light damage was recorded. It is likely that the damage is reported as very light to light this year, as much of the mapped acreshave been recorded for the last several years, where much of the host material (lodgepole and limber pine) has already been killed, leaving smaller diameter trees, which are not favored hosts of MPB.

Figure 7. Mountain pine beetle area mapped, 2022.

Summit County has small to very large pockets of very light to light damage with a couple of medium sized pockets of very light damage near Bull Park area, then a small pocket of light damage going east to just north of Big Meadows. There is also a large pocket of very light damage just north of Deadhorse Park. Very small pockets are noted going east to several medium to large pockets of very light to light damage around Bear Park and McCoy Park area, and then east to Hidden Lake near the Summit County/Dagget County line. Dagget County has a medium and a large pocket of very light damage near the Anson Lake area, and a couple medium sized pockets of very light damage just south and east of East Fork Deep 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 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 2022, ADS noted that most counties had some DFB induced mortality.

Sanpete, Utah, Juab, and San Juan counties had the highest number of acres mapped.

Sanpete County had the most mapped acres with several small to medium sized pockets of very light to light damage in the Ferron Mountain area around the Dairy Creek, and a medium sized pocket of moderate damage near Flagstaff Peak and a medium sized pocket of very light damage west of the Flagstaff Peak area. A few small pockets of moderate damage was also noted north of Manti Ridge to South San Pitch Canyon area. Larger pockets of very light damage were noted around Knob Mountain and Spring Canyon Road. Also small to medium sized pockets of light to severe damage were seen near Hell Hole Ridge and scattered south to Lake Hill Campground area.

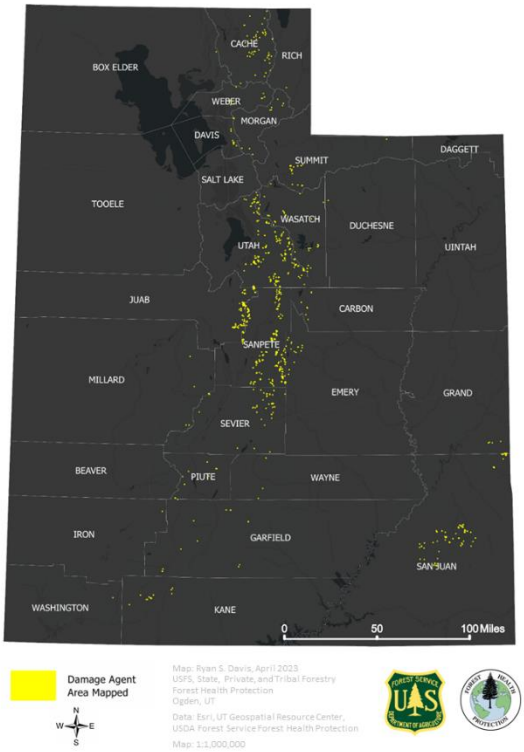

Figure 8. Douglas-fir beetle area mapped, 2022.

Utah County had the second most damage of all counties, where several small to medium sized pockets of light to severe DFB induced mortality was noted from Coffeepot Ridge running south to southeast of Browns Ridge. Small, scattered pockets of moderate to severe damage around the Loafers Ridge area. Mud Hollow and Drunkerd Hollow. Small to medium sized pockets of light to moderate damage was noted just north of Fourth Water Ridge and running just north of Fifth Water Ridge.

Juab County had small to medium sized pockets of moderate damage near Tayrn Hollow.

San Juan County had several small to medium pockets of moderate damage just north of Texas Canyon area. Small to medium sized pockets of moderate damage were noted near Mormon Pasture Canyon. Several small pockets of very light to moderate damage are scattered around Shay Mountain.

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 30+ years by spruce beetle. Spruce beetle-caused mortality continues to impact mature spruce stands.

In 2022, ADS shows that Duchesne, Dagget, Summit, and Uinta counties all have significant damage from spruce beetle induced mortality. Small to very large sized pockets of very light to moderate damage were noted scattered around the intersection of the four county lines, and then spreading out into all four counties. In Summit County, spruce beetle is spreading northwest to Dead Horse Park and in Duchesne County southwest to Painter Basin. In Dagget County spruce beetle is spreding northeast to Deep Creek. In Uinta County spruce beetle is spreading southeast to the Mill Park area.

Figure 9. Spruce beetle area mapped, 2022.

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. Several counties had WPB mapped acres in 2022. The largest damage was seen in Beaver and Garfield counties.

Beaver County had 511 acers mapped, there are medium to very large sized pockets of very light to moderate WPB induced damage around Patterson Hollow and Birch Lake. Several medium to large sized pockets of light damage northeast of Horse Flat. There is a small and very large pocket of very light damage around North Fork Baker Canyon, and a very large pocket of moderate damage east of Rattlesnake Peak. Garfield County had 177 acers mapped. There is a medium sized pocket of very light damage northeast of Water Hollow, and a small pocket of moderate damage near Park Ridge

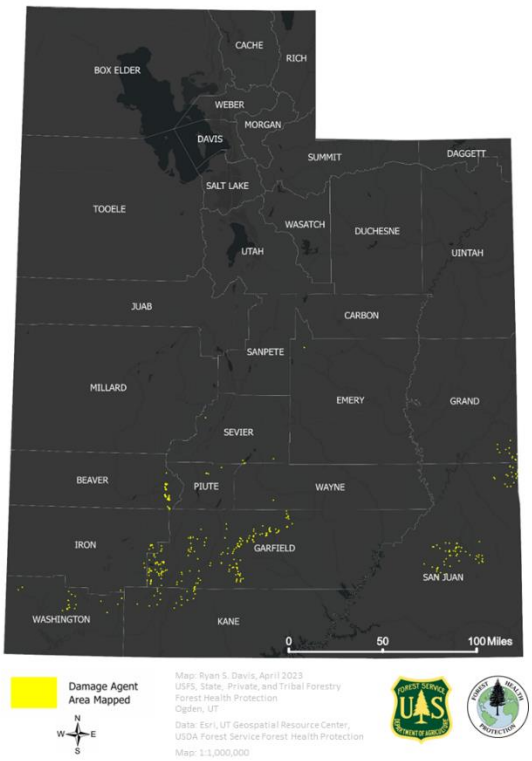

Figure 10. Western pine beetle area mapped, 2022.

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 2022. 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.

Fir Engraver Beetle
Scolytus ventralis LeConte

Hosts: true firs; primarily white fir in Utah

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 Heterobasidion root disease (*Heterobasidion annosum*).

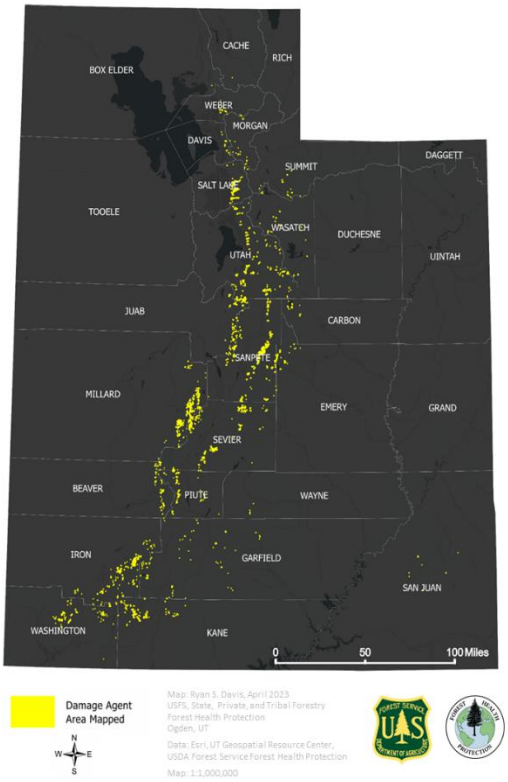

Figure 11. Fir engraver area mapped, 2022.

Most counties had some mapped acres by FEB.
Sanpete, Sevier, Millard, Iron, and Utah counties had the largest number of acres mapped.

Utah County has around 3,286 acers mapped, with scattered small to very large pockets of moderate damage North of Big East Lake to Wimmer Ranch Creek and southwest through the Amos Backbone area, and southeast to just before Rock Hill Hollow area. Sanpete County has approximately 6,284 acres mapped, with patches of light to moderate damage, most of which were noted scattered around Powerhouse Ridge and running south to Maple Creek and Lake Hill Campground area.

Severe County has about 3,917 mapped acres showing several medium to very large patches of very light to severe damage running east and south of Dead Horse Ridge down to the Bull Valley Mountain area.

Millard County noted approximately 4,632 mapped acres with scattered small to very large patches of very light to severe damage running from Wild Goose Canyon south to Leavitts Canyon area.

Iron County has about 2,798 mapped acres, noting very large pockets of moderate damage just south of Hells Canyon, and small to large pockets of light to severe damage scattered around Sugarloaf Mountain and Cabbage Valley.

Pinyon Engraver Beetle
Ips confusus LeConte

Hosts: Colorado and singleleaf pinyon.

Injured or stressed trees are preferred by pinyon engraver beetles. Pinyon 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, pinyon engravers carry a wood staining fungus into the tree, which in combination with the feeding larva, kills the tree.

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

Many counties had some acres mapped, however, Garfield, Sevier, and San Juan counties by far have the largest numbers of mapped acers in 2022. However, Piute, Wayne, and Iron counties also had some significant number of acres mapped.

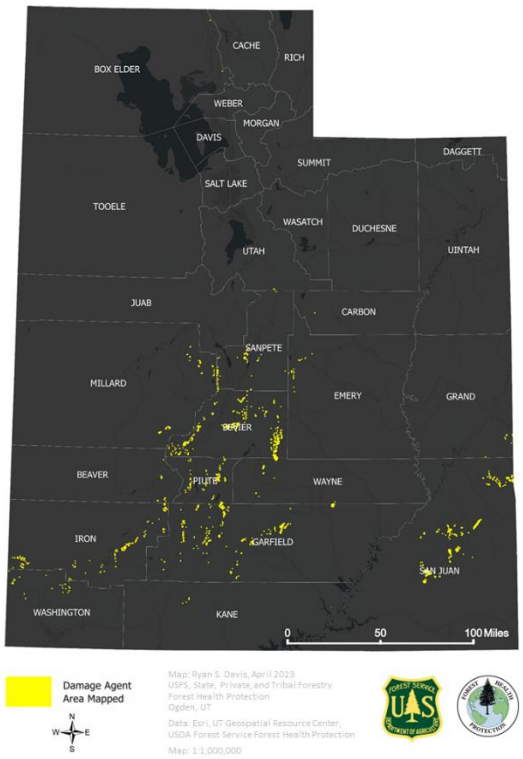

Figure 12. Pinyon engraver beetle area mapped, 2022.

Garfield County had 4,314 mapped acers. There were several small to large sized pockets, of very light to severe damage noted around Haycock Mountain, Marshall Canyon, Burnt Hollow, northwest of Johns Valley, surrounding Russell Hollow, northwest of Poison Creek Bench, Buck Hollow, and Black Hills. Very large pockets of light to moderate damage were noted near Cottonwood Canyon/Slickrock Canyon area. An isolated very large pocket of moderate damage was noted west of Big Lakes Peak near Deer Heaven.

Sevier County had 3,511 acres mapped. There were scattered small pockets and a few large to very large pockets of very light to moderate damage from Deer Creek Canyon running southwest to around Skinner Canyon and Sam Stowe Creek. Several small to medium sized pockets of very light to light were noted south of Gooseberry Valley and running south and southeast to around Cedar Mountain, Black Mountain and the Rocks area. A few small to medium sized pockets of very light damage was noted near Mud Spring Hollow. A large pocket of severe damage was noted near Spring Canyon. Many small to very large pockets of very light to moderate damage were noted going north and west, from Limestone Cliffs and running south to and across the Sevier/Wayne County line.

San Juan County had 6,024 acres mapped. Showing many small to very large pockets of very light to moderate damage surrounding Carpenter Basin, Pole Canyon, and running south and east of Pine Ridge to the Utah/Colorado state line. A couple very large pockets of light damage was noted west of Upper Rattlesnake Ranch No 1 Resv'r. There is a very large pocket of light

damage near Peters Point Ridge. The rest of the mapped acers appears to be from many small to very large pockets of very light to severe damage, surrounding Salt Creak Mesa and running slightly southeast and mostly southwest to Grand Gulch Plateau.

Woodboring Moths

Figure 13. Pine pitch moth larva (Whitney Cranshaw, Colorado State University, Bugwood.org).

Pitch Mass Borer (*Dioryctria* spp.) [Lepidoptera: Pyralidae]
Pine Pitch Moth (*D. ponderosae* Dyar)
Sequoia Pitch Moth (*Synanthedon sequoiae*) [Lepidoptera: Sesiidae]

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

Pitch moth 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.

Figure 14. Sequoia pitch moth resin masses (Christine Buhl, Oregon Department of Forestry, Bugwood.org).

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. These borers have been seen in many counties in 2022, mostly in pinyon pine. Sequoia pitch moth is also common in Austrian and Scots pine in urban areas.

Woodboring Beetles

Flatheaded Fir Borer (*Phaenops drummondi* prev. *Melanophila*) [Coleoptera: Buprestidae]

Hosts: Douglas-fir, true firs; occasionally spruce and western hemlock and larch (not in UT)

Flatheaded fir borer typically attacks trees that are under stress from mechanical injury, mistletoe infection, fire damage, drought stress or recently felled trees. Under recent climate conditions flatheaded fir borer has been found infesting and killing drought stressed Douglas-fir growing at lower elevations and on dry, rocky sites with shallow soils, typically within transitional areas between juniper and Douglas-fir types.

It is difficult to distinguish Douglas-fir mortality caused by Douglas-fir beetle and flatheaded fir borer via ADS, but workers should be aware that there could be an increase in flatheaded fir borer-caused mortality if hot dry conditions persist.

Figure 15. Flatheaded fir borer larvae and galleries (Dave Powell, USDA Forest Service, Forest Health Protection).

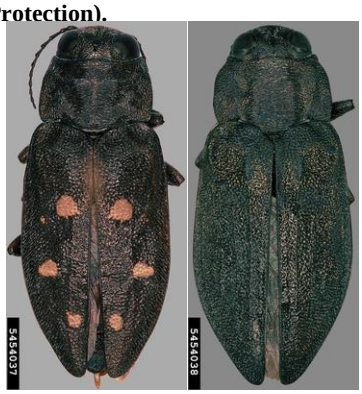

Figure 16. Flatheaded fir borer adults - color variation (Steven Valley, Oregon Department of Agriculture and Food, Bugwood.org).

NON-NATIVE/INVASIVE INSECTS: STATUS

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

Moth Defoliators

Spongy Moth (SM)
Lymantria dispar
Formerly known as Gypsy Moth

Hosts: various deciduous tree species

Since the late 1800's, spongy moth caterpillars have defoliated millions of acres in the northeastern United States. The spongy 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 spongy 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 SM 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 SM have been caught in traps between 2008 and 2015.

The 2016 Utah SM Program placed 1,823 detection traps in areas of highest risk of introduction and establishment. These trapping efforts resulted in the detection of one SM 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.

Woodboring Beetles

Emerald Ash Borer (EAB)

Agrilus planipennis

Figure 17. Emerald ash borer adult (Bugwood.org).

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 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. Since 2016 no EAB were detected from either federal or state efforts. In 2022, the UDAF Insect Program placed a total of 77 EAB traps throughout Cache, Carbon, Davis, Duchesne, Salt Lake, Tooele, Uintah, Utah, and Weber counties. Utah DNR placed an additional 29 traps across Emery, Grand, Iron, Juab, Millard, San Juan, Sevier, Washington, and Wayne counties. Trap site placement was prioritized for high-risk areas such as: places that were likely to have out-of-state firewood introduced, vicinities where trees have been reported as potentially infested by arborists or homeowners, and neighborhoods identified as having numerous ash trees in decline. In 2023 the UDAF Insect Program will continue leading task force efforts such as regulatory measures, trapping and monitoring visual symptoms. For more information contact the Utah Department of Agriculture and Food.

https://ag.utah.gov/wp-content/uploads/2023/02/2022-Insect-Report-Web.pdf

Sap Feeders

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.

In September 2017 BWA was confirmed in Utah. It has now been detected via ADS and ground verified in Box Elder, Cache, Davis, Morgan, Rich, Salt Lake, Summit, Utah, Wasatch, and Weber, counties 28,750 acres mapped. It appears that BWA is located in the northern counties, wherever there is subalpine fir. Because BWA is wind-dispersed; insect infestation, and infestation severity, are patchy.

Figure 18. Gouting (twig swelling) caused by balsam woolly adelgid feeding (Ryan Davis, USDA Forest Service, Forest Health Protection).

Figure 20. White woollike wax covering balsam woolly adelgids ("woollies") (Ryan Davis, USDA Forest Service, Forest Health Protection).

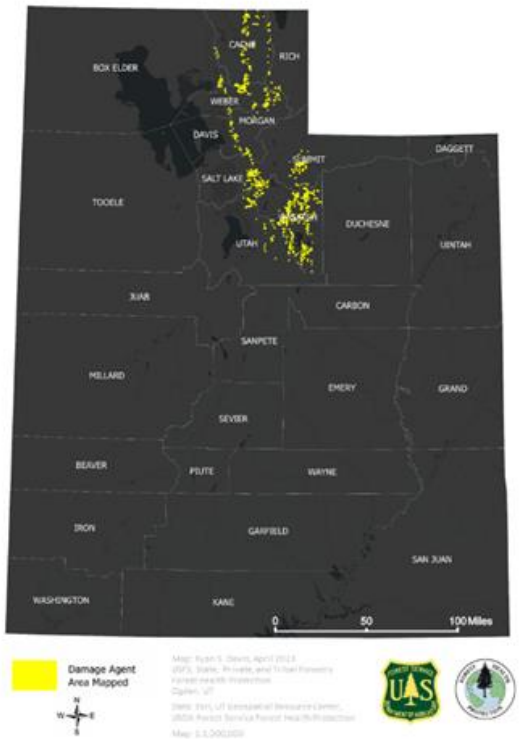

Figure 19. Balsam woolly adelgid area mapped, 2022.

Oystershell Scale
Lepidosaphes ulmi

Figure 21. Oystershell scale on aspen (Justin Williams, USDA Forest Service, Forest Health Protection).

Hosts: *Populus* spp., *Salix* spp., *Fraxinus* spp., *Acer* spp.; over 100 hosts recorded. Primary hosts of concern in forested settings are trembling aspen and willows.

Oystershell scale (OSS) is a non-native hard scale insect that was introduced to north America over 300 years ago and is widely distributed throughout the United States, particularly in urban areas. In Arizona, OSS was recently found killing all size classes of aspen trees in the forest, including valuable regeneration and recruitment-sized aspen. OSS is one of many biotic factors, along with abiotic factors such as drought and heat stress, herbivory, management, etc., responsible for aspen health decline throughout the Intermountain West. In 2021, OSS was confirmed in an aspen stand on the Uinta-Wasatch-Cache National Forest in a drainage within Provo Canyon (Pole Canyon), Utah. Ground verification indicates that about 50 acres of aspen, of all size classes, are heavily infested with OSS, leading to tree mortality in some cases. Outward from the epicenter, OSS is found in decreasing severity over a 500-acre area. FHP staff will continue to monitor OSS in Pole Canyon and work with Uinta-Wasatch-Cache National Forest UWC staff to develop management strategies. Regional-scale surveys for OSS have been initiated in 2022 to help determine the distribution and severity of OSS in natural aspen stands. These ground surveys in (Utah County), estimate an approximately 1,000-acre area is infested with oystershell scale. Aspen mortality has been observed on approximately 50 acres. Infestation of urban aspen in (Summit County), extending over approximately 2 acres. Oystershell scale was also reported on aspen in Garfield and Kane Counties, and Beus Canyon, (Weber County). The extent of infestation is estimated to be less than 10 acres in each location with variable densities of oystershell scale and limited mortality.

Stem and Branch Diseases

(typically not detectable by ADS)

Figure 22. Southwestern dwarf mistletoe (Maria Newcomb, USDA Forest Service, Forest Health Protection).

Dwarf Mistletoes

Arceuthobium spp.

Hosts: Douglas-fir, pines, and true firs

Dwarf mistletoes (DM) are the single most damaging parasitic disease 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 cause topkill or tree mortality, affects forest canopy structure, lowers resistance to drought, and 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.

Pinyon Blister Rust

Cronartium occidentale

Hosts: Colorado and singleleaf pinyon

Figure 23. Pinyon blister rust on branch.

This native rust causes stem rust cankers and branch flagging on both Colorado piñon and singleleaf pinyon 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 (*Ribes* spp., commonly called currants and gooseberries) are located.

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 many situations. Susceptibility of the tree hosts 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 pockets 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 can rapidly 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. In general, the production of conspicuous fruiting bodies (conks) 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.

Heterobasidion Root Disease

Heterobasidion occidentale and H. irregulare

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

Figure 24. Annosum (Heterobasidion) conk at the base of a tree (John Guyon, USDA Forest Service, Forest Health Protection).

This disease can be found throughout the state and on a wide range of tree hosts, but is most commonly found as *H. occidentale* on true firs, Douglas-fir, and spruce acting as butt decay or as a saprophyte on dead trees, stumps, and roots. Trees of all ages can be infected, and in some cases killed. 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 a cream-colored bottom pore surface. Advanced decay in the root tissues looks white, stringy, and somewhat laminate.

Armillaria Root Disease
Armillaria spp.

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

Figure 25. Armillaria fans on the Ashley National Forest (John Guyon, USDA Forest Service, Forest Health Protection).

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. 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 pinyon pine

Black stain root disease is an important disease of several hosts, but it is only found on pinyon pine in Utah. It often kills infected trees within a few years, and can result in groups of tree mortality several acres in size. In 2021, black stain root disease was detected during ground surveys in individual declining and dead single-leaf piñon pines and small disease pockets at locations in Box Elder County, Utah, and additionally in two-needle pinyon pine stands in the foothills of the La Sal Mountains in San Juan County, Utah. Many of the trees with signs of black stain root disease were also attacked by pinyon engraver beetle (*Ips confusus*). 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 mapped acresby pinyon engraver 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. 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.

In 2022, several counties showed some mapped acres totaling 457 statewide Summit County had the highest mapped acres (192), several small to large pockets of very severe damage was noted near the Utah Wyoming border between Chalk Creek area and the Mirror Lake Scenic byway

Figure 26. Aspen leaf spot on aspen leaf (John Guyon, USDA Forest Service, Forest Health Protection).

Figure 27. Marssonina leaf blight area mapped, 2022.

Subalpine Fir

Subalpine Fir Decline (formerly 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 2022, SAF mortality was noted in most counties flown, statewide acers mapped totaled 26,899. However, it is difficult to determine from the air the actual agent or agents affecting the Subalpine Fir.

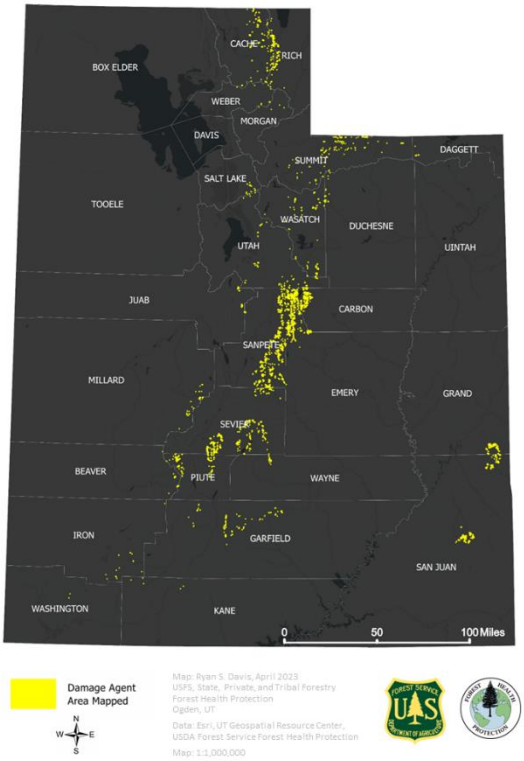

Figure 28. Subalpine fir decline area mapped, 2022.

Aspen

Aspen Dieback

Host: aspen

Aspen dieback in Utah was not noted in 2022. The recorded mapped acres of aspen dieback peaked in 2007 at 126,057 mapped acres across the state. Aspen dieback has been attributed to a number of factors including: drought, grazing, lack of disturbance, 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

Climate/Weather

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 mapped acres in 2022.

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 2022, there were no acers of wind caused damage mapped in Utah.

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 these agents to build to outbreak levels. Drought-related damage was not mapped in any counties flown in 2022, though drought is likely one of the major stress factors in Utah forests in the past several years. Since 2018, reports of juniper dieback and mortality have been reported from southeast Utah, the Uinta Basin, western and southwestern Utah and west of Tooele. This dieback and mortality, in most or all cases, is being driven by hot, drought conditions.

Physical/Mechanical

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.

Within the 2022 ADS there were no Avalanches/Mudslides noted.

Flood

In 2022, ADS noted flooding damage totaling 21.7 mapped acres statewide; in Emery County (1.0 acre) and in Summit County (20.7 acres).

NOXIOUS WEEDS

Overview

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**

Useful Links

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/**.

https://www.fs.usda.gov/detail/r4/forest-grasslandhealth/?cid=fsbdev3_016163
USDA Forest Service, State, Private, and Tribal Forestry, Forest Health Protection Aerial Detection website for Region 4 (Intermountain Region), including Utah.

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