

United States Department of Agriculture



# Montana Forest Insect and Disease Conditions and Program Highlights 2016



Forest Health Protection



Montana Department of Natural Resources and Conservation Forestry Division



Forest Service Region 1 Northern Region

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# MONTANA

## Forest Insect and Disease Conditions and Program Highlights – 2016

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## ABBREVIATIONS

<u>Category</u>	<u>Abbr.</u>	<u>Name</u>
<b>Beetles</b>	DFB	= Douglas-fir beetle
	FE	= Fir engraver
	PE	= Pine engraver
	MPB	= Mountain pine beetle
	RTB	= Red turpentine beetle
	SB	= Spruce beetle
	WBBB	= Western balsam bark beetle
	WPB	= Western pine beetle
<b>Defoliators</b>	DFTM	= Douglas-fir tussock moth
	LCB	= Larch casebearer
	PB	= Pine butterfly
	WSBW	= Western spruce budworm
	SAF Mort	= Subalpine fir mortality
<b>Exotic Insects</b>	UNKD	= Unknown defoliator
	BWA	= Balsam woolly adelgid
<b>Pathogens</b>	LNC	= Larch Needle Cast
	LPPDM	= Lodgepole pine dwarf mistletoe
	LPDM	= Limber pine dwarf mistletoe
	MB	= Marssonina blight
	DFDM	= Douglas-fir dwarf mistletoe
	WLDM	= Western larch dwarf mistletoe
	WPBR	= White pine blister rust
<b>Hosts</b>	DF	= Douglas-fir
	ES	= Engelmann spruce
	GF	= Grand fir
	HE5NP	= High elevation five needle pines
	LP	= Limber pine
	LPP	= Lodgepole pine
	PP	= Ponderosa pine
	QA	= Quaking aspen
	SAF	= Subalpine fir
	WBP	= Whitebark pine
	WL	= Western larch
	WWP	= Western white pine
	<b>Other</b>	ADS
BLM		= Bureau of Land Management
FIA		= Forest Inventory and Analysis
FHP		= Forest Health Protection
FS		= Forest Service
MT		= Montana
NF		= National Forest
NP		= National Park
IR		= Indian Reservation
RA		= Reporting Area
RD		= Ranger District
TPA		= Trees per acre

\*For a list of scientific names see Common and Scientific Names, page 57

# HIGHLIGHTS

- Root disease fungi cause damage and mortality on nearly 3 million acres of National Forest lands in western Montana every year.
- White pine blister rust continues to damage and kill all three of the five-needle pine species in the state across most of their ranges.
- Mountain pine beetle-caused mortality continues to decline from 2009 peak levels of 3.7 million acres to 11, 000 acres in 2016.
- Western spruce budworm defoliation, though extensive, significantly decreased from 1,205,015 acres in 2015 to 663,485 acres in 2016.

# SUMMARY OF CONDITIONS

## Bark Beetles

### *Mountain pine beetle*

In Montana, the total area affected by MPB decreased by 94% from the 2015 surveys to just over 10,000 acres in 2016. Of these, nearly 75% were in LPP, 15% in PP, 10% in WBP and LP and 1% in WWP. MPB-caused tree mortality declined significantly in most counties although Granite, Flathead, Lincoln, Madison, Missoula, Ravalli and Sanders counties still have several hundred acres of MPB-caused tree mortality each. Beaverhead County with just over 2,000 acres and Sanders County with just over 1,000 acres had the most MPB-caused tree mortality which occurred primarily in LPP forests. In areas where mortality occurred in 2016, some additional mortality may be expected. However, we expect MPB-caused tree mortality will continue to decline to endemic levels over the next few years.

### *Douglas-fir beetle*

Douglas-fir beetle (DFB)-caused mortality in Region 1 was detected at similar low levels in 2016 as compared to 2015 aerial surveys. DFB-caused mortality was detected on all land ownership types including federal, tribal, state and private lands with most activity occurring on federally managed National Forest lands. Tree mortality was elevated in patchy and scattered pockets throughout the Region, typically where activity was detected in 2015.

Slight increases in tree mortality caused by DFB were notable within the southeastern portion of the Flathead Indian Reservation and eastern portions of the Flathead National Forest.

Overall, much of the DF host type throughout Region 1 has experienced severe defoliation from WSBW, a chronic disturbance over the past fifteen years. This defoliation, if coupled with unusually warm and dry weather or another outbreak catalyst, could promote increased DFB activity in subsequent years.

Acres of DFB-caused mortality may be under-reported across Region 1 due to difficulties associated with assessing DFB-caused mortality in trees with prior WSBW defoliation or in areas not flown due to fire activity.

### *Spruce beetle*

Estimates of areas affected by SB-caused tree mortality remained constant, with very low levels of mortality in both 2015 and 2016. Beetle populations remained endemic throughout Montana. Damage was limited to isolated pockets scattered throughout National Forest land ownerships within the state.

Recent SB outbreaks occurred on federally managed lands within the Gravelly Mountains on the Beaverhead-Deerlodge NF and within the Rock Creek drainage on the Custer-Gallatin National Forest. Ground surveys indicated populations returned to endemic levels in 2016 as no green-infested trees were identified. SB populations are not expected to erupt again within these locations as the prevalence of susceptible, large-diameter spruce host has been substantially depleted.

## **Defoliators**

The number of acres defoliated by WSBW decreased in 2016 by approximately 20 percent but remains high at 663,000 acres in counties both east and west of the Continental Divide. Areas with significant levels of defoliation (>50,000 acres) were in Beaverhead, Flathead, Gallatin, Judith Basin, Madison, Meagher and Park counties. In 2016, defoliation intensity remained high in many areas, especially on several forests east of the Continental Divide, where WSBW has been recorded for several years. WSBW occurred in almost every county with forested lands including National Forest lands intermingled with surrounding lands of other ownerships.

Defoliation from DFTM or LCB was not detected in 2016. About 3,000 acres of defoliation from PB was recorded on the Bitterroot NF. Almost 1,000 acres were recorded as impacted by an unknown defoliator. The majority of the defoliation occurred in Madison and Ravalli counties on hardwoods, shrubs and mountain hemlock.

## **Root Diseases**

Root diseases are diseases of the site and do not change drastically from one year to the next. Based on a recent assessment using FIA plots, root disease fungi are estimated to cause damage and mortality on nearly 3 million acres of NF lands in western Montana each year. Root disease hazard, calculated from the FIA root disease data, occurs at various levels on over 6.5 million acres on all ownerships in western Montana. Root disease-caused mortality is more common west of the Continental Divide. We currently do not have an assessment of root disease distribution and impact east of the Continental Divide. In general, large areas of root disease can be found east of the Divide, but it tends to occur in more discrete patches, rather than being ubiquitous throughout an area. Also, root diseases can be commonly found in riparian areas east of the Continental Divide, often in ES and SAF. The most impacting root diseases are Armillaria root disease, laminated root rot, Heterobasidion root disease, schweinitzii root and butt rot, and to a lesser extent tomentosus root rot.

## **White Pine Blister Rust**

### *Western white pine*

Mature WWP continues to be lost due to a combination of WPBR and MPB. Lack of suitable sites, either man-made or natural, limits natural regeneration, and WPBR may kill a high proportion of natural seedlings. Rust-resistant stock is planted operationally on suitable WWP sites on federal, state, and

private forest lands throughout northwestern Montana. In addition to planting rust-resistant stock, pruning of the lower bole is an important tool used in WPBR management.

### *Whitebark pine*

WPBR has been impacting WBP ecosystems for many decades. In addition, recent outbreaks of MPB have caused widespread mortality of mature trees in many WBP stands already impacted by WPBR. The combination of WPBR, MPB outbreaks, and lack of natural regeneration due to fire suppression has impacted regeneration at many locations within the range of WBP.

### *Limber pine*

LP is found at elevations ranging from 2,700 feet near the community of Terry in far eastern Montana to around 9,000 feet in and around the Beaverhead-Deerlodge National Forest in southwestern Montana. West of the Continental Divide, LP is largely confined to limited areas adjacent to the Continental Divide, while scattered populations of LP can be found across much of eastern Montana. WPBR is found throughout much of the distribution of LP, but there are a few areas where LP remains apparently free of the disease, including locations southwest of Ennis and south of Billings.

### **Abiotic Damage**

Dieback of QA was scattered in Montana east of the Continental Divide. Much of the dieback was concentrated along the east slopes of the Rocky Mountain Front in the Blackfeet IR. Smaller concentrations of QA dieback were in the Bears Paw Mountains on the Rocky Boys IR and the Highwood, Little Snowy, and Big Snowy Mountains on the Helena-Lewis & Clark NF.

### **Foliar Diseases**

Foliar diseases were at relatively low levels in 2016. The only foliar disease recorded during the 2016 aerial surveys consisted of 2,100 acres of larch needle cast. These acres were scattered across the counties of northwestern and west central Montana.

### **Dwarf Mistletoes**

Historical assessments of dwarf mistletoe stands in Montana show that about 16% of DF, 33% of LPP, and 30% of WL stands are infected with dwarf mistletoe. More recent assessments using FIA data collected on over 50,000 trees across Montana show that only about 1% of DF, 3.2% of LPP, and 3.9% of WL trees are infected. The clumpy nature and protracted disease-cycle of dwarf mistletoes allow for impacts across an individual stand to range from low to severe. The clumpy nature of dwarf mistletoe is likely the reason for differences between these two measurements; the first is measuring infected stands and the second is measuring infected trees.

## ANNUAL AERIAL DETECTION SURVEY

Aerial detection surveys are an overview assessment designed to locate and document forest change events, as seen from the air. It is a form of observational data collection that allows trained specialists to survey large tracts of forested land in a relatively short period of time. Single engine, high-wing aircraft flying at speeds of approximately 90 to 130 mph at an average altitude of 1,500 feet above ground level are used to fly either grid or contour patterns within a Reporting Area (RA). The damage extent and intensity of the aerially detected signatures of recently killed or defoliated trees are delineated as polygons using specialized software.

Legacy data, surveys prior to 2016, were collected using application software on laptop PC's called DASM (Digital Aerial Sketch Mapping) systems. These polygons were given a code for the agent that likely caused the damage, which is inferred from the size and species of trees affected as well as the color and pattern of the damage. The agent code is followed by the total number of trees killed (# of trees or TPA) or an intensity of the damage (L for light and H for heavy). Areas burned by wildfire were not surveyed until the third year following a fire. The actual amount of mortality from tree diseases, dwarf mistletoes, and WPBR are greatly underestimated with ADS because symptoms from these agents can be difficult and, in some instances, impossible to identify from the air.

The 2016 survey season incorporated substantial change to survey methodology that more closely align to those used by the Canadian Forest Service (CFS) for aerial overview surveys. The Digital Mobile Sketch Mapping (DMSM) project from FHAAS (Forest Health Assessment and Applied Sciences Team, formerly FHTET – Forest Health Technology Enterprise Team) “standardizes several updates to aerial detection survey (ADS) methodology with an eye toward more effective integration with ground survey and remote sensing.” For details, visit:

[https://www.fs.fed.us/foresthealth/technology/detection\\_surveys.html](https://www.fs.fed.us/foresthealth/technology/detection_surveys.html).

These updates include:

- **Central database.** Survey data collected with DMSM is uploaded (synched) from the tablet to a central database. Authentication to upload and download data from this secure database requires an ArcGIS On-Line (AGOL) login.
- **Grid cells** as a 3rd option, along with points and polygons, for mapping damage features. Grids are available in resolutions of 240, 480, 960 or 1920-square meters (~14, 57, 228, or 911 acres).
- **5-class, Percent-of-tree-canopy-affected method for mapping damage intensity on areas.** DMSM requires a ‘percent-class’ call on all damage areas (cells and polygons) regardless of damage type.
- **5-class, Number of affected tree method for mapping damage intensity on points.** Points are used for mapping isolated clusters of damaged trees.
- **The DMSM database does not include separate fields for defoliation SEVERITY and PATTERN.** Instead of a separate field for within-tree severity based on the percent of foliage affected, the list of DMSM Damage Types has been expanded to differentiate 3 defoliation severity levels; < 50%, 50-75%, and > 75% average defoliation among affected trees.

- **Quick Keys:** similar to air survey “cheat sheets’, Quick Key lists pre-define for a particular state, region, or survey area the damage agent, host, and damage type combinations that surveyors expect to map from the plane.
- **Host calls are species-specific:** Unlike prior ADS guidelines that allow forest types (e.g. Western fir-spruce type) or genera (e.g. ‘Spruce’) to be recorded, DMSM requires species-specific host calls.
- **Host groups:** To accommodate cases where a damage causing agent affects multiple hosts and where it’s not possible or practical to differentiate damage for each individual host from the air, DMSM will accommodate “host groups” made up of up to 5 tree species.
- **Damage area features may overlap.** The percent-class method allows acres of damage estimation without double counting overlapping damage areas.
- **Avoid adding secondary aerial observations for the same damage feature.** Given the inherent imprecision of aerial survey, it is sufficient to label damage features with the most prevalent damage type and/or the primary causal agent.

DMSM characterizes damage intensity by the percent of live and standing dead trees within the cell or polygon that are damaged/recently dead. For small groups of damaged trees captured as point features, DMSM uses tree count classes.

Referred more simply as ‘percent-class’, DMSM requires a percent-of-tree-canopy-affected call on all damage areas (cells and polygons) regardless of damage type. Similarly, a tree count range of affected trees is required for all damage features represented as points.

The list of Damage Intensity classes for areas and points is shown below:

<b>PCT_AFFECTED*</b>	<b>Number of Trees**</b>
Very Light (1-3%)	1
Light (4-10%)	2 - 5
Moderate (11-29%)	6 - 15
Severe (30-50%)	16 - 30
Very Severe (>50%)	> 30

\* Percent Affected used for damage polygons & grid cells

\*\* Number of Trees used for damage point features

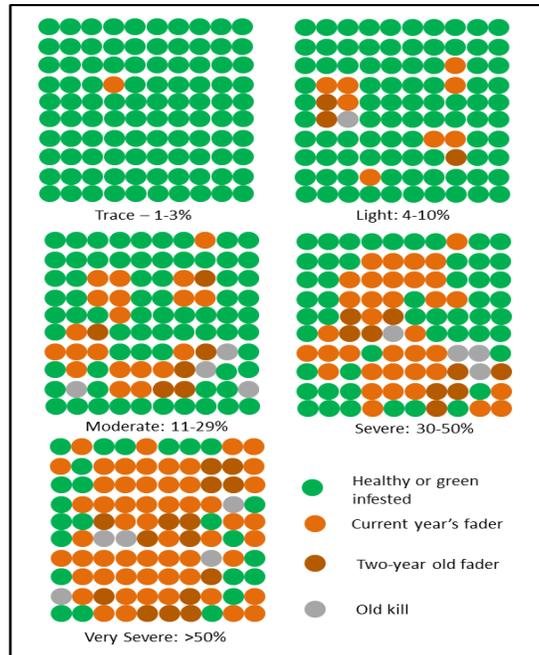
The percent-class method equates a single large crown tree with a similar canopy area comprised of tightly spaced smaller crown trees.

This percent or ratio can be expressed as:

Number (area of canopy) of damaged or recently dead trees within the damage area polygon or grid cell
Number (area of canopy) of all live and standing dead trees within the damage area polygon or grid cell

Note that the treed area (the denominator in the percent of trees call) is all trees, not just hosts, nor just live trees but standing dead as well. In the graphic below, 'Old kill' and 'Two-year old fader' represent standing dead trees considered part of the treed area denominator.

Also note that non-treed areas (water, roads, meadows, etc.) that may cover part of the damage area polygon or grid cell do not factor into the percent-class call. It is the live and standing dead trees within the polygon or grid cell, and not the area of the polygon or grid cell as a whole that represent the denominator in this equation (FHAAS, 2016).



**From: U.S. Department of Agriculture, Forest Service, Forest Health Assessment and Applied Sciences Team. 2016. Digital Mobile Sketch Mapping (DMSM) Updates to Forest Health Survey with DMSM. 10p.**

The annual ADS in Montana was conducted from July 5 to September 29, 2016. The survey encompassed approximately 35.1 million acres of mixed ownership forested lands, including Yellowstone National Park (YNP) while excluding most designated wilderness areas (Figure 2). Five FHP observers and one contract observer, using three contract aircraft, conducted the 2016 ADS and identified approximately 965,000 acres of forest damage within Montana and YNP.

For Regional summary purposes, polygon damage intensity or percent affected classes were grouped into severity classes of Low, Medium and High. This grouping occurred for two primary reasons. First, these severity classes represent known damage levels pertinent to forest managers. As an example, low severity mortality rates (<10%) are typically considered as background levels that would not conflict with management objectives whereas Moderate and High Severity rates are often undesirable. Second, as ADS data does not have levels of ground validation sufficient to support standard error attribution to surveyed estimates, collapsing to broad severity classes increases the reliability of this information.

Specifically, classes were grouped as follows. Very Light (1-3%) and Light (4-10%) percent affected became **Low Severity**; Moderate (11-29%) percent affected became **Moderate Severity**; while Severe

(30-50%) and Very Severe (>50%) percent affected became **High Severity**. Points were buffered to 2 acres and grouped into **low** and **moderate severity** classes. Point damage ranges of 1, 2-5, 6-15, and 16-30 trees became **Low Severity**; and >30 trees points became **Moderate Severity**.

The data summarized in this report are a product of the annual ADS, as well as ground surveys and biological evaluations. The digital data files, data summaries, and ADS damage maps are available from the Missoula FHP Field Office, in both paper and digital GIS format. Data may also be downloaded from our FS webpage. <https://www.fs.usda.gov/detail/r1/forest-grasslandhealth/?cid=stelprdb5366459>

## INSECT AND DISEASE CONDITIONS BY COUNTY

### County Results

For each county, damage by ownership is noted and, to the extent possible, we have indicated areas affected and estimated extent of damage. Counties that are not included had no reported information. Forestland data in the following tables are from the annualized surveys performed by USDA Forest Service, FIA (<http://www.fia.fs.fed.us>). In some of our tables acres of damage are reported for some ownership where there is no forestland reported by FIA. Because of the limited forestland within ownerships of some counties, the density of FIA plots may not have been sufficient at the county level to identify forested acres (i.e. forestland exists but was missed in the FIA sample resulting in an estimate of zero acres). This discrepancy is within their standard of error. Acres flown include areas of non-forest covered during the survey.

### Beaverhead County

#### Forestland, Mortality, and Defoliation by Ownership and Severity (2,315,465 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>1,292,695</b>	<b>1,092,289</b>	<b>117,073</b>	<b>52,253</b>	<b>31,080</b>			
BWA	4	4	-	-	-	4	-	-
Decline	17	17	-	-	-	-	17	-
DFB	215	149	44	13	9	215	-	-
Fire	139	139	-	-	-	-	-	139
MPB-High Elev.	726	710	4	4	8	663	7	56
MPB-LPP	2,248	2,161	23	49	15	2,237	11	-
SAF mortality	538	487	34	12	5	283	84	171
SB	24	22	2	-	-	24	-	-
UNKD	41	-	-	41	-	37	-	4
<b>WSBW</b>	<b>52,031</b>	<b>31,227</b>	<b>11,722</b>	<b>5,793</b>	<b>3,289</b>	<b>26,379</b>	<b>-</b>	<b>25,652</b>

Much of the same areas were flown in 2015 and 2016, covering nearly all forested mountain ranges in the county. MPB activity was down to 2,248 acres in 2016, a significant decrease from 80,000 acres in 2015. Scattered spots of MPB activity were again detected throughout the Pioneer Mountains and in the Beaverhead Range. The only larger polygons noted were at the south end of the Pioneers around Maverick Mountain and Torrey Mountain (west of Dinner Station camp ground). Based on field reports some of this mortality may be secondary bark beetles although none was reported by aerial survey.

Mortality due to SB remains low, while DFB activity increased slightly to 215 acres compared to 164 acres in 2015. However, in areas of high WSBW defoliation, the signature fading crown may be difficult to detect from the air. Mortality in SAF has increased but remains low hovering around 500 acres this year compared to 66 acres detected in 2015. WSBW activity increased significantly in the county

(12,543 acres in 2015 to 52,031 acres in 2016), especially in the northern and southern ends of the Pioneer Mountains where DF dominates.

About 17 acres with QA dieback were observed about 1 mile northeast of Dinner Station Campground. LPPDM is moderate to severe in some areas of the Pintler Face Project Area (MFO-TR-16-30). WPBR is common in WBP and LP. LPDM is present in this county.

## Big Horn County

### Forestland, Mortality and Defoliation Acres by Ownership and Severity (819,316 ac flown)

Damage Agent	Ownership					Damage Severity (acres)			
	Total	USFS	Other Fed	Private	State	Total	Low	Mod	High
<b>Forestland</b>	<b>419,489</b>	-	7,355	387,909	24,225	3756	2200	0	1557
DFB	2	-	-	2	-	6	0	-	6
Dieback	6	-	6	-	-	2	2	-	-
MB	40	-	35	5	-	40	0	-	40
MPB-High-Elev	4	-	4	-	-	6	6	-	-
MPB-LPP	2	-	2	-	-	-	-	-	-
PE	162	-	109	53	-	162	162	-	-
SAF Mort	4	-	2	2	-	4	4	-	-
<b>WSBW</b>	<b>3,526</b>	-	3,402	134	-	3536	2026	-	1510

Areas flown by ADS in Bighorn County in 2016 were similar to those flown in 2015. The most notable mortality agent was PE which caused low levels of PP mortality in areas widely scattered throughout the county. Substantial PE-caused mortality occurred in 2013 following the 2012 severe drought in the Northern Cheyenne IR and surrounding Custer-Gallatin NF-managed lands but declined to low levels in 2014 and has remains low. PP is of a size class and density considered susceptible to further PE-attack should severe drought conditions return to this area. WSBW was also detected in DF host throughout the county at low levels similar to those detected in 2015.

Six acres with QA dieback were observed about 3.7 miles southeast of Crown Butte. Five polygons of Marssonina leaf blight were observed in QA. Two polygons (20 acres and 5 acres) were located about 1.75 miles north northwest of Crown Butte. The other three polygons (8, 5, and 3 acres) were located 10 to 13 miles east northeast of the community of Lodge Grass. WPBR is present in LP in this county. LPPDM is known to significantly impact LPP in the Pryor Mountains. LPDM is present in the county.

## Blaine County

### Forestland, Mortality and Defoliation Acres by Ownership and Severity (64,240 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>136,921</b>	-	<b>75,012</b>	<b>4,590</b>	<b>57,319</b>			
<b>DFB</b>	2	-	2	-	-	2	-	-
<b>Dieback</b>	17	-	17	-	-	-	-	17
<b>MPB-LPP</b>	22	-	22	-	-	22	-	-
<b>MPB-PP</b>	36	-	36	-	-	8	28	-
<b>PE</b>	8	-	8	-	-	8	-	-

The only portion of county flown in 2016 was what constitutes the southern quarter of the Fort Belknap IR and the fringe edge of the Rocky Boys IR on the west county edge. This roughly matches what was flown in 2015. Of the approximately 64,000 acres flown, MPB, DFB, and PE continue on a three year trend of under 100 acres of activity from each agent.

Three small areas with dieback in QA totaling 17 acres were observed in the southeastern corner of the county on the Ft. Belknap IR near the town of Lodgepole. Western gall rust and comandra blister rust are common in PP on the Fort Belknap IR causing stem deformities, branch mortality, top kill, and occasional whole tree mortality. Armillaria root disease is found on the Fort Belknap IR, in the Mission Canyon area, with large pockets developing in DF and QA. LPPDM is present in the county.

## Broadwater County

### Forestland, Mortality and Defoliation Acres by Ownership and Severity (470,046 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>287,324</b>	<b>167,534</b>	<b>31,661</b>	<b>88,129</b>	<b>0</b>			
<b>DFB</b>	165	141	-	24	-	104	53	8
<b>MPB-High Elev</b>	2	2	-	-	-	2	-	-
<b>MPB-LPP</b>	6	4	-	2	-	6	-	-
<b>SAF Mort</b>	52	50	-	2	-	52	-	-
<b>WSBW</b>	19,439	8,675	1,083	9,394	288	5,829	-	13,610

Most of the forested area was flown in 2016. By far, WSBW was the insect causing the most damage. The number of acres defoliated by WSBW decreased slightly; from 20,817 acres in 2015 to 19,439 acres in 2016. The majority of defoliation was observed in the Big Belt Mountains. Levels of DFB-caused tree mortality decreased significantly in the county. MPB remained low and scattered mostly in the eastern part of the county.

WPBR was detected in LP in the county. Armillaria root disease is present in the county, and schweinitzii root and butt rot is quite common, causing significant decay in butt logs of large, older DF. LPPDM is present in the county.

## Carbon County

### Forestland, Mortality and Defoliation Acres by Ownership and Severity (351,747 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>313,462</b>	<b>170,321</b>	<b>90,348</b>	<b>46,605</b>	<b>6,188</b>			
<b>DFB</b>	4	2	-	2	-	4	-	-
<b>MPB-High Elev</b>	46	44	-	2	-	46	-	-
<b>MPB-WWP</b>	8	2	4	2	-	8	-	-
<b>SAF Mort</b>	113	105	4	4	-	113	-	-
<b>WSBW</b>	1,095	864	1	230	-	232	-	863
<b>UNKM</b>	2	2	-	-	-	2	-	-

Aerial surveys primarily occurred within an area of the Beartooth Mountains in the western portion of the county near Red Lodge and in the Pryor Mountains in the eastern portion of the county similar to the areas covered in 2015. In these areas, MPB activity in LPP and WBP continued to decline below the levels detected in 2015. Ground surveys found limited green-attacked pockets with MPB colonization within the Hellroaring Plateau area. Similarly, MPB and SB outbreaks observed in recent years throughout high-value recreation sites in the Rock Creek drainage subsided as populations of both insects returned to endemic levels. Scattered pockets of WSBW-caused defoliation were detected in the southern Pryor Mountains on the Crow IR and within the eastern portion of the county.

WPBR is common in WBP and LP. LPPDM and LPDM are present in the county.

## Carter County

### Forestland, Mortality and Defoliation Acres by Ownership and Severity (357,065 ac flown)

Damage Agent	Ownership					Damage Severity (acres)			
	Total	USFS	Other Fed	State	Private	Total	Low	Mod	High
<b>Forestland</b>	<b>103,269</b>	<b>65,753</b>	-	-	<b>37,516</b>	<b>134</b>			<b>134</b>
<b>PE</b>		53	8	7	66	134			134

Minimal PE activity was detected in Carter County in private and federal-managed lands during the 2016 aerial survey. No other forest pest activity was noted.

## Cascade County

### Forestland, Mortality and Defoliation Acres by Ownership and Severity (487,212 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>330,899</b>	<b>179,294</b>	<b>26,097</b>	<b>104,725</b>	<b>20,784</b>			
DFB	90	58	2	17	13	67	23	-
Dieback	79	2	-	77	-	-	-	79
MPB-High Elev	10	8	-	2	-	10	-	-
MPB-LPP	81	38	2	42	-	81	-	-
MPB-PP	6	4	2		-	6	-	-
SAF Mort	17	16	-	2	-	17	-	-
WSBW	9,201	4,670	678	3,100	753	3,846	-	5,355

Most of the forested portion of the county was surveyed in 2016 as in 2015. WSBW was the insect causing the most damage in the southern part of the county along the borders of Judith Basin, Lewis and Clark and Meagher Counties. WSBW decreased by about 80% in 2016. The number of acres with DFB-caused mortality decreased and remained low in 2016, though the intensity increased in some areas. MPB-caused tree mortality remained low for all pine species across the county. SAF mortality was detected at very low levels (17 acres).

About 79 acres of dieback of QA were observed on the east side of the county in the Little Belt and Highwood Mountains, along the border of the Helena-Lewis & Clark NF. Armillaria root disease is a concern in Logging Creek campground (MFO-TR-16-12). Armillaria root disease is present in the southeastern portion of the county, and schweinitzii root and butt rot is quite common, causing significant decay in butt logs of larger, older DF. Tomentosus root rot is known to occur in several areas. WPBR is common in LP in the county.

## Chouteau County

### Forestland, Mortality and Defoliation Acres by Ownership and Severity (269,683 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>61,687</b>	<b>16,098</b>	<b>10,244</b>	<b>33,882</b>	<b>1,463</b>			
DFB	109	8	32	69	-	48	61	-
Dieback	127	-	87	40	-	-	-	127
MPB-LPP	14	10	-	4	-	14	-	-
MPB-PP	24	2	6	14	2	24	-	-
PE	4	-	2	2	-	4	-	-
Windthrow	19	14	-	4	1	-	-	19
WSBW	305	10	40	248	8	287	-	19

Two regions of the county were flown in 2015 and 2016, including part of the southern half of the Rocky Boys IR in the northeastern corner of the county, and the Highwood Mountains in the southern end of the county. In the Bear Paw Mountains, the principle agents are DFB and dieback in QA. In the Highland Mountains, QA dieback was detected largely in the northeast quarter, WSBW-caused defoliation in the northwest quarter, and MPB in LPP in the central portion. Overall, damage agent activity remained low where WSBW activity caused the highest number of impacted acres (300 acres).

Two pockets of windthrow were detected. One 5-acre patch was north of the Helena-Lewis & Clark NF near Keaster Creek. The second 14-acre patch was on the Judith RD at the headwaters of Pohlod Creek.

The southeast portion of Thain Creek Campground is impacted by Armillaria root disease. In addition, some older LPP have extensive brown cubical butt rot that has contributed to structural tree failure within the campground (MFO-TR-16-11).

## Custer County

### Forestland, Mortality and Defoliation Acres by Ownership and Severity (211,353 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
Forestland	168,751	-	26,477	132,864	9,410	44	0	0
PE			1	43		44	0	0

Aerial surveys primarily occurred within the southwestern corner of Custer County in 2016. Very limited PE-caused tree mortality was detected in this area within PP host types. No other notable insect activity was detected.

## Deer Lodge County

### Forestland, Mortality and Defoliation Acres by Ownership and Severity (438,389 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
Forestland	284,344	203,001	6,256	34,088	40,999			
DFB	12	6	-	4	2	12	-	-
Fire	5	5	-	-	-	-	-	5
MB	265	10	-	226	29	265	-	-
MPB-High Elev	22	20	-	2	0	22	-	-
MPB-LPP	50	32	-	14	3	50	-	-
SAF Mort	6	4	-	-	2	6	-	-
WPBR	2	-	-	2	-	2	-	-
WSBW	12,765	3,192	125	5,721	3,728	6,619	-	6,146

With the exception of the I-90 corridor the majority of the county was flown in both 2015 and 2016. What had been very limited MPB activity is now nearly non-existent with under 100 acres noted in 2016. Mortality from SB, DFB, and SAF complex was low; less than 15 acres were identified. WSBW activity continued to increase in 2016, from 2,385 acres to 12,765 acres.

About 265 acres of Marssonina leaf blight on QA was observed in three polygons; seventy acres were located about one mile west of Stump Town, 55 acres about 1.25 miles south of Stump Town, and about 140 acres were seen about four miles south southwest of Anaconda. LPPDM is moderate to severe in some areas of the Pintler Face Project Area (MFO-TR-16-30). WPBR was detected in LP in the county. Schweinitzii root and butt rot is common in DF, causing decay in butt logs but not acting as an aggressive root pathogen. LPPDM and LPDM are also present in the county. Two acres of WPBR were identified in WBP about 8 miles west southwest of Stump Town.

## Fergus County

### Forestland, Mortality and Defoliation by Ownership and Severity (954,874 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>538,991</b>	<b>87,560</b>	<b>184,875</b>	<b>12,388</b>	<b>254,169</b>			
<b>DFB</b>	127	22	37	64	4	127	-	-
<b>Dieback</b>	590	13	2	564	12	-	-	590
<b>Drought</b>	130	-	-	130	-	130	-	-
<b>MPB-High Elev</b>	4	4	-	-	-	4	-	-
<b>MPB-LPP</b>	58	6	32	21	-	58	-	-
<b>MPB-PP</b>	348	18	114	214	2	319	29	-
<b>PE</b>	102	17	6	77	2	102	-	-
<b>SAF Mort</b>	12	12	-	-	-	12	-	-
<b>Windthrow</b>	87	-	37	50	-	-	-	87
<b>WSBW</b>	13,484	10,659	236	2,349	240	6,978	-	6,505

WSBW was the insect causing the most damage in 2016, similar in numbers of acres affected and locations as in 2015. Most of the damage from WSBW was found in the southern part of the county in the Big Snowy Mountains. MPB activity increased especially in PP and was found scattered in forested areas in the central and southern part of the county. PE activity increased significantly along with damage recorded as drought. Most of the drought damage was in the northern part of the Big Snowy Mountains in willow-riparian areas. SAF mortality remained at very low levels.

Numerous areas (totaling 590 acres) of QA dieback were observed in the Judith, Big Snowy, and Little Moccasin Mountains. Pockets of windthrow were reported in the North Moccasin and Judith Mountains.

Armillaria root disease occurs in the Moccasin Mountains north of Lewistown and near Crystal Lake, south of Lewiston. Root, butt, and stem decays have contributed to substantial increases in structural tree failures at Crystal Lake Campground in recent years (MFO-TR-16-11). LPPDM is present in the county.

## Flathead County

### Forestland, Mortality and Defoliation by Ownership and Severity (2,914,442 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>2,798,952</b>	<b>1,747,670</b>	<b>503,365</b>	<b>415,568</b>	<b>132,349</b>			
<b>BWA</b>	130	63	-	67	-	77	18	35
<b>DFB</b>	2,242	1,437	149	406	249	1,167	792	282
<b>Drought</b>	10	10	-	-	-	10	-	-
<b>FE</b>	2,346	799	96	402	1,050	528	1,603	215
<b>LNC</b>	84	14	-	69	-	-	-	84
<b>MPB-High Elev</b>	12	12	-	-	-	12	-	-
<b>MPB-LPP</b>	1,604	317	1,258	25	4	326	471	807
<b>MPB-PP</b>	44	10	4	22	8	44	-	-
<b>MPB-WWP</b>	2	-	-	2	-	2	-	-
<b>PE</b>	12	8	-	4	-	12	-	-
<b>SAF Mort</b>	1,210	1,031	78	24	77	796	302	112
<b>SB</b>	19	-	17	2	-	19	-	-
<b>Windthrow</b>	15	15	-	-	-	-	-	15
<b>WPB</b>	4	2	-	2	-	4	-	-
<b>WSBW</b>	53,198	45,762	3,432	2,882	1,122	40,279	-	12,919

With the exception of wilderness areas, there was an increase of 700,000 acres flown in 2016 in the county compared to acres flown in 2015. The insect causing the most damage in the county was WSBW followed by DFB and FE. DFB activity remained elevated and increased from 1,256 acres in 2015 to 2,242 acres in 2016. DFB has the potential to continue to increase over the next few years in areas that experienced wildfires in 2015 (MFO-TR-16-34). FE-caused tree mortality increased significantly (35 acres to 2,346 acres) and was detected predominantly in the Swan Range.

Acres with defoliation from WSBW continues to decrease but is still considered high (53,198 acres) and scattered throughout the county. WSBW remains very active in the Whitefish, Flathead Mountain and Swan Ranges. No defoliation from DFTM was recorded via ground or ADS surveys in 2016.

MPB activity increased in LP and remained low in PP. Some of the additional acres detected with MPB in LP is due to an increase in the area flown along the Continental Divide. MPB activity remained low in WWP and HE5NP in 2016.

SB, PE and WPB activity was very low in the county in 2016. SAF mortality acreage increased from 171 acres in 2015 to 1,210 acres in 2016; a portion of the additional acres impacted is due to an increase in the area flown along the Continental Divide.

Three polygons of LNC were observed for a total of 84 acres. The largest polygon was 57 acres located about 1.5 miles south of Hubbard Reservoir. A 14 acre polygon was located about 5 miles west northwest of Lakeside and a 12 acre polygon of LNC was located about 1/10 of a mile south southwest of Bigfork Dam. Two polygons of blowdown totaling 15 acres were observed. A 13 acre polygon was located about 2.2 miles east of Lake Rogers and the second polygon (two acres above FS Road 114A) was observed about two miles west northwest of Thoma lookout. One ten acre polygon was described as drought damage in western red cedar and was located about 3.6 miles west northwest of Olney.

In Swan Lake Campground, decay fungi threaten structural integrity of conifers and hardwoods and Armillaria root disease is damaging trees along the north side of the campground (MFO-TR-16-04). In Beaver Creek Campground near Spotted Bear, root and butt rots and Indian paint fungus are affecting older trees, and Armillaria root disease is impacting DF and SAF in one corner of the campground (MFO-TR-16-34). Armillaria root disease, stem decays, and dwarf mistletoes are impacting trees within the Taylor Creek Project Area (MFO-TR-16-35).

WPBR is common in both WWP and WBP in the county. Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are Heterobasidion root disease in firs, Armillaria root disease, and schweinitzii root and butt rot. The tree species most affected by all root diseases are DF and true firs. Heterobasidion root disease is known to occur in PP in this county. DFDM, LPPDM, and WLDM are present and common in the county.

## Gallatin County

### Forestland, Mortality and Defoliation Acres by Ownership and Severity (1,167,925 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>889,788</b>	<b>593,509</b>	<b>56,283</b>	<b>19,920</b>	<b>220,077</b>			
<b>DFB</b>	88	41	4	41	2	88	-	-
<b>Fire</b>	2	0	-	2	-	2	-	-
<b>MPB-High Elev</b>	30	30	-	-	-	30	-	-
<b>MPB-LPP</b>	125	113	2	8	2	125	-	-
<b>SAF Mort</b>	222	196	8	18	0	222	-	-
<b>SB</b>	2	2	-	-	-	2	-	-
<b>UNKD</b>	90	19	-	71	-	29	-	60
<b>WPBR</b>	40	40	-	-	-	40	-	-
<b>WSBW</b>	69,761	31,386	125	35,812	2,438	11,426	-	58,335

Similar areas were surveyed in Gallatin County in 2016 as in 2015. MPB activity continued to decline and was observed at very low levels in LPP and WBP host in the county. Conversely, WSBW activity increased in DF host across private and federally managed lands with three times greater area totals detected in the county in 2016 (69,761 acres) relative to defoliation detected in 2015 (16,298 acres). DFB activity, which was high in recent years, declined in 2016 to very low levels in widely scattered pockets and individual trees.

Two small areas of WBP were detected with WPBR on the Bozeman RD near The Sentinel in the Bridger Mountains. Significant levels of schweinitzii root and butt rot and decay caused by tomentosus root rot in DF and ES occur in campgrounds and other portions of the Custer-Gallatin NF. Blowdown of DF following thinning activities occurred near Bridger Bowl Ski Area. About 20% of the DF had tomentosus or schweinitzii root disease (MFO-TR-16-27). LPPDM and western gall rust were seen in the Rendezvous Cross-country Ski Area outside of West Yellowstone (MFO-TR-16-27).

LPPDM is present and a management concern in various areas, especially on flat land with obsidian sand soils. WPBR is common in WBP and LP in this county.

## Glacier County

### Forestland, Mortality and Defoliation Acres by Ownership and Severity (799,970 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>400,458</b>	<b>27,467</b>	<b>208,694</b>	<b>0</b>	<b>164,297</b>			
<b>DFB</b>	191	6	182	2	-	86	67	38
<b>Dieback</b>	4,871	16	3,497	1,359	-	-	1,885	2,986
<b>MPB-LPP</b>	8	2	6	-	-	8	-	-
<b>SAF Mort</b>	1,510	44	1,466	-	-	622	359	529
<b>SB</b>	150	-	149	1	-	150	-	-
<b>Windthrow</b>	72	-	27	46	-	-	-	72
<b>WSBW</b>	5,835	122	5,420	294	-	4,365	-	1,470

Aerial surveys were limited to the western portion of Glacier County in 2016, similar to the area covered in 2015. In this area, WSBW activity continued to decline in 2016 (5,835 acres) relative to activity detected in 2015 (19,338 acres). This activity occurred primarily on federally managed lands in DF host. DFB activity was at low levels in 2015 and declined even further in 2016 impacting limited numbers of widely scattered groups of trees in this portion of the county.

Over 4,800 acres of QA had various levels of dieback. These areas were predominantly on the Blackfoot IR. The largest area was over 1,000 acres near Two Medicine Ridge. Three areas of windthrow, all less than 50 acres, were observed on the Blackfoot IR.

WPBR is common in WBP and LP. Armillaria root disease is known to be a significant pathogen in DF in the western portion of the county on the Blackfeet IR and the Helena-Lewis & Clark National Forest, and LPPDM and WLDM are also present in the county.

## Golden Valley County

### Forestland, Mortality and Defoliation by Ownership and Severity (103,473 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>76,151</b>	<b>17,242</b>	<b>5,747</b>	<b>-</b>	<b>53,162</b>			
<b>DFB</b>	4	4	-	-	-	4	-	-
<b>Dieback</b>	51	-	-	51	-	-	-	51
<b>MPB-PP</b>	16	2	2	12	-	16	-	-
<b>MPB-WWP</b>	2	2	-	-	-	2	-	-
<b>PE</b>	41	5	-	36	-	41	-	-
<b>SAF Mort</b>	2	2	-	-	-	2	-	-
<b>Windthrow</b>	4	-	-	4	-	-	-	4
<b>WPBR</b>	117	-	6	111	-	-	-	117
<b>WSBW</b>	15,104	9,209	2,904	2,872	120	4,997	-	10,107

In 2016 twenty percent fewer acres were flown in the county than in 2015. The insect causing the most damage was WSBW with an increase of 11,000 defoliated acres. All of the defoliation from WSBW was in forested areas in the northern part of the county. DFB activity decreased and MPB remained at low levels. PE was detected on a few acres in 2016.

A 51-acre area had QA dieback at the northern end of the county in the Little Snowy Mountains east of McLean Lake.

## Granite County

### Forestland, Mortality and Defoliation by Ownership and Severity (1,099,663 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>816,276</b>	<b>600,358</b>	<b>25,970</b>	<b>25,904</b>	<b>164,044</b>			
BWA	62	2	-	60	-	2	-	60
DFB	132	65	17	48	2	118	-	15
Fire	5	5	-	-	-	-	-	5
MPB-High Elev	61	60	-	1	-	40	21	-
MPB-LPP	303	280	-	23	-	294	9	-
MPB-PP	20	16	2	-	2	20	-	-
PE	2	1	-	1	-	2	-	-
SAF Mort	178	170	2	7	-	172	7	-
SB	4	4	-	-	-	4	-	-
Windthrow	106	106	-	-	-	-	-	106
WPB	2	2	-	-	-	2	-	-
WPBR	2	2	-	-	-	2	-	-
<b>WSBW</b>	<b>46,945</b>	<b>36,374</b>	<b>2,670</b>	<b>7,253</b>	<b>647</b>	<b>23,246</b>	<b>-</b>	<b>23,699</b>

The entire county was surveyed in both 2015 and 2016. All damage agents decreased in detectable activity in 2016. The remaining activity was scattered throughout the county where hosts are found. Specifically, MPB was down to 400 acres total from 24,386 acres in 2015 and more than 136,000 acres in 2014. DFB also continued to decline (203 acres to 132 acres), although continued high levels of WSBW may make fading trees harder to detect. The area affected by WSBW decreased by 30% although remained high at nearly 46,945 acres. Windthrow of just over 100 acres was noted as two polygons in the Sapphire range.

Two areas with windthrow were found on Missoula RD. A 74-acre spot was north of Eagle Point in the Sapphire Mountains. A spot of 31 acres was detected along Ranch Creek above Rock Creek.

Common root diseases found in this county include Heterobasidion root disease in firs, Armillaria root disease, schweinitzii root and butt rot, and tomentosus root rot. DF and true firs are most affected by the first three root diseases and ES, SAF, and DF are most affected by tomentosus root rot. Heterobasidion root disease is known to occur in PP.

Elytroderma needle disease is a significant agent in PP in localized areas. LPPDM and WLDM are present in the county.

## Hill County

### Forestland, Mortality and Defoliation by Ownership and Severity (90,885 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>33,654</b>	-	-	<b>1,530</b>	<b>32,124</b>			
DFB	24	-	16	6	2	18	6	-
Dieback	223	-	30	187	6	-	-	223
MPB-LPP	8	-	8	-	-	8	-	-
MPB-PP	4	-	2	2	-	4	-	-
PE	2	-	-	2	-	2	-	-

In both 2015 and 2016 the area that makes up the southern half of the Rocky Boys IR was surveyed. Overall activity remains low. MPB, DFB, and PE were each under 25 acres of detectable mortality.

Dieback of QA was the disease most often detected from the air occurring in over 220 acres. This was located on the Rocky Boys IR in the southeast corner of the county. Schweinitzii root and butt rot and low levels of Armillaria root disease can be found in stands near Bailey Mountain and in the general area of West Fork of Beaver Creek in the southern portion of Rocky Boy's IR. Red ray rot is very common in PP on private lands bordering the reservation. LPPDM is common in many stands. Elytroderma needle blight is impacting LPP in the West Fork Beaver Creek drainage.

## Jefferson County

### Forestland, Mortality and Defoliation by Ownership and Severity (783,994 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>650,673</b>	<b>426,815</b>	<b>66,488</b>	<b>12,877</b>	<b>144,493</b>			
DFB	44	14	21	9	-	20	24	-
MPB-High Elev	1		-	1	-	1	-	-
MPB-LPP	12	10	-	2	-	12	-	-
MPB-PP	6		2	4	-	6	-	-
SAF Mort	46	44	2		-	46	-	-
<b>WSBW</b>	<b>38,762</b>	<b>27,563</b>	<b>5,781</b>	<b>5,260</b>	<b>158</b>	<b>13,054</b>	-	<b>25,709</b>

A majority of the county was flown in both 2015 and 2016 with the exception of the agricultural lands of the southeast quarter. MPB remains low at under 20 acres, with both DFB and SAF mortality continuing their trend of less than 100 acres affected. WSBW, however, continued increasing from 9,000 acres in 2015 to nearly 39,000 acres of damage in 2016.

Some areas of the Red Rock Analysis Area, southern area of the county, showed light to moderate LPPDM infestations (MFO-TR-16-38). WPBR has been found on LP in the county.

## Judith Basin County

### Forestland, Mortality and Defoliation by Ownership and Severity (628,550 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>302,221</b>	<b>274,980</b>	<b>-</b>	<b>5,837</b>	<b>21,404</b>			
<b>DFB</b>	52	34	-	16	2	36	16	-
<b>Dieback</b>	176	-	-	176	-	-	-	176
<b>MPB-High Elev</b>	26	24	-	2	-	26	-	-
<b>MPB-LPP</b>	105	105	-	-	-	105	-	-
<b>MPB-PP</b>	6	2	-	4	-	6	-	-
<b>SAF Mort</b>	50	50	-	-	-	50	-	-
<b>Windthrow</b>	55	55	-	-	-	-	-	55
<b>WSBW</b>	69,759	64,972	1,226	2,667	894	26,659	-	43,100

There was an increase of 80,000 acres surveyed in 2016. The insect causing the most damage was WSBW. The number of acres defoliated by WSBW more than doubled in 2016 (24,724 acres to 69,759 acres). Most of the WSBW defoliation was scattered throughout the south-western part of the county and in the Little Belt Mountains. Small forested areas in the southern part of the county had high severity defoliation (greater than 50% defoliation). MPB activity stayed consistent in PP and HE5NP, in contrast MPB activity increased significantly in LP in the Little Belt Mountains. DFB and SAF mortality remained at low and scattered levels in the county.

Located north in the Highwood Mountains and in the south along Big Otter Creek near Limestone Butte 176 acres of QA dieback was detected. WPBR is common in LP. Armillaria root disease is significant in localized areas. Tomentosus root rot is known to be significant in some campgrounds. LPPDM is present in the county.

## Lake County

### Forestland, Mortality and Defoliation by Ownership and Severity (1,022,423 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>549,272</b>	<b>168,843</b>	<b>-</b>	<b>47,789</b>	<b>332,640</b>			
<b>BWA</b>	2	2	-	-	-	2	-	-
<b>DFB</b>	3,028	640	2,127	93	168	2,217	788	23
<b>Drought</b>	1,973	903	-	860	209	-	-	1,973
<b>FE</b>	3,231	1,511	656	884	180	1,672	1,297	262
<b>LNC</b>	167	2	-	73	92	-	20	147
<b>MPB-LPP</b>	103	-	79	8	15	71	32	-
<b>MPB-PP</b>	104	2	72	25	6	104	-	-
<b>PE</b>	18	-	6	10	2	18	-	-
<b>SAF Mort</b>	784	440	303	17	23	410	302	72
<b>SB</b>	2	-	-	-	2	2	-	-
<b>WPB</b>	4	-	4	-	-	4	-	-
<b>WSBW</b>	12,332	6,791	3,263	1,330	947	9,548	-	2,784

There was a significant increase in the area surveyed in Lake County during 2016 relative to 2015. WSBW-caused defoliation declined in 2016 to 12,332 acres from 46,067 acres in 2015. The decline in areas detected with WSBW-caused defoliation is more pronounced than the comparison of acres impacted suggests. However, it should be noted that aerial surveys conducted in the early summer of 2016 may have occurred prior to the detectability of defoliation symptoms in host crowns. FE activity increased in GF in 2016 (3,231 acres) from minimal levels detected in 2015 (9 acres). Similar FE increases occurred throughout western Montana and northern Idaho in 2015 following dry summer conditions in 2014. DFB caused similar amounts of low-level mortality of DF in 2016 as was detected in 2015.

Ten polygons (ranging from approximately 46 acres to 570 acres for a total of nearly 2,000 acres) described as drought injury to western redcedar was observed within an 8 mile radius surrounding the old State Forest headquarters at Goat Creek. Western redcedar had been damaged by extreme temperature fluctuations in November 2014 (see MFO-TR-15-12 for related information). Ground truthing will be necessary to determine if the damage is related to the 2014 weather event. LNC was observed on five polygons ranging in size from two acres to 95 acres (totaling 167 acres) within a ten mile radius of the old State Forest headquarters at Goat Creek. Brown cubical root and butt rot, and Armillaria root disease, western larch dwarf mistletoe, and Douglas-fir dwarf mistletoe are impacting DF in different stands of the Weed Lake Project Area (MFO-TR-16-37). WPBR is common in both WWP and WBP. Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are Heterobasidion root disease in firs, Armillaria root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. Heterobasidion root

disease is known to occur in PP. Elytroderma needle blight is a significant agent in PP in localized areas in the county, as noted by ADS. DFDM, LPPDM, and WLDM are present in the county.

## Lewis and Clark County

### Forestland, Mortality and Defoliation by Ownership and Severity (1,075,488 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	1,402,168	983,953	67,836	314,075	36,303			
<b>DFB</b>	210	144	24	28	14	173	32	4
<b>LNC</b>	119	119	-	-	-	-	-	119
<b>MPB-LPP</b>	35	35	-	-	-	14	21	-
<b>MPB-PP</b>	28	2	4	16	6	28	-	-
<b>MPB-WWP</b>	69	1	-	61	7	-	-	69
<b>PE</b>	6	0	-	4	2	6	-	-
<b>SAF Mort</b>	89	81	-	6	2	32	57	-
<b>WSBW</b>	21,741	15,723	964	4,397	657	12,236	-	9,506

The insect causing the most damage was WSBW and defoliation was especially evident along the Continental Divide. The number of acres of recorded WSBW defoliation decreased significantly but this may be due to fewer acres surveyed in 2016. DFB and PE remained at similar levels in 2016. The number of acres affected by MPB remained low and at similar levels in LP, PP and HE5NP forests. PE and SAF mortality were at low and scattered levels in the county.

LNC was recorded on WL on the Lincoln RD west of Stemple Pass. Schweintizii root and butt rot is causing damage to DF in a silvicultural certification stand located in the Tenmile South-Helena Project area (MFO-TR-16-42). Armillaria root disease is present in the southeastern portion of the county, and schweintizii root and butt rot is quite common, causing significant decay in butt logs of larger, older DF. WPBR is common in WBP and LP. LPPDM is common in the county.

## Liberty County

There was no aerial survey of this county in 2016.

WPBR occurs in LP and WBP on East Butte of the Sweetgrass Hills. LPPDM is present in this county.

## Lincoln County

### Forestland, Mortality and Defoliation by Ownership and Severity (2,351,362 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>2,178,307</b>	<b>1,734,571</b>	<b>-</b>	<b>387,787</b>	<b>55,950</b>			
<b>BWA</b>	2	2	-	-	-	-	2	-
<b>DFB</b>	3,086	2,549	2	446	89	1,591	745	750
<b>Drought</b>	234	20	-	124	90	66	168	-
<b>FE</b>	1,950	1,616	-	317	17	1,126	574	250
<b>LNC</b>	103	103	-	-	-	-	15	88
<b>MPB-LPP</b>	321	295	-	26	-	137	125	58
<b>MPB-PP</b>	113	102	-	11	-	113	-	-
<b>MPB-WWP</b>	4	4	-	-	-	4	-	-
<b>PE</b>	6	2	-	2	2	4	2	-
<b>SAF Mort</b>	1,966	1,942	-	20	4	1,401	405	160
<b>SB</b>	2	2	-	-	-	2	-	-
<b>Windthrow</b>	96	96	-	-	-	-	7	90
<b>WPB</b>	4	2	-	2	-	4	-	-
<b>WPBR</b>	211	193	-	18	-	192	19	-
<b>WSBW</b>	5,444	4,806	-	479	159	3,460	-	1,984

The entire county was surveyed in 2016, similar to 2015. DFB was the bark beetle causing the most damage with 3,086 acres affected, slightly up from 2015 levels. Around one quarter of the DFB damage identified in Montana in 2016 was noted in Lincoln County. FE in GF was detected at nearly 2,000 acres, constituting approximately one quarter of the total acres of FE detected in the state. MPB remained present but decreased to less than 500 affected acres, located as scattered spots along the southern edge of the county. Mortality of SAF due to various factors increased over the past several years to nearly 2,000 acres. WSBW defoliation was the primary damage agent yet incidental when considered across the state, and occurred largely at low severity.

WPBR caused mortality was found near the western border of the county. In the same area there was evidence of Heterobasidion and Armillaria root disease affecting WH and GF, respectively. Root diseases near the western border of the county were affecting numerous hosts, predominantly DF and GF.

WLDM and pini rot were determined to have a large impact on the host species, WL. Elytroderma needle disease was detected at moderate severity levels in PP.

Three pockets of drought-related mortality of western redcedar were identified in the southern part of the county. The pockets were located along Libby Creek, Little Wolf Creek, and near Redemption Hill. Only two areas were seen with LNC on the Kootenai NF. One was in Reinhart Gulch east of Hwy 2. The

second was near Bonnet Top at the north end of the county. Atropellis cankers are present in many LPP east of Lake Koocanusa, reducing vigor of individual trees, and contributing to stem failure. WPBR is common in both WWP and WBP. DFDM, LPPDM, and WLDM are present in this county. An evaluation of the Starry Goat analysis area west of Troy on the Three Rivers RD was done (MFO-TR-16-19). WPBR was significantly impacting older planted WWP in some stands. In a silvicultural certification stand, many of the planted WWP trees have slow growing bole cankers, indicating possible phenotypic resistance. Armillaria and Heterobasidion root diseases are present at low severity (MFO-TR-16-18) in the county.

Pockets of Armillaria root disease were present primarily in more susceptible hosts. WLDM was observed at high severity in some areas. Other diseases noted in the area include schweinitzii root and butt rot, red ring rot, and Elytroderma needle disease.

Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are Heterobasidion root disease in true fir, Armillaria root disease, laminated root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. Heterobasidion root disease is known to occur in PP.

## Madison County

### Forestland, Mortality and Defoliation by Ownership and Severity (1,595,097 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	903,154	586,160	104,262	200,384	12,347			
<b>Decline</b>	3	-	-	3	-	3	-	-
<b>DFB</b>	78	46	16	10	6	78	-	-
<b>Fire</b>	139	-	139	-	-	-	-	139
<b>MPB-High Elev</b>	24	18	6	-	-	24	-	-
<b>MPB-LPP</b>	284	274	6	2	2	153	131	-
<b>MPB-WWP</b>	6	6	-	-	-	6	-	-
<b>SAF Mort</b>	337	275	38	19	5	254	83	-
<b>SB</b>	157	157	-	-	-	147	10	-
<b>UNKD</b>	581	581	-	-	-	-	-	581
<b>WSBW</b>	66,966	42,186	6,983	15,705	2,091	36,173	-	30,793

The acres surveyed in Madison County increased in 2016 with the inclusion of the area northwest of Twin Bridges in the Highland Mountains. Minimal MPB activity (300 acres) was detected in 2016, down from 2015 acres (1,032). Mortality from DFB, ESB, and SAF mortality remained low (75-350 acres). The damage agent with the largest footprint was WSBW which continued to trend upward to nearly 67,000 acres. The increase up from 41,000 acres in 2015 is not attributed to the increased survey area, a review of areas flown both years reveal an appreciable increase in 2016. WSBW activity is present wherever a host is present. In areas with significant activity, defoliation may mask the fading of trees attacked by DFB. One large polygon over 500 acres was marked as unknown defoliation in an unknown hardwood. Based on the location, near Divide Creek, the host is most likely QA.

A small pocket of QA dieback was noted in the Gravelly Range at Haypress Lakes. WPBR is common in WBP and LP. LPDM is present in the county. Schweinitzii root and butt rot is affecting old DF stands.

## Meagher County

### Forestland, Mortality and Defoliation by Ownership and Severity (1,384,458 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>659,416</b>	<b>441,876</b>	<b>6,035</b>	<b>199,320</b>	<b>12,185</b>			
<b>DFB</b>	274	177	-	89	7	257	10	7
<b>MPB-High Elev</b>	16	4	-	10	2	16	-	-
<b>MPB-LPP</b>	69	43	-	26	-	56	-	13
<b>MPB-PP</b>	30	11	-	15	4	30	-	-
<b>PE</b>	8	2	-	6	-	8	-	-
<b>SAF Mort</b>	246	225	-	18	2	204	42	-
<b>Windthrow</b>	30	30	-	-	-	-	-	30
<b>WSBW</b>	75,906	46,595	807	27,513	991	43,788	-	32,118

Damage from WSBW increased by about 30%. Increases in WSBW damage was especially evident in the Little Belt Mountains while remaining at similar levels in the Big Belt Mountains including the Moose Creek drainage (MFO-TR-16-21). Approximately 300 acres of primarily DF blew down in the Holloway drainage on the Townsend Ranger District (MFO-TR-16-32).

DFB decreased from 803 acres in 2015 to 274 acres in 2016 but has the potential to increase in localized areas in response to blow down. MPB activity across the county decreased significantly in LPP and high-elevation WBP and remained at similar levels in PP. SAF mortality increased by about 80%. The number of acres recorded with PE-caused tree mortality remained very low.

A pocket of windthrow was observed on the White Sulphur Springs RD along Tenderfoot Creek in the Tenderfoot Creek Experimental Forest. Old trees, associated decay, and openings are contributing to structural tree failures within King's Hill Campground (MFO-TR-16-12). Spruce broom rust is impacting regeneration, causing top kill in some intermediate ES, and contributing to overstory ES mortality in Grasshopper Campground (MFO-TR-16-12). LPPDM is present and causing damage in many LPP stands within the Moose Creek Project Area (MFO-TR-16-21). In the Smith-Shields Forest Health Project Area LPPDM was found in numerous LPP-dominated stands, and tomentosus root rot was found in association with blowdown, (MFO-TR-16-08).

Tomentosus root rot and Schweinitzii root and butt rot are damaging older ES and DF in localized areas. WPBR is common in WBP and LP. LPPDM is present and damaging LPP in this county, as are comandra blister rust and Atropellis canker.

## Mineral County

### Forestland, Mortality and Defoliation by Ownership and Severity (705,342 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Foresland</b>	<b>730,033</b>	<b>657,729</b>	<b>-</b>	<b>35,342</b>	<b>36,962</b>			
<b>BWA</b>	11	11	-	-	-	11	-	-
<b>DFB</b>	149	136	-	11	2	143	6	-
<b>FE</b>	68	65	-	3	-	68	-	-
<b>LNC</b>	351	341	-	10	-	-	7	344
<b>MPB-LPP</b>	207	182	-	21	4	148	59	-
<b>MPB-PP</b>	96	88	-	4	4	80	17	-
<b>SAF Mort</b>	785	785	-	-	-	714	15	56
<b>SB</b>	2	2	-	-	-	2	-	-
<b>Windthrow</b>	146	146	-	-	-	-	-	146
<b>WPB</b>	8	6	-	2	-	8	-	-
<b>WSBW</b>	9,787	9,514	-	160	114	8,154	-	1,633

Similar areas were surveyed in Mineral County in 2016 as were in 2015. MPB activity in LPP declined to minimal levels in 2016 relative to the substantial area detected with mortality in 2015. WSBW activity, which increased nine-fold in 2015 relative to minimal amounts that were detected in 2014, continued to cause low-severity defoliation in 2016. This activity was scattered throughout the county and primarily impacted DF host. DFB activity remained at very low levels causing widely scattered pockets of DF mortality within the northern portion of the county.

Armillaria root disease and schweinitzii root and butt rot was found impacting DF and may be associated with the decline of stressed PP in certain project areas of the county. Western gall rust has been discovered to be impacting PP, leading to the decline of individual trees (TR-16-03).

Windthrow was detected at two locations on the Lolo NF; a small spot was identified near Whiterock Gulch and a much larger area was found near White Mountain. Over 350 acres of WL were identified with LNC on the Superior RD. Specific locations were in Slowey Gulch, Lozo Creek, North Fork Second Creek, and South Fork Trout Creek. A project area on the Superior RD, Murphy Flats, was found to have Armillaria root disease and western gall rust in PP (MFO-TR-16-03). Seedlings growing at Savenac Nursery had indicators of damage indicative of various abiotic factors, including off-site, frost, and possibly herbicide (MFO-TR-16-17).

WPBR is common in WWP and WBP. The more common root diseases known to occur in this county are Heterobasidion root disease in firs, Armillaria root disease, laminated root disease, and schweinitzii root and butt rot. The species most affected are DF and true firs. Tomentosus root rot has been found impacting WL trees heavily infected with WLDM. Heterobasidion root disease is known to occur in PP. DFDM, LPPDM, and WLDM are also present in the county.

## Missoula County

### Forestland, Mortality and Defoliation by Ownership and Severity (1,655,185 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>1,413,378</b>	<b>709,203</b>	<b>19,267</b>	<b>511,487</b>	<b>173,422</b>			
<b>DFB</b>	805	432	187	147	39	556	24	226
<b>FE</b>	20	16	2	2	-	20	-	-
<b>LNC</b>	1,083	846	-	237	-	73	26	984
<b>MPB-LPP</b>	407	323	27	52	5	278	129	-
<b>MPB-PP</b>	245	69	22	126	29	245	-	-
<b>PE</b>	204	162	2	34	5	44	80	80
<b>SAF Mort</b>	733	371	148	211	2	263	247	223
<b>Scale Insects</b>	243	189	-	12	42	-	-	243
<b>WPB</b>	18	8	-	8	2	18	-	-
<b>WSBW</b>	34,750	16,556	1,671	14,996	1,527	19,665	-	15,085

Similar areas were flown in 2016 as were surveyed in 2015 throughout Missoula County. Overall insect activity declined substantially relative to the damage detected in 2015. MPB activity, which was high in LPP host in 2015 (19,868 acres), was detected at minimal levels in 2016 (407 acres). Similarly, there was a five-fold reduction in WSBW-caused defoliation in 2016 (34,750 acres) relative to 2015 (186,592 acres). Areas that did have defoliation were generally noted to have light, rather than severe, levels of damage. DFB activity continued at low levels causing widely scattered pockets of DF mortality in the county. SAF mortality did increase from minimal levels in 2015 (90 acres) to low levels in 2016 (733 acres).

Over 1,000 acres with LNC were observed. The principal areas affected were in the northeast (Clearwater River watershed) and southwest parts (Lolo Creek watershed) of the county. Black pineleaf scale was detected from ground observations on PP in the greater Missoula area. Damage was not detected from aerial surveys.

Armillaria root disease, Schweinitzii root and butt rot, and quinine decay were detected in the northern part of the county resulting in substantial DF and SAF mortality. DFDM and Armillaria root disease were detected in the southwestern corner of the county affecting DF.

An evaluation of Holland Lake Campground, Swan Lake RD (MFO-TR-16-02) identified several root diseases, including Armillaria, schweinitzii, and tomentosus affecting DF and ES. Other diseases noted include western gall rust, Indian paint fungus, and stem decay of cottonwood. A stand on the Swan Lake RD had substantial mortality of DF and SAF from Armillaria root disease (MFO-TR-16-10). Other diseases detected included LPPDM, schweinitzii root and butt rot, and quinine conk. Lee Creek Campground, Missoula RD, was evaluated for damage agents following significant MPB-caused mortality (MFO-TR-16-20). Armillaria root disease and schweinitzii root and butt rot were found in DF In part of the

campground. A stand in the Rattlesnake National Recreation Area was found to have heavy infections of DFDM and mortality pockets from Armillaria root disease.

Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are Heterobasidion root disease in firs, Armillaria root disease, laminated root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. Heterobasidion root disease is known to occur in PP. WPBR is common in both WWP and WBP. Elytroderma needle blight is a significant agent in PP in localized areas in this county. Comandra blister rust is common in PP, as are DFDM, LPPDM, and WLDM in their respective hosts.

## Musselshell County

### Forestland, Mortality and Defoliation by Ownership and Severity (18,201 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>323,203</b>	<b>-</b>	<b>20,461</b>	<b>293,018</b>	<b>9,724</b>			
<b>MPB-PP</b>	2	0	0	2	0	2	0	0

The northwest corner near the Little Snowy range was flown in both 2015 and 2016 detecting no insect or disease activity of importance.

## Park County

### Forestland, Mortality and Defoliation by Ownership and Severity (1,164,902 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>1,028,652</b>	<b>737,820</b>	<b>69,765</b>	<b>197,668</b>	<b>23,399</b>			
<b>DFB</b>	106	60	-	44	2	82	24	-
<b>MPB-High Elev</b>	36	14	12	10	-	36	-	-
<b>MPB-LPP</b>	18	12	-	6	-	18	-	-
<b>SAF Mort</b>	274	253	12	9	-	90	184	-
<b>SB</b>	4	0	4	-	-	4	-	-
<b>WPBR</b>	4	-	-	4	-	4	-	-
<b>WSBW</b>	84,716	19,544	3,335	60,307	1,531	17,622	-	67,094

Similar areas in Park County were flown in 2016 as were surveyed in 2015. WSBW activity decreased from 186,592 acres detected in 2015 to 84,716 acres impacted in 2015. Very low levels of SAF mortality and MPB activity in LPP and WBP occurred in 2016 at similar levels that were detected in 2015.

In the Smith-Shields Forest Health Project Area LPPDM was found in numerous LPP-dominated stands, and tomentosus root rot was found in association with blowdown (MFO-TR-16-08).

WPBR is common in WBP and LP stands. Tomentosus root rot and schweinitzii root and butt rot are known to be significant in some campgrounds, and LPPDM is present in the county.

## Phillips County

### Forestland, Mortality and Defoliation by Ownership and Severity (125,793 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>132,313</b>	-	<b>96,006</b>	<b>33,282</b>	<b>3,026</b>			
DFB	4	-	4	-	-	18	6	-
MPB-LPP	12	-	12	-	-	-	-	223
MPB-PP	16	-	13	3	-	8	-	-
PE	10	-	8	-	2	4	-	-
Windthrow	13	-	13	-	-	2	-	-

In both 2015 and 2016 the area that makes up the southern quarter of the Fort Belknap IR, along with private and BLM managed lands in the Little Rocky Mountains was surveyed. Of the nearly 126,000 acres flown, MPB, DFB, and PE all remained at low levels, under 30 acres damaged by any one agent.

A small spot with windthrow was seen near Zortman on the Ft. Belknap IR. Western gall rust and comandra blister rust are common in PP on the Fort Belknap IR causing stem deformities, branch mortality, top kill, and occasional whole tree mortality. Armillaria root disease can be found on the Fort Belknap IR, in the Mission Canyon area, with large pockets developing in DF and QA. LPPDM is present in the county.

## Pondera County

### Forestland, Mortality and Defoliation by Ownership and Severity (221,182 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>138,171</b>	<b>120,894</b>	-	-	<b>17,276</b>			
DFB	16	6	2	4	4	16	-	-
Dieback	401	-	271	130	-	-	-	401
MPB-High Elev	2	-	-	2	-	2	-	-
MPB-LPP	4	4	-	-	-	4	-	-
PE	2	2	-	-	-	2	-	-
SAF Mort	14	14	-	-	-	14	-	-
WSBW	1,480	1,195	7	177	102	833	-	647

The insect causing the most damage was WSBW. Defoliation from WSBW decreased by more than 50% in the Sawtooth Mountain range in areas where it occurred in 2015. DFB and MPB in lodgepole pine remained at low levels. SAF mortality decreased to very low levels in 2016.

About 400 acres of QA dieback was recorded mostly on the Blackfeet IR. Numerous small pockets of QA dieback were observed in the vicinity of Heart Butte. WPBR is common in WBP and LP in this county.

## Powder River County

### Forestland, Mortality and Defoliation by Ownership and Severity (586,444 ac flown)

Damage Agent	Ownership					Disease Severity (acres)		
	Total	Federal	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>489,986</b>	<b>272,354</b>	<b>67,257</b>	<b>10,599</b>	<b>139,776</b>			
<b>PE</b>	818	677	6	121	14	818	0	0

Minimal PE-caused PP mortality was detected in widely scattered pockets and individual trees within Powder River County in 2016. This is consistent with very low levels of PE activity observed in 2015. No other insect activity of note was observed during 2016 aerial surveys.

## Powell County

### Forestland, Mortality and Defoliation by Ownership and Severity (1,256,668 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>991,777</b>	<b>652,349</b>	<b>79,078</b>	<b>51,533</b>	<b>208,817</b>			
<b>BWA</b>	2	-	2	-	-	2	-	-
<b>DFB</b>	337	189	70	58	20	288	-	49
<b>MPB-High Elev</b>	8	8	-	-	-	8	-	-
<b>MPB-LPP</b>	57	31	11	13	2	50	7	-
<b>MPB-PP</b>	70	4	14	41	11	70	-	-
<b>PE</b>	20	4	-	16	-	20	-	-
<b>SAF Mort</b>	575	530	30	10	4	481	45	49
<b>Windthrow</b>	17	17	-	-	-	-	-	17
<b>WSBW</b>	31,577	15,862	1,819	11,321	2,576	20,705	-	10,873

WSBW defoliation was found throughout most of the county and decreased significantly in most areas where it was recorded in 2015 (79,457 acres to 31,577 acres) despite a 20% decrease in acres flown. Significant defoliation from WSBW was recorded along the Continental Divide and in the Boulder, Lewis and Clark, Nevada and Swan Mountain Ranges. Low and scattered levels of defoliation were recorded in the Garnet Range. DFB activity decreased in number of acres affected; intensity increased in the Swan. Some of the DFB activity was in or near areas that have been defoliated by WSBW over several years. MPB activity significantly decreased in LPP, PP and HE5NP forests for number of acres affected and severity. Most of the activity was recorded in the Garnet range and along the Continental Divide. SB and PE remained at low levels. Low levels of SAF mortality were recorded in 2016.

A small area with windthrow was seen along Pikes Peak Creek below Emery Ridge. An evaluation of Lake Alva Campground, Seeley Lake RD (MFO-TR-16-20) identified the presence of root disease, but did not identify the species. DFDM was also found in this campground. A stand of PP near Ward Creek on BLM land was being significantly impacted by comandra blister rust with cankers and top-kill (MFO-TR-16-29).

Root diseases are common in counties west of the Continental Divide. The more common ones known to occur in this county are Heterobasidion root disease in firs, Armillaria root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. Tomentosus root rot has been found in over mature spruce. WPBR is common in WBP and LP. LPPDM is present in the county.

## Ravalli County

### Forestland, Mortality and Defoliation by Ownership and Severity (1,393,098 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>1,191,472</b>	<b>1,050,138</b>	<b>-</b>	<b>35,233</b>	<b>106,101</b>			
<b>BWA</b>	172	168	-	3	-	132	29	11
<b>DFB</b>	635	616	-	9	10	562	49	24
<b>MPB-High Elev</b>	10	10	-	-	-	10	-	-
<b>MPB-LPP</b>	584	571	-	8	4	178	192	213
<b>MPB-PP</b>	177	114	-	49	14	177	-	-
<b>PB</b>	3,001	93	-	2,735	173	1,148	-	1,853
<b>PE</b>	251	211	-	10	30	54	-	197
<b>SAF Mort</b>	427	426	-	1	-	226	165	36
<b>SB</b>	6	4	-	2	-	6	-	-
<b>UNKD</b>	228	27	-	201	-	-	-	228
<b>WPB</b>	54	31	-	16	8	54	-	-
<b>WSBW</b>	19,107	17,032	-	1,864	212	13,971	-	5,136

The insect causing the most damage was WSBW in both the Sapphire and Bitterroot Mountain ranges including the Gold Butterfly drainage (MFO-TR-16-16). However, number of acres affected by WSBW in 2016 decreased by nearly 60% and the level of severity of defoliation decreased in most locations. A couple hundred acres of unknown defoliation was recorded. Three thousand acres of PB defoliation was recorded along the foothills of the Sapphire Range in the central part of the county. Nearly 200 acres of BWA damage and 6 acres of SB-caused tree mortality were detected for the first time in the county.

MPB activity decreased in all pine species in number of acres affected and intensity. MPB activity was mapped across the county in the Sapphire and Bitterroot Mountains but more beetle-caused mortality was found in the Sapphire Range in both years. MPB activity is expected to continue to decline over the next few years (MFO-TR-15-39).

DFB activity increased nearly 40% in impacted acres, intensity is trending up and it was found in similar locations as in 2015. DFB was found in association with WSBW activity in some areas of the county. WPB increased while SB remained at low levels. SAF decline remained at similar levels (about 400 acres) and was found predominantly along the southern end of the Continental Divide.

Spores of *Heterobasidion irregulare*, cause of Heterobasidion root disease of pine, were detected in an active timber sale that is part of the Como Forest Health Project (MFO-TR-16-01) located on the western side of the county. DFDM is damaging DF within several stands in the Gold Butterfly Analysis Area (MFO-TR-16-16). Common root diseases known to occur in this county are Heterobasidion root disease, Armillaria root disease, laminated root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. Heterobasidion root disease is known to occur in PP in the foothills of both the Bitterroot and Sapphire Mountains. Tomentosus root rot is occasionally observed in ES. WPBR is common in WBP. Notable levels of comandra blister rust cause top kill in PP in the foothills of the Bitterroot Mountains. Elytroderma needle blight is a significant agent in localized areas in this county; high levels continue to exist in the area around Lake Como. DFDM, LPPDM, and WLDM are present in the county, with DFDM being quite common in the lower elevations of the Sapphire and Bitterroot Mountains.

## Rosebud County

### Forestland, Mortality and Defoliation by Ownership and Severity (688,063 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>412,132</b>	<b>71,097</b>	<b>34,361</b>	<b>37,555</b>	<b>269,119</b>			
PE	267	92	144	31	0	267	0	0

Forested areas in the southern portion of the county within the Custer-Gallatin NF and Northern Cheyenne IR were surveyed in 2016. The only mortality agent identified by ADS was PE which caused mortality at very low levels in 2016. Substantial PE-caused mortality occurred in 2013 following the 2012 severe drought year in the Northern Cheyenne IR and surrounding Custer-Gallatin NF but declined to low levels in 2014 and has since remained there based on ground and aerial surveys. PP host is of a size class and density that is considered susceptible to further PE-attack should severe drought conditions return to this area.

## Sanders County

### Forestland, Mortality and Defoliation by Ownership and Severity (1,732,389 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>1,449,333</b>	<b>914,708</b>	<b>5,567</b>	<b>62,826</b>	<b>466,233</b>			
<b>BWA</b>	62	62	-	-	-	40	22	
<b>DFB</b>	2,508	2,223	20	206	60	1,442	740	327
<b>Drought</b>	109		54	55	-			109
<b>FE</b>	2,387	1,979	47	308	52	1,107	1,013	267
<b>LNC</b>	204	191	-	13	-			204
<b>MPB-LPP</b>	1,187	1,013	34	138	2	529	429	229
<b>MPB-PP</b>	189	85	38	38	28	163		25
<b>MPB-WWP</b>	2	-	-	2	-	2		
<b>PE</b>	21	17	4		-	12	9	
<b>SAF Mort</b>	1,875	1,830	32	12	1	1,386	330	159
<b>Windthrow</b>	104	77	18	8	-		2	102
<b>WPB</b>	8	8	-	-	-	8		
<b>WSBW</b>	17,285	11,987	2,678	2,188	431	16,451		834

Similar forested areas were surveyed in 2016 as in 2015 within Sanders County. WSBW remained active in the county with notable pockets west of Hot Springs, and in the western portion of the county. MPB activity in LPP declined in recent years but continues at similar low levels in 2016 as was detected in 2015. Similarly, DFB activity was detected at low levels in 2016 consistent with the area impacted in 2015.

Two areas with LNC were identified at the north end of the county. One area was between Snake Creek and E Fork Bull River and the other near Rock Creek. A number of small pockets of wind damage were observed on the Kaniksu NF. Drought symptoms on western redcedar were seen in an area east of Camas Prairie. Armillaria root disease and WLDM (MFO-TR-16-22) were impacting stands on the Cabinet RD of the Kootenai NF. Armillaria root disease is causing mortality within the Marten-Powers Analysis Area, including Marten Creek Campground (MFO-TR-16-24). A large analysis area, Elk-Rice, on the Cabinet RD, in the western portion of the county was examined (MFO-TR-16-23). Several root diseases were found, including Armillaria, laminated root disease, Heterobasidion root disease, schweinitzii root and butt rot, and tomentosus root disease affecting DF, GF, WH, and SAF. A project area on the Superior RD known as Two Short had Armillaria root disease and laminated root disease of DF scattered across the area causing mortality (MFO-TR-16-30). Some of the stands also had DFDM.

The root diseases known to occur in this county are Heterobasidion root disease, Armillaria root disease, laminated root disease, and schweinitzii root and butt rot. The tree species most affected are DF and true firs. Heterobasidion root disease is known to occur in PP, while tomentosus root rot is known to

occur in localized areas in the county, affecting DF and ES. WPBR is common in both WWP and WBP. DFDL, LPPDM, and WLDM are present and common in the county.

## Silver Bow County

### Forestland, Mortality and Defoliation by Ownership and Severity (446,513 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>249,888</b>	<b>138,343</b>	<b>25,881</b>	<b>11,469</b>	<b>74,195</b>			
DFB	60	48	6	4	2	60	-	-
Dieback	30	-	5	25	-	5	-	25
MPB-High Elev	9	4	-	3	2	9	-	-
MPB-LPP	8	8	-	-	-	8	-	-
SAF Mort	28	28	-	-	-	4	24	-
<b>WSBW</b>	<b>46,173</b>	<b>22,945</b>	<b>2,804</b>	<b>17,578</b>	<b>2,846</b>	<b>20,588</b>	<b>-</b>	<b>25,585</b>

Nearly the entire county was surveyed in 2016, over twice the area flown in 2015. Areas of overlap were along the NW county border including the Fleecer Mountains and the south end of the Boulder range (north of Butte). Despite an increase in area flown, MPB, DFB and SAF mortality were all under 100 detected acres. However, WSBW increased significantly, from 3,209 acres in 2015 to 46,173 acres in 2016. The increase can be attributed largely to increased flight coverage in 2016, although in areas flown both years, an increase in impacted acres is also visible.

About 25 acres of QA dieback was observed along Fly Creek located in the center of the county near Interstate 15, 3.5 miles south of Deer Lodge Pass. An additional 5 acre polygon of QA dieback was observed about 1.3 miles south of King and Queen Hill near the border with Madison County.

WPBR is common in WBP and LP. LPPDM occurs in the county.

## Stillwater County

### Forestland, Mortality and Defoliation by Ownership and Severity (99,760 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>261,628</b>	<b>115,855</b>	<b>5,336</b>	<b>5,336</b>	<b>135,101</b>			
MPB-High Elev	10	8	-	2	-	10	-	-
SAF Mort	10	10	-	-	-	10	-	-
SB	2	2	-	-	-	2	-	-
<b>WSBW</b>	<b>1,059</b>	<b>827</b>	<b>-</b>	<b>232</b>	<b>-</b>	<b>762</b>	<b>-</b>	<b>297</b>

Aerial surveys were limited to the southwestern portion of Stillwater County in 2016. WSBW occurred at low levels similar to that noted during 2015 flights. No other insect activity was notable in 2016.

## Sweet Grass County

### Forestland, Mortality and Defoliation by Ownership and Severity (363,067 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>405,224</b>	<b>238,988</b>	<b>9,659</b>	<b>3,643</b>	<b>152,934</b>			
DFB	4	2	-	2	-	4	-	-
MPB-High Elev	30	30	-	-	-	30	-	-
MPB-LPP	2	2	-	-	-	2	-	-
SAF Mort	62	62	-	-	-	22	40	-
WPBR	16	16	-	-	-	16	-	-
<b>WSBW</b>	<b>22,159</b>	<b>10,485</b>	<b>377</b>	<b>11,029</b>	<b>269</b>	<b>8,306</b>	<b>-</b>	<b>13,853</b>

Similar areas were aerially surveyed in the northwestern and southern portions of Sweet Grass County in 2016 and 2015. WSBW-caused defoliation continued in DF within the county in 2016 at levels similar to those detected in 2015. Defoliation was primarily detected in federally managed lands. MPB activity, which declined substantially to low levels in 2015, was detected at minimal levels in 2016 across surveyed portions of the county.

WPBR has been found in WBP and LP in the county. Several locations with WPBR were aerially detected near Contact Mountain, and between Pickett Pin and Iron Mountains, in the southern portion of the county. Tomentosus root rot, schweinitzii root and butt rot, and stem decays affect over-mature conifers in the county.

## Teton County

### Forestland, Mortality and Defoliation by Ownership and Severity (277,128 ac flown)

Damage Agent	Ownership					Damage Severity (acres)		
	Total	USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>246,030</b>	<b>195,733</b>	<b>23,750</b>	<b>7,618</b>	<b>18,929</b>			
DFB	34	22	4	6	2	34	-	-
MPB-High Elev	26	20	-	4	2	26	-	-
MPB-LPP	8	6	2	-	-	8	-	-
SAF Mort	199	197	2	-	-	54	62	83
<b>WSBW</b>	<b>5,215</b>	<b>1,982</b>	<b>1,194</b>	<b>1,140</b>	<b>899</b>	<b>4,408</b>	<b>-</b>	<b>807</b>

The insect causing the most damage was WSBW. The number of acres with WSBW defoliation continues to increase from 4,179 acres in 2015 to 5,215 acres in 2016 including a 5-fold increase along the Front Range. A small portion of the acres defoliated (a few hundred out of 5,215) were in an area not surveyed in 2015. MPB in all species of pines remained at low and scattered levels. The number of acres of DFB-caused tree mortality increased from 2 to 34. SAF mortality significantly increased and was recorded on almost 200 acres in 2016 up from 59 acres in 2015.

WPBR is common in WBP and LP in this county. Armillaria root disease has caused conifer and QA mortality. Tomentosus root rot and schweinitzii root and butt rot are causing damage in over mature conifers in parts of this county.

## Wheatland County

### Forestland, Mortality and Defoliation by Ownership and Severity (259,156 ac flown)

Damage Agent	Total	Ownership				Damage Severity (acres)		
		USFS	Other Fed	Private	State	Low	Mod	High
<b>Forestland</b>	<b>83,381</b>	<b>49,411</b>	<b>-</b>	<b>7,720</b>	<b>26,249</b>			
DFB	4	2	-	2	-	4	-	-
MPB-High Elev	6	4	-	2	-	6	-	-
MPB-LPP	2	2	-	-	-	2	-	-
MPB-PP	16	12	-	4	0	16	-	-
SAF Mort	2	2	-	-	-	2	-	-
<b>WSBW</b>	<b>23,275</b>	<b>20,140</b>	<b>67</b>	<b>2,919</b>	<b>149</b>	<b>10,856</b>	<b>-</b>	<b>12,419</b>

Damage from all insects was in forested stands in the northwest portion of the county in the Castle and Little Belt Mountain ranges. The number of acres defoliated by WSBW continued to increase and nearly doubled between 2015 (12,751 acres) and 2016 (23,275 acres). MPB and DFB remained at very low levels. A few acres of subalpine fir mortality were recorded.

WPBR occurs in LP in this county.

**Table 1. Forest Mortality, Defoliation, and Other Damage on Montana National Forests, National Parks, and Tribal Lands, 2016**

<b>Administrative Unit/Damage Agent</b>	<b>Severity*</b>			
<b>BEAVERHEAD NF</b>				
<b>DILLON RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Decline	0	17	0	17
Douglas-fir Beetle	71	0	0	71
Fire	0	0	36	36
Mountain Pine Beetle (HE5NP)	234	0	17	252
Mountain Pine Beetle (LPP)	1,652	11	0	1,664
Subalpine Fir Mortality	54	11	0	65
Spruce beetle	2	0	0	2
Western Spruce Budworm	7,585	0	5,660	13,245
<b>MADISON RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	20	0	0	20
Mountain Pine Beetle (HE5NP)	4	0	0	4
Mountain Pine Beetle (LPP)	46	0	0	46
Mountain Pine Beetle (WWP)	2	0	0	2
Subalpine Fir Mortality	85	79	0	164
Spruce beetle	127	10	0	136
Western Spruce Budworm	11,236	0	4,411	15,646
<b>SHERIDAN RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	8	0	0	8
Mountain Pine Beetle (HE5NP)	8	0	0	8
Mountain Pine Beetle (LPP)	48	0	0	48
Mountain Pine Beetle (WWP)	2	0	0	2
Subalpine Fir Mortality	98	0	0	98
Spruce beetle	22	0	0	22
Unknown Defoliator	0	0	581	581
Western Spruce Budworm	9,860	0	9,840	19,701
<b>WISDOM RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	4	0	0	4
Douglas-fir Beetle	43	0	0	43
Fire	0	0	47	47
Mountain Pine Beetle (HE5NP)	308	0	38	347
Mountain Pine Beetle (LPP)	377	0	0	377
Subalpine Fir Mortality	89	0	0	89
Spruce beetle	8	0	0	8
Western Spruce Budworm	550	0	4,703	5,254

Administrative Unit/Damage Agent	Severity			Total Acres
	Low	Moderate	High	
<b>WISE RIVER RD</b>				
Douglas-fir Beetle	36	0	0	36
Fire	0	0	60	60
Mountain Pine Beetle (HE5NP)	117	7	0	124
Mountain Pine Beetle (LPP)	138	0	0	138
Subalpine Fir Mortality	62	73	171	306
Spruce beetle	10	0	0	10
Western Spruce Budworm	8,101	0	4,760	12,861
<b><u>BITTERROOT NF</u></b>				
<b>DARBY RD</b>				
Balsam Wooly Adelgid	57	0	0	57
Douglas-fir Beetle	53	0	0	53
Mountain Pine Beetle (LPP)	29	0	0	29
Mountain Pine Beetle (PP)	24	0	0	24
Pine Engraver Beetle	2	0	0	2
Subalpine Fir Mortality	30	26	0	56
White Pine Beetle	2	0	0	2
Western Spruce Budworm	4,330	0	1,434	5,764
<b>STEVENSVILLE RD</b>				
Balsam Wooly Adelgid	46	0	0	46
Douglas-fir Beetle	46	0	0	46
Mountain Pine Beetle (HE5NP)	8	0	0	8
Mountain Pine Beetle (LPP)	66	143	131	340
Mountain Pine Beetle (PP)	24	0	0	24
Pine Butterfly		0	8	8
Pine Engraver Beetle	4	0	0	4
Subalpine Fir Mortality	43	97	29	170
Unknown Defoliator		0	24	24
White Pine Beetle	12	0	0	12
Western Spruce Budworm	5,113	0	827	5,940
<b>SULA RD</b>				
Balsam Wooly Adelgid	1	0	6	7
Douglas-fir Beetle	16	2	0	18
Mountain Pine Beetle (LPP)	60	97	82	239
Mountain Pine Beetle (PP)	13	0	0	13
Pine Engraver Beetle	8	0	197	205
Subalpine Fir Mortality	56	6	0	62
Spruce Beetle	2	0	0	2

<b>Administrative Unit/Damage Agent</b>	<b>Severity</b>			<b>Total Acres</b>
<b>SULA RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Western Pine Beetle	6	0	0	6
Western Spruce Budworm	3,202	0	1,539	4,740
<b>WEST FORK RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	25	29	4	58
Douglas-fir Beetle	434	45	24	503
Mountain Pine Beetle (HE5NP)	2	0	0	2
Mountain Pine Beetle (LPP)	24	0	0	24
Mountain Pine Beetle (PP)	54	0	0	54
Subalpine Fir Mortality	98	36	7	141
Spruce beetle	2	0	0	2
Western Pine Beetle	10	0	0	10
Western Spruce Budworm	481	0	81	561
<b><u>CUSTER NF</u></b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
<b>ASHLAND RD</b>				
Pine Engraver Beetle	768	0	0	768
<b>BEARTOOTH RD</b>				
Douglas-fir Beetle	2	0	0	2
Mountain Pine Beetle (HE5NP)	70	0	0	70
Mountain Pine Beetle (WWP)	2	0	0	2
Subalpine Fir Mortality	133	0	0	133
Spruce beetle	2	0	0	2
Western Spruce Budworm	2,054	0	1,055	3,108
Unknown Mortality	2	0	0	2
<b>SIOUX RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Pine Engraver Beetle	75	0	0	75
<b><u>DEER LODGE NF</u></b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
<b>BUTTE RD</b>				
Douglas-fir Beetle	46	0	0	46
Mountain Pine Beetle (HE5NP)	0	0	0	0
Mountain Pine Beetle (LPP)	2	0	0	2
Subalpine Fir Mortality	8	24	0	32
Western Spruce Budworm	10,264	0	9,724	19,988
<b>DEER LODGE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	10	0	0	10
Mountain Pine Beetle (HE5NP)	39	0	0	39
Mountain Pine Beetle (LPP)	34	0	0	34
Subalpine Fir Mortality	10	0	0	10
Windthrow	0	0	17	17

Administrative Unit/Damage Agent	Severity			Total Acres
	Low	Moderate	High	
<b>DEER LODGE RD</b>				
Western Spruce Budworm	4,901	0	3,316	8,217
<b>JEFFERSON RD</b>				
Mountain Pine Beetle (LPP)	28	0	0	28
Mountain Pine Beetle (WWP)	4	0	0	4
Subalpine Fir Mortality	2	0	0	2
Western Spruce Budworm	22	0	0	22
<b>PHILIPSBURG RD</b>				
Balsam Woolly Adelgid	2	0	0	2
Douglas-fir Beetle	34	0	0	34
Fire	0	0	5	5
Mountain Pine Beetle (HE5NP)	20	21	0	41
Mountain Pine Beetle (LPP)	237	0	0	237
Subalpine Fir Mortality	141	7	0	148
Spruce beetle	4	0	0	4
White Pine Blister Rust	2	0	0	2
Western Spruce Budworm	8,279	0	11,676	19,955
<b><u>FLATHEAD NF</u></b>				
<b>GLACIER VIEW RD</b>				
Douglas-fir Beetle	22	0	0	22
Fir Engraver Beetle	14	0	0	14
Mountain Pine Beetle (HE5NP)	10	0	0	10
Mountain Pine Beetle (LPP)	12	0	0	12
Subalpine Fir Mortality	392	162	48	603
Windthrow	0	0	2	2
Western Spruce Budworm	1,310	0	2,383	3,693
<b>HUNGRY HORSE RD</b>				
Balsam Woolly Adelgid	8	0	0	8
Douglas-fir Beetle	282	34	28	344
Fir Engraver Beetle	67	10	0	76
Mountain Pine Beetle (HE5NP)	2	0	0	2
Mountain Pine Beetle (LPP)	65	0	22	86
Mountain Pine Beetle (PP)	6	0	0	6
Pine Engraver Beetle	8	0	0	8
Subalpine Fir Mortality	134	117	25	276
Western Spruce Budworm	12,653	0	3,774	16,428
<b>SPOTTED BEAR RD</b>				
Douglas-fir Beetle	24	0	0	24
Fir Engraver	4	0	0	4

<b>Administrative Unit/Damage Agent</b>	<b>Severity</b>			
<b>SPOTTED BEAR RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Mountain Pine Beetle (LPP)	12	37	0	49
Pine Engraver	4	0	0	4
Subalpine Fir Mortality	14	0	27	41
Western Spruce Budworm	14,993	0	6,299	21,292
<b>SWAN LAKE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	2	0	0	2
Douglas-fir Beetle	775	468	227	1,470
Drought	0	0	902	902
Fir Engraver Beetle	766	1,228	71	2,065
Larch Needle Cast	0	2	140	142
Mountain Pine Beetle (LPP)	8		0	8
Mountain Pine Beetle (PP)	10		0	10
Pine Engraver Beetle	0	6	0	7
Subalpine Fir Mortality	195	473	7	675
Windthrow	0	0	13	13
Western Pine Beetle	2	0	0	2
Western Spruce Budworm	6,607	0	3,886	10,493
<b>TALLY LAKE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	0	18	35	53
Douglas-fir Beetle	150	24	47	220
Drought	10	0	0	10
Fir Engraver Beetle	43	31	60	134
Mountain Pine Beetle (PP)	2	0	0	2
Subalpine Fir Mortality	118	6	39	163
Western Spruce Budworm	3,197	0	301	3,498
<b><u>GALLATIN NF</u></b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
<b>BIG TIMBER RD</b>				
Douglas-fir Beetle	8	0	0	8
Mountain Pine Beetle (HE5NP)	14	0	0	14
Mountain Pine Beetle (LPP)	8	0	0	8
Subalpine Fir Mortality	31	225	0	255
White Pine Blister Rust	16	0	0	16
Western Spruce Budworm	4,575	0	4,840	9,416
<b>BOZEMAN RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	43	0	0	43
Fire	0	0	0	0
Mountain Pine Beetle (HE5NP)	22	0	0	22
Mountain Pine Beetle (LPP)	78	131	0	210

<b>Administrative Unit/Damage Agent</b>	<b>Severity</b>			
<b>BOZEMAN RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Subalpine Fir Mortality	74	0	0	74
Spruce beetle	2	0	0	2
White Pine Blister Rust	40	0	0	40
Western Spruce Budworm	5,738	0	27,102	32,840
<b>GARDINER RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	2	0	0	2
Mountain Pine Beetle (HE5NP)	4	0	0	4
Mountain Pine Beetle (LPP)	4	0	0	4
Subalpine Fir Mortality	30	0	0	30
Spruce beetle	0	0	0	0
Western Spruce Budworm	314	0	4,926	5,240
<b>HEBGEN LAKE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	6	0	0	6
Mountain Pine Beetle (HE5NP)	10	0	0	10
Mountain Pine Beetle (LPP)	92	0	0	92
Subalpine Fir Mortality	154	0	0	154
Unknown Defoliator	19	0	0	19
Western Spruce Budworm	50	0	16	66
<b>LIVINGSTON RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	26	24	0	50
Mountain Pine Beetle (HE5NP)	12	0	0	12
Mountain Pine Beetle (LPP)	10	0	0	10
Subalpine Fir Mortality	28	0	0	28
Western Spruce Budworm	6,645	0	8,019	14,664
White Pine Blister Rust	26	24	0	50
<b><u>HELENA NF</u></b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
<b>HELENA RD</b>				
Douglas-fir Beetle	33	8	4	45
Mountain Pine Beetle (LPP)	13	0	0	13
Mountain Pine Beetle (PP)	2	0	0	2
Mountain Pine Beetle (WWP)	0	0	1	1
Subalpine Fir Mortality	18	0	0	18
Western Spruce Budworm	9,693	0	9,683	19,377
<b>LINCOLN RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	142	22	49	213
Larch Needle Cast	0	0	119	119
Mountain Pine Beetle (LPP)	12	21	0	33
Mountain Pine Beetle (PP)	4	0	0	4

<b>Administrative Unit/Damage Agent</b>	<b>Severity</b>			
<b>LINCOLN RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Pine Engraver Beetle	0	0	0	0
Subalpine Fir Mortality	258	69	17	344
Western Spruce Budworm	2,478	0	3,601	6,079
<b>TOWNSEND RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	108	53	8	168
Mountain Pine Beetle (HE5NP)	2	0	0	2
Mountain Pine Beetle (LPP)	8	0	0	8
Subalpine Fir Mortality	159	32	0	190
Western Spruce Budworm	6,533	0	7,109	13,643
Pine Engraver Beetle	108	53	8	168
<b><u>KOOTENAI NF</u></b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
<b>CABINET RD</b>				
Balsam Woolly Adelgid	38	22	12	72
Douglas-fir Beetle	371	365	97	833
Fir Engraver Beetle	911	756	217	1,884
Larch Needle Cast	0	0	191	191
Mountain Pine Beetle (LPP)	326	379	223	928
Mountain Pine Beetle (PP)	41	0	0	41
Pine Engraver Beetle	4	0	0	4
Subalpine Fir Mortality	958	324	159	1,441
Windthrow	0	2	75	77
Western Spruce Budworm	1,292	0	127	1,420
<b>FISH RIVER RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	383	591	392	1,367
Drought	0	0	0	0
Fir Engraver Beetle	163	117	103	383
Larch Needle Cast	0	0	5	5
Mountain Pine Beetle (LPP)	55	2	0	57
Mountain Pine Beetle (PP)	25	0	0	25
Subalpine Fir Mortality	182	0	7	189
Western Spruce Budworm	713	0	0	713
Pine Engraver Beetle	383	591	392	1,367
<b>FORTINE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	2	0	0	2
Douglas-fir Beetle	193	55	50	298
Fir Engraver Beetle	39	18	2	59
Mountain Pine Beetle (LPP)	4	0	0	4
Mountain Pine Beetle (PP)	6	0	0	6

Administrative Unit/Damage Agent	Severity			Total Acres
	Low	Moderate	High	
<b>FORTINE RD</b>				
Subalpine Fir Mortality	321	149	27	497
Western Spruce Budworm	1,480	0	1,525	3,005
<b>LIBBY RD</b>				
Douglas-fir Beetle	429	19	52	500
Drought	20	0	0	20
Fir Engraver Beetle	543	288	42	873
Larch Needle Cast	0	0	83	83
Mountain Pine Beetle (LPP)	18	0	27	45
Mountain Pine Beetle (PP)	16	0	0	16
Mountain Pine Beetle (WWP)	2	0	0	2
Subalpine Fir Mortality	152	87	41	281
Spruce beetle	2	0	0	2
Western Pine Beetle	2	0	0	2
White Pine Blister Rust	24	0	0	24
Western Spruce Budworm	72	0	129	201
<b>REXFORD RD</b>				
Douglas-fir Beetle	128	0	3	131
Drought	24	0	2	26
Fir Engraver Beetle	4	0	0	4
Mountain Pine Beetle (LPP)	28	0	0	28
Mountain Pine Beetle (PP)	177	126	51	354
Subalpine Fir Mortality	106	19	0	125
White Pine Blister Rust	652	0	268	920
Western Spruce Budworm	128	0	3	131
<b>THREE RIVERS RD</b>				
Balsam Woolly Adelgid	8	2	0	10
Douglas-fir Beetle	263	1	117	382
Fir Engraver Beetle	239	24	30	292
Larch Needle Cast	0	15	0	15
Mountain Pine Beetle (LPP)	70	97	22	189
Mountain Pine Beetle (PP)	30	0	0	30
Mountain Pine Beetle (WWP)	2	0	0	2
Pine Engraver Beetle	2	0	0	2
Subalpine Fir Mortality	427	43	0	470
Windthrow	0	7	90	96
White Pine Blister Rust	121	0	0	121
Western Spruce Budworm	776	0	163	939

<b>Administrative Unit/Damage Agent</b>	<b>Severity</b>			
<b><u>LEWIS AND CLARK NF</u></b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
<b>JUDITH RD</b>				
Douglas-fir Beetle	58	0	0	58
Mountain Pine Beetle (HE5NP)	24	0	0	24
Mountain Pine Beetle (LPP)	90	0	0	90
Mountain Pine Beetle (PP)	10	0	0	10
Subalpine Fir Mortality	63	0	0	63
Windthrow	0	0	69	69
Western Spruce Budworm	27,418	0	43,952	71,370
<b>KINGS HILL RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	128	23	7	158
Dieback	0	0	2	2
Mountain Pine Beetle (HE5NP)	14	0	0	14
Mountain Pine Beetle (LPP)	99	0	0	99
Mountain Pine Beetle (PP)	14	0	0	14
Pine Engraver Beetle	2	0	0	2
Subalpine Fir Mortality	100	0	0	100
Windthrow	0	0	30	30
Western Spruce Budworm	6,012	0	7,413	13,425
<b>MUSSELSHELL RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	41	10	0	51
Dieback	0	0	13	13
Mountain Pine Beetle (HE5NP)	6	0	0	6
Mountain Pine Beetle (LPP)	6	0	0	6
Mountain Pine Beetle (PP)	26	0	0	26
Mountain Pine Beetle (WWP)	2	0	0	2
Pine Engraver Beetle	22	0	0	22
Subalpine Fir Mortality	7	0	0	7
Western Spruce Budworm	29,706	0	32,391	62,097
<b>ROCKY MOUNTAIN RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	34	0	0	34
Dieback	0	0	16	16
Mountain Pine Beetle (HE5NP)	20	0	0	20
Mountain Pine Beetle (LPP)	12	0	0	12
Pine Engraver Beetle	2	0	0	2
Subalpine Fir Mortality	68	103	83	255
Western Spruce Budworm	2,247	0	1,050	3,298

<b>Administrative Unit/Damage Agent</b>	<b>Severity</b>			<b>Total Acres</b>
	<b>Low</b>	<b>Moderate</b>	<b>High</b>	
<b><u>LOLO NF</u></b>				
<b>MISSOULA RD</b>				
Douglas-fir Beetle	142	2	58	202
Fir Engraver Beetle	2	0	0	2
Larch Needle Cast	46	19	50	114
Mountain Pine Beetle (LPP)	194	37	0	231
Mountain Pine Beetle (PP)	48	0	0	48
Pine Engraver Beetle	11	62	0	73
Fir Engraver Beetle	51	23	21	95
Subalpine Fir Mortality	0	0	106	106
Windthrow	12	0	0	12
Western Pine Beetle	9,486	0	9,448	18,933
Western Spruce Budworm	2	0	0	2
<b>NINEMILE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	2	0	0	2
Douglas-fir Beetle	76	0	0	76
Fir Engraver Beetle	10	0	0	10
Larch Needle Cast	0	7	0	7
Mountain Pine Beetle (LPP)	115	59	0	174
Mountain Pine Beetle (PP)	57	0	0	57
Pine Engraver Beetle	0	0	79	79
Subalpine Fir Mortality	522	15	56	594
Scale Insects	0	0	189	189
Windthrow	0	0	146	146
Western Pine Beetle	2	0	0	2
Western Spruce Budworm	4,908	0	517	5,425
<b>PLAINS RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	370	104	105	579
Fir Engraver Beetle	23	0	9	32
Mountain Pine Beetle (LPP)	81	163	0	244
Mountain Pine Beetle (PP)	17	0	0	17
Pine Engraver Beetle	2	9	0	11
Subalpine Fir Mortality	27	0	0	27
Western Pine Beetle	6	0	0	6
Western Spruce Budworm	2,831	0	0	2,831
<b>SEELEY LAKE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	90	0	0	90
Larch Needle Cast	0	0	606	606
Mountain Pine Beetle (LPP)	16	7	0	23

<b>Administrative Unit/Damage Agent</b>	<b>Severity</b>			
<b>SEELEY LAKE RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Pine Engraver Beetle	4	0	0	4
Subalpine Fir Mortality	213	34	31	278
Western Spruce Budworm	3,667	0	6,272	9,939
<b>SUPERIOR RD</b>				
Balsam Woolly Adelgid	9	0	0	9
Douglas-fir Beetle	104	0	0	104
Fir Engraver Beetle	61	0	0	61
Larch Needle Cast	0	0	334	334
Mountain Pine Beetle (LPP)	56	0	0	56
Mountain Pine Beetle (PP)	40	17	0	56
Subalpine Fir Mortality	253	0	0	253
Spruce beetle	2	0	0	2
Western Pine Beetle	2	0	0	2
Western Spruce Budworm	5,390	0	1,418	6,808
<b>THOMPSON FALLS RD</b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Balsam Woolly Adelgid	2	0	0	2
Douglas-fir Beetle	560	184	81	825
Fir Engraver Beetle	112	0	0	112
Mountain Pine Beetle (LPP)	6	0	0	6
Mountain Pine Beetle (PP)	25	0	0	25
Pine Engraver Beetle	2	0	0	2
Subalpine Fir Mortality	358	6	0	364
Windthrow	0	0	41	41
Western Pine Beetle	2	0	0	2
Western Spruce Budworm	7,153	0	490	7,643
<b><u>BLACKFEET IR</u></b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	8	0	4	12
Dieback	0	1,885	3,366	5,251
Mountain Pine Beetle (LPP)	2	0	0	2
Subalpine Fir Mortality	6	10	76	92
Spruce Beetle	16	0	0	16
Windthrow	0	0	72	72
Western Spruce Budworm	1,657	0	807	2,464
<b><u>CROW IR</u></b>	<b>Low</b>	<b>Moderate</b>	<b>High</b>	<b>Total Acres</b>
Douglas-fir Beetle	2	0	0	2
Dieback	0	0	6	6
Marssonina Blight	0	0	40	40
Mountain Pine Beetle (HE5NP)	4	0	0	4

<b>Administrative Unit/Damage Unit</b>	<b>Severity</b>			<b>Total Acres</b>
	<b>Low</b>	<b>Moderate</b>	<b>High</b>	
<b><u>CROW IR</u></b>				
Mountain Pine Beetle (LPP)	2	0	0	2
Pine Engraver Beetle	104	0	0	104
Subalpine Fir Mortality	4	0	0	4
Western Spruce Budworm	2,026	0	1,510	3,536
<b><u>FLATHEAD IR</u></b>				
Douglas-fir Beetle	1,745	677	6	2,427
Drought	0	0	109	109
Fir Engraver Beetle	797	43	0	840
Mountain Pine Beetle (LPP)	103	51	0	155
Mountain Pine Beetle (PP)	172	0	0	172
Pine Engraver Beetle	16	0	0	16
Subalpine Fir Mortality	348	50	98	495
Windthrow	0	0	18	18
Western Spruce Budworm	4	0	0	4
<b><u>FORT BELKNAP IR</u></b>				
Douglas-fir Beetle	6	0	0	6
Dieback	0	0	17	17
Mountain Pine Beetle (LPP)	34	0	0	34
Mountain Pine Beetle (PP)	24	28	0	52
Pine Engraver Beetle	18	0	0	18
Windthrow	0	0	13	13
<b><u>NORTHERN CHEYENNE IR</u></b>				
Pine Engraver Beetle	218	0	0	218
<b><u>ROCKY BOYS IR</u></b>				
Douglas-fir Beetle	36	58	0	94
Dieback	0	0	324	324
Mountain Pine Beetle (LPP)	12	0	0	12
Mountain Pine Beetle (PP)	20	0	0	20
Pine Engraver Beetle	6	0	0	6
<b><u>GLACIER NP</u></b>				
Douglas-fir Beetle	222	68	33	323
Fir Engraver Beetle	84	0	23	106
Mountain Pine Beetle (LPP)	228	258	785	1,270
Subalpine Fir Mortality	692	307	453	1,452
Spruce Beetle	151	0	0	151
Western Spruce Budworm	6,365	0	649	7,014
<b><u>YELLOWSTONE NP</u></b>				
Balsam Woolly Adelgid	4	0	0	4

Administrative Unit/Damage Agent	Severity*			Total Acres
	Low	Moderate	High	
<b><u>YELLOWSTONE NP</u></b>				
Douglas-fir Beetle	38	0	0	38
Fire	0	0	20	20
Flooding	10	0	0	10
Mountain Pine Beetle (HE5NP)	53	0	0	53
Mountain Pine Beetle (LPP)	389	0	0	389
Subalpine Fir Mortality	321	0	664	985
Spruce Beetle	15	0	0	15
Western Spruce Budworm	2,884	0	3,539	6,423

\* Severity breakdowns for all damage except defoliators: Low = < 10% of trees impacted; Mod = 10-30%; High = >30%

\* Severity breakdowns for defoliators: Low is < 50% defoliation; High is ≥ 50% defoliation

**Table 2. Host Type Infested by Bark Beetles on all Ownership Statewide, 2016 (Acres)\***

INSECT <sup>1</sup>	USFS	OTHER FEDERAL	PRIVATE	STATE	TOTAL
BWA	314	2	131	0	447
DFB	9,279	2,969	1,881	710	14,839
FE	5,985	801	1,917	1,299	10,002
MPB -HE5NP	1,034	26	46	14	1,120
MPB-LPP	5,882	1,527	487	60	7,956
MPB-PP	542	333	605	116	1,596
MPB-WWP	15	4	67	7	93
PE	1,253	304	517	66	2,140
SAF	9,684	2,161	394	127	12,366
SB	195	171	5	2	373
WPB	58	4	30	10	102

<sup>1</sup> BWA = Balsam Woolly Adelgid; DFB = Douglas-Fir Beetle; FE Fir Engraver Beetle; MPB-HE5NP = Mountain Pine Beetle in High Elevation 5-Needle Pines (WBP & LP); MPB-LPP = Mountain Pine Beetle in Lodgepole Pine; MPB-PP = Mountain Pine Beetle in Ponderosa Pine; MPB-WWP = Mountain Pine Beetle in Western White Pine; PE = Pine Engraver Beetle; SAF = Subalpine Fir mortality complex; SB = Spruce Beetle; WPB = Western Pine Beetle

**Table 3. Bark Beetle Infestations Statewide (total acres impacted and current severity) 2014 – 2016**

INSECTS <sup>1</sup>	2014	2015	2016*			
	Acres	Acres	Acres	Low	Moderate	High
DFB	20,466	14,321	14,839	9,626	3,461	1,752
SB	1,166	1,137	373	364	10	0
FE	1,052	85	10,002	4,521	4,487	993
MPB	598,836	174,387	10,764	7,573	1,720	1,470
PE	2,024	1,281	2,140	1,772	91	277
SAF	4,235	2,329	12,366	7,962	2,753	1,651
WPB	22	50	102	102	0	0
<b>Total</b>	<b>627,801</b>	<b>193,590</b>	<b>50,586</b>	<b>31,920</b>	<b>12,522</b>	<b>6,143</b>

<sup>1</sup> DFB = Douglas-Fir Beetle; SB = Spruce Beetle; FE = Fir Engraver Beetle; PE = Pine Engraver Beetle; MPB = Mountain Pine Beetle; SAF = Subalpine Fir mortality complex; WPB = Western Pine Beetle

**Table 4. Douglas-fir Beetle – Caused Mortality on all Ownerships Statewide, 2014-2016**

Reporting Area	2014	2015	2016*			
	Acres	Acres	Acres	Low	Moderate	High
Beaverhead	1,702	436	177	177		
Bitterroot	252	408	620	549	47	24
Custer	382		2	2		
Deerlodge	872	275	128	118		
Flathead	1,831	1,841	2,081	1,253	526	302
Gallatin	859	665	109	85	24	
Garnets	112	103				
Helena	1,232	1,006	426	283	82	61
Kootenai	5,503	4,093	3,510	1,768	1,031	712
Lewis and Clark	1,077	1,302	302	261	33	7
Lolo	3,136	1,025	1,874	1,341	290	243
Blackfeet IR	32	131	10	6		4
Crow IR	24					
Flathead IR	2,382	2,553	2,332	1,649	677	6
Fort Belknap IR	52	16	2	2		
No. Cheyenne IR	0					
Rocky Boy's IR	267	127	36	18	18	
Glacier NP	728	300	320	218	68	33
Yellowstone NP <sup>1</sup>	26	44	38	38		
<b>Total</b>	<b>20,469</b>	<b>14,325</b>	<b>16,662</b>	<b>7,494</b>	<b>2,710</b>	<b>1,392</b>

\* Severity breakdowns for all damage except defoliators: Low= < 10% of trees impacted; Mod= 10-30%; High = >30%

\* Severity breakdown for defoliators: Low is <50% defoliation; High is ≥ 50% defoliation

**Table 5. Mountain Pine Beetle – Caused Mortality on State and Private Lands, Statewide, 2014-2016 (Acres)**

Reporting Area	2014				2015				2016			
	LPP*	PP	HE5NP	WWP	LPP	PP	HE5NP	WWP	LPP	PP	HE5NP	WWP
Beaverhead	12,332	31	223	0	3,448	4	188	0	64	0	26	0
Bitterroot	984	4,907	0	0	437	443	0	0	8	64	0	0
Custer	742	17	10	0	0	0	0	0	0	0	2	1
Deerlodge	8,018	61	2,144	0	663	12	300	0	22	4	6	0
Flathead	504	118	0	0	10	20	0	0	23	38	0	1
Gallatin	220	67	1,688	0	20	1	36	0	13	0	6	0
Garnets	21	181	0	0	37	175	0	0	24	92	0	0
Helena	178	308	4	0	10	126	0	0	7	49	0	8
Kootenai	746	67	0	2	420	12	0	145	18	10	0	0
Lewis and Clark	89	3,852	254	0	13	171	4	0	18	113	23	0
Lolo	2,854	463	0	0	2,308	84	0	0	29	108	0	1
Blackfeet IR	0	0	0	0	0	0	0	0	2	0	0	0
Crow IR	18	16	8	2	0	0	0	0	2	0	0	0
Flathead IR	870	540	0	0	0	6	0	0	16	38	0	0
Fort Belknap IR	34	96	0	0	2	0	0	0	34	2	0	0
No. Cheyenne IR	0	0	0	0	0	0	0	0	0	0	0	0
Rocky Boy's IR	324	6	0	0	8	0	0	0	2	9	0	0
Glacier NP	19	0	0	0	0	0	0	0	1	0	0	0
Yellowstone NP <sup>1</sup>	0	0	0	0	0	0	0	0	389	0	53	0
<b>Total</b>	<b>27,953</b>	<b>10,730</b>	<b>4,331</b>	<b>4</b>	<b>7,376</b>	<b>1,054</b>	<b>529</b>	<b>145</b>	<b>245</b>	<b>527</b>	<b>63</b>	<b>11</b>

\*LPP = Lodgepole Pine, PP = Ponderosa Pine, HE5NP = High Elevation Five Needle Pines, WWP = Western White Pine

**Table 6. Mountain Pine Beetle – Caused Mortality on all Federal Ownerships, Statewide, 2014-2016 (Acres)**

Reporting Area	2014				2015				2016			
	LPP	PP	HE5NP	WWP	LPP	PP	HE5NP	WWP	LPP	PP	HE5NP	WWP
Beaverhead	250,589	45	21,703	0	70,355	26	8,895	0	2,287	0	738	4
Bitterroot	80,687	17,890	2,076	0	25,142	1,726	957	0	637	135	10	0
Custer	777	28	2,968	0					0	0	72	4
Deerlodge	102,837	68	12,899	0	17,688	6	2,756	0	299	0	83	2
Flathead	997	46	4	0	6,252	24	0	4	176	22	12	0
Gallatin	2,018	35	7,071	0	764	5	642	0	340	0	66	0
Garnet	45	9	0	0	60	20	0	0	0	0	0	0
Helena	135	110	26	0	77	33	22	0	55	8	2	1
Kootenai	5,062	285	4	2	1,151	18	2	4,752	1,349	152	0	4
Lewis and Clark	2,050	3,609	481	0	171	98	294	0	217	52	64	2
Lolo	37,720	857	82	0	27,168	396	632	3	814	251	0	2
Blackfeet IR	0	0	0	0	4	0	0	0	16	0	0	0
Crow IR	0	0	0	0					9	0	18	0
Flathead IR	2	12	0	0	111	20	12	0	252	611	0	0
Fort Belknap IR	2	40	0	0	22	38	0	0	78	81	0	0
No. Cheyenne IR	0	0	0	0					0	0	0	0
Rocky Boy's IR	4	0	0	0	39	4	0	0	36	30	0	0
Glacier NP	2,474	2	0	0	2	0	0	0	301	0	0	0
Yellowstone NP <sup>1</sup>	404	0	220	0	297	0	56	0	7	0	42	0
<b>Total</b>	<b>485,803</b>	<b>23,036</b>	<b>47,534</b>	<b>2</b>	<b>149,303</b>	<b>2,414</b>	<b>14,268</b>	<b>4,759</b>	<b>6,873</b>	<b>1,342</b>	<b>1,107</b>	<b>19</b>

LPP = Lodgepole Pine; PP = Ponderosa Pine; HE5NP = 5 needle pines (WBP & LP); WWP = Western White Pine; <sup>1</sup>Yellowstone NP includes MT, ID and WY acres

**Table 7. Additional Bark Beetle-Caused Mortality on all Ownerships, Statewide, 2014-2016 (Acres)**

Reporting Area	<u>Spruce Beetle</u>			<u>Fir Engraver</u>			<u>Pine Engraver</u>			<u>Subalpine Fir Mortality</u>			<u>Western Pine Beetle</u>		
	2014	2015	2016	2014	2015	2016	2014	2015	2016	2014	2015	2016	2014	2015	2016
Beaverhead	248	436	181	0	0	0	0	0	0	251	132	820	0	0	0
Bitterroot	100	10	6	0	4	4	6	1,178	251	150	326	433	4	16	54
Custer	32	0	0	0	0	0	266	0	1,088	235	00	142	0	0	0
Deerlodge	132	0	4	0	0	0	30	0	0	102	36	225	2	0	0
Flathead	2	95	2	767	57	4,661	6	4	30	463	326	1,878	0	0	4
Gallatin	187	161	3	0	0	0	2	4	4	216	232	579	0	0	0
Garnets	0	20	0	0	0	0	0	0	34	12	10	48	0	0	0
Helena	66	0	0	0	0	0	6	12	12	108	52	583	8	2	0
Kootenai	6	43	4	233	10	4,007	2	0	10	898	112	3,224	0	0	4
Lewis and Clark	138	56	0	0	6	0	31	32	145	316	506	431	2	0	0
Lolo	142	28	2	36	2	388	632	2	192	624	194	1,829	4	26	36
Blackfeet IR	4	14	16	0	0	0	0	0	0	20	12	92	0	0	0
Crow IR	2		2	0	0	0	471	0	104	4	0	4	0	0	0
Flathead IR	2	11	0	10	6	840	121	4	16	124	105	495	0	6	4
Fort Belknap IR	0	0	0	0	0	0	0	37	18	0	2	0	0	0	0
No. Cheyenne IR	0		0	0	0	0	452	0	218	0	0	0	2	0	0
Rocky Boy's IR	0	4	4	0	0	0	0	0	6	0	2	0	0	0	0
Glacier NP	102	171	151	0	0	106	0	0	0	649	18	1,452	0	0	0
Yellowstone NP <sup>1</sup>	4	86	12	0	0	0	0	0	0	212	157	20	0	0	0
<b>Total</b>	<b>1,167</b>	<b>1,135</b>	<b>387</b>	<b>1,046</b>	<b>83</b>	<b>10,002</b>	<b>2,025</b>	<b>1,273</b>	<b>2,124</b>	<b>4,384</b>	<b>2,222</b>	<b>12,366</b>	<b>22</b>	<b>50</b>	<b>96</b>

<sup>1</sup>Yellowstone NP includes MT, ID, and WY acres

**Table 8. Western Spruce Budworm Defoliation by Reporting Area on all Ownerships, Statewide, 2014-2016 (Acres)**

<i>Reporting Area</i>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Beaverhead	53,401	42,312	70,207
Bitterroot	7,382	34,739	17,567
Custer	1,059	0	3,258
Deerlodge	15,327	49,657	91,661
Flathead	320,468	165,264	59,414
Gallatin	35,268	96,604	115,347
Garnets	59,470	4,460	0
Helena	116,120	276,220	48,666
Kootenai	39,796	44,673	7,549
Lewis and Clark	71,603	131,246	158,526
Lolo	82,636	279,311	64,878
Blackfeet IR	3,407	6,931	2,166
Crow IR	1,347	0	3,402
Flathead IR	17	39,183	7,407
Fort Belknap IR	0	62	0
No. Cheyenne IR	0	0	0
Rocky Boy's IR	207	161	0
Glacier NP	68,728	31,362	7,014
Yellowstone NP <sup>1</sup>	1,825	2,830	6,423
<b>Total</b>	<b>878,061</b>	<b>1,205,015</b>	<b>663,485</b>

## PUBLICATIONS-2016

- DeNitto, G.; Lockman, B.; Jackson, M. 2016. Spore trapping for Heterobasidion root disease in Como Forest Health Project area. **MFO-TR-16-01**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 6p.
- DeNitto, G.; Egan, J. 2016. Insect and disease observations on Ward Creek Property, BLM Missoula. **MFO-TR-16-29**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 7p.
- Egan, J.; Lockman, B. 2016. Insect and disease evaluation for Murphy Flats Project Area on the West Zone of the Lolo National Forest. **MFO-TR-16-03**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 14p.
- Egan, J.; Lockman, B. 2016. Insect and disease evaluation for Smith-Shields Forest Health project in the Crazy Mountains, Custer-Gallatin National Forest. **MFO-TR-16-08**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 17p.
- Egan, J.M.; Lockman, B. 2016. Insect activity and FHP funding review for East Zone, Lolo National Forest. **MFO-TR-16-20**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 10p.
- Egan, J.M. 2016. Insect activity and FHP funding proposal review for Beartooth Ranger District, Custer-Gallatin National Forest. **MFO-TR-16-15**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 3p.
- Egan, J.M.; Lockman, B. 2016. Evaluation of insect activity and projects proposed for FY17 FHP funding on the West Zone, Lolo National Forest. **MFO-TR-16-26**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 11p.
- Egan, J.M.; Lockman, B. 2016. Evaluation of insect activity and projects proposed for FY17 FHP funding for the western Districts of the Custer-Gallatin National Forest. **MFO-TR-16-27**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 8p.
- Fettig, C.J.; Steed, B.E., Bulaon, B.M.; Mortenson, L.A.; Progar, R.A.; Bradley, C.A.; Munson, A.S.; Mafra-Neto, A. 2016. Efficacy of SPLAT<sup>®</sup> Verb for protecting individual *Pinus contorta*, *Pinus ponderosa*, and *Pinus lambertiana* from mortality attributed to *Dendroctonus ponderosae*. Journal of the Entomological Society of British Columbia (on web at <http://journal.entsocbc.ca/index.php/journal/article/view/937>)
- Hagle, S.K.; Tucker, G.J.; Anderson, M.A. 2016. Root disease and other mortality agents on the Clearwater National Forest: 22-year results from Mex Mountain growth and mortality permanent plots. FHP Numbered Report No. 16-05. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 29p.
- Jackson, M.; Sturdevant, N. 2016. Holland Lake Developed Recreation Area (Flathead National Forest). **MFO-TR-16-02**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 5p.
- Jackson, M.; Sturdevant, N. 2016. Disease and insect evaluation in Stand #01100223010184 – Beaver Creek (Flathead National Forest). **MFO-TR-16-10**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 7p.

- Jackson, M. 2016. Forest disease evaluation of Crystal Lake and Thain Creek Campgrounds (Helena-Lewis & Clark National Forest). **MFO-TR-16-11**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 7p.
- Kegley, S.; Sturdevant, N. 2016. Effect of trap type on pitch moth trapping in western Montana. FHP Numbered Report No. 16-04. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 5p.
- Lockman, B.; Bush, R.; Barber, J. 2016. Assessing root disease presence, severity and hazard in northern Idaho and western Montana using Forest Inventory and Analysis (FIA) plots and the USFS Northern Region VMap database. FHP Numbered Report No. 16-07. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 26p.
- Lockman, I.B.; Kearns, H.S.J., eds. 2016. Forest root diseases across the United States. Gen. Tech. Rep. RMRS-GTR-342. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 55p.
- Lockman, B.; Egan, J. 2016. Savenac Nursery, Christmas tree plantation, Superior RD, Lolo NF. **MFO-TR-16-17**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 3p.
- Lockman, B.; Steed, B. 2016. Assessment of diseases and insects in N. Macy's silviculture certification stand, Three Rivers RD, Kootenai NF. **MFO-TR-16-18**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 8p.
- Lockman, B.; Steed, B. 2016. Assessment of Diseases and Insects in the Starry Goat Analyses Area, Three Rivers RD, Kootenai NF. **MFO-TR-16-18**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 26p.
- Lockman, B.; Steed, B. 2016. Assessment of diseases and insects in J. Durkin's Silviculture certification stand, Cabinet RD, Kootenai NF. **MFO-TR-16-22**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 7p.
- Lockman, B.; Egan, J. 2016. Assessment of diseases and insects in Two Short Project Area, Superior RD, Lolo NF. **MFO-TR-16-30**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 18p.
- McMahan, A.J.; Steed, B.E.; Lowrey, L.; Zweifler, M.O. 2016. FINDIT macro-enabled Excel calculator V2. Ft. Collins, CO: U.S. Department of Agriculture, Forest Service, Forest Health Technology Enterprise Team (FHTET).
- Miller, D. R.; Allison, J. D.; Crowe, C. M.; Dickenson, D. M.; Eglitis, A.; Hofstetter, R. W.; Munson, A. S.; Poland, T. M.; Reid, L. S.; Steed, B. E.; Sweeney, J. D. 2016. Pine sawyers (Coleoptera: Cerambycidae) attracted to  $\alpha$ -Pinene, monochamol and ipsenol in North America. *Journal of Economic Entomology* 109:1205-1214.
- Randall, C. 2016. US Fish and Wildlife National Bison Range weed biological control trip report, Dalmatian toadflax standardized impact monitoring protocol plots and spotted knapweed root sampling for biological control agents. **MFO-TR-16-05**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 21p.
- Randall, C. 2016. Badger Cabin yellow toadflax stem-mining weevil, *Mecinus janthinus*, biological control site visit, Lewis and Clark NF. **MFO-TR-16-06**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 15p.

- Randall, C. 2016. St. Johnswort biological control monitoring at the Lost Lake Trailhead and Mink Peak, Superior Ranger District, Lolo NF. **MFO-TR-16-43**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 9p.
- Steed, B.; Randall, C.; Barber, J.; Bush, R. 2016. Hazard rating bark beetle activity in pine species using the Northern Region vegetation map (R1-VMap). FHP Numbered Report No. 16-08. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 33p.
- Steed, B. 2016. Bark beetle concerns at Fort Belknap IR related to wind throw, 2016. **MFO-TR-16-14**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 3p.
- Steed, B.; Lockman, B. 2016. Assessment of Diseases and Insects in the Elk Rice Analyses Area, Cabinet RD, Kootenai NF. **MFO-TR-16-23**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest. 26p.
- Steed, B.; Lockman, B. 2016. Assessment of disease and insect concerns in Marten-Powers Analysis Area, Cabinet RD, Kootenai NF. **MFO-TR-16-24**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest. 14p.
- Steed, B.; Lockman, B. 2016. Insect and disease conditions on current and possible future FHP-funded projects, Kootenai NF. **MFO-TR-16-25**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest. 25p.
- Steed, B.; Jackson, M. 2016. Assessment of insects and diseases in the Red Rocks Farm Bill Area, Jefferson RD, Beaverhead-Deerlodge NF. **MFO-TR-16-38**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 33p.
- Steed, B. 2016. Insect concerns on the Beaverhead-Deerlodge National Forest relevant to vegetation management and FHP funding, 2016. **MFO-TR-16-40**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 13p.
- Sturdevant, N.; Kegley, S.; Hayes, C.; Lowrey, L.; Wakarchuk, D. 2016. Effects of verbenone and other repellents on protecting ponderosa and lodgepole pines from mountain pine beetle-caused mortality. FHP Numbered Report No. 16-03. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 15p.
- Sturdevant, N.J.; Kegley, S.J.; Crane, B.; Hayes, C. 2016. Evaluation of trapping and tree wrapping as management tools to reduce damage from Sequoia pitch moth at the Big Fork Tree Improvement Area. FHP Numbered Report No. 16-06. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 4p.
- Sturdevant, N.; Jackson, M. 2016. Evaluating insect and disease conditions at the Swan Lake Campground and the development of a vegetation management plan (Flathead National Forest). **MFO-TR-16-04**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 6p.
- Sturdevant, N.; Jackson, M. 2016. Douglas-fir beetle activity in wind throw in the Cabin Gulch Project Area (Helena-Lewis & Clark National Forest). **MFO-TR-16-13**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 8p.

- Sturdevant, N.; Jackson, M. 2016. Insect and disease activity in the Moose Creek Project Area (Helena-L &C National Forest). **MFO-TR-16-21**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 7p.
- Sturdevant, N.; Jackson, M. 2016. Insect and disease activity in the Gold Butterfly Analysis Area (Bitterroot National Forest). **MFO-TR-16-16**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 4p.
- Sturdevant, N.; Erickson, B. 2016. Restoring aspen by reducing Douglas-fir encroachment using Douglas-fir beetle tree baits. **MFO-TR-16-28**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 3p.
- Sturdevant, N. 2016. Potential for Douglas-fir beetle activity in the Holloway Drainage following a significant wind throw event-2016. **MFO-TR-16-32**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 9p.
- Sturdevant, N.J.; Jackson, M. 2016. Bark beetle activity and trends in response to the Trail Creek Fire and insect and disease activity in the Beaver Creek Campground, Flathead National Forest. **MFO-TR-16-34**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 6p.
- Sturdevant, N.J.; Jackson, M. 2016. Insect and disease conditions and trends in Stand 0135 in the Tenmile South-Helena Project Area; Riley Dopler's Certification Stand, Helena National Forest. **MFO-TR-16-39**. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Region, Forest Health Protection. 9p.
- U.S. Department of Agriculture, Forest Service, Forest Health Assessment and Applied Sciences Team. 2016. Digital Mobile Sketch Mapping (DMSM) Updates to Forest Health Survey with DMSM. 10p.

## COMMON AND SCIENTIFIC NAMES

Common Name	Pathogens	Primary Hosts
Annosus root disease (S-Type)	<i>Heterobasidion occidentale</i> Otrrosina & Garbelotto	DF, GF, SAF
(P-Type)	<i>Heterobasidion irregulare</i> Garbelotto & Otrrosina	PP
Armillaria root disease	<i>Armillaria ostoyae</i> (Romagn.) Herink	DF, GF, SAF, saplings of all conifers
Aspen heart rot	<i>Phellinus tremulae</i> (Bond.) Bond. & Borisov.	QA
Aspen shoot blight	<i>Venturia macularis</i> (Fr.) E. Muller & Arx	QA
Atropellis canker	<i>Atropellis piniphila</i> (Weir) Lohman & Cash	LPP
Black canker	<i>Ceratocystis fimbriata</i> Ellis & Halst.	QA
Black stain root disease	<i>Ophiostoma wageneri</i> (Goheen & F.W. Cobb ) Harrington	DF, PP
Comandra rust	<i>Cronartium comandrae</i> Pk.	LPP, PP
Diplodia shoot blight	<i>Diplodia pinea</i> (Desmaz.) J. Kickx fil.	PP
Dothistroma needle blight	<i>Mycosphaerella pini</i> Rost. In Munk	PP, LPP, LP
Dutch Elm Disease	<i>Ophiostoma ulmi</i> (Buisman) Nannf.	Elms
Dwarf mistletoes	<i>Arceuthobium</i> spp.	DF, LP, LPP, WL
Elytroderma needle disease	<i>Elytroderma deformans</i> (Weir) Darker	PP
Ganoderma	<i>Ganoderma applanatum</i> (Pers.) Pat.	QA
Indian paint fungus	<i>Echinodontium tinctorium</i> (Ell. & Ev.) Ell. & Ev.	GF, WH
Laminated root rot	<i>Phellinus weirii</i> (Murrill) R.L. Gilbertson.	DF, GF, SAF, WH
Larch needle blight	<i>Hypodermella laricis</i> Tub.	WL
Larch needle cast	<i>Meria laricis</i> Vuill.	WL
Marsonnina leaf spot	<i>Marsonnina populi</i> (Lib.) Magn.	QA
Red ray rot	<i>Dichomitus squalens</i> (P. Karst.) D.A. Reid	PP
Red ring rot	<i>Phellinus pini</i> (Thore :Fr.) A.Ames	DF, ES, PP, WL
Rhabdocline needle blight	<i>Rhabdocline pseudotsugae</i> Syd.	DF
Schweinitzii root and butt rot	<i>Phaeolus schweinitzii</i> (Fr. :Fr.) Pat.	Mainly DF, all conifers
Spruce broom rust	<i>Chrysomyxa arctostaphyli</i> Diet.	ES
Tomentosus root disease	<i>Onnia tomentosa</i> (Fr.) P. Karst.	ES, DF, LPP, SAF, WL
Western gall rust	<i>Endocronartium harknessii</i> (J.P. Moore) Y. Hiratsuka	PP, LPP
White pine blister rust	<i>Cronartium ribicola</i> J.C. Fisch.	LP, WBP, WWP
Balsam woolly adelgid	<i>Adelges piceae</i> Ratzeburg	GF, SAF
Douglas-fir beetle	<i>Dendroctonus pseudotsugae</i> Hopkins	DF
Douglas-fir tussock moth	<i>Orygia pseudotsugata</i> (McDunnough)	DF, ES, TF

## COMMON AND SCIENTIFIC NAMES

Common Name	Insects	Primary Hosts
Fall webworm	<i>Hyphantria cunea</i> (Drury)	CC
Fir engraver beetle	<i>Scolytis ventralis</i> LeConte	GF, SAF
Larch casebearer	<i>Coleophora laricella</i> (Hubner)	WL
Mountain pine beetle	<i>Dendroctonus ponderosae</i> Hopkins	All pines
Pine butterfly	<i>Neophasia menapia</i> (Felder & Felder)	PP
Pine engraver beetle	<i>Ips pini</i> (Say)	LPP, PP
Spruce beetle	<i>Dendroctonus rufipennis</i> Swaine	ES
Western balsam bark beetle	<i>Dryocoetes confuses</i> Swaine	SAF
Western pine beetle	<i>Dendroctonus brevicomis</i> LeConte	PP
Western spruce budworm	<i>Choristoneura occidentalis</i> Freeman	DF, GF, SAF, ES, WL

CC = chokecherry; DF = Douglas-fir; ES = Engelmann spruce; GF = grand fir; LP = limber pine; LPP = lodgepole pine; PP = ponderosa pine; QA = quaking aspen; SAF = subalpine fir; TF = true firs; WWP = western white pine; WH = western hemlock; WL = western larch; WBP = whitebark pine

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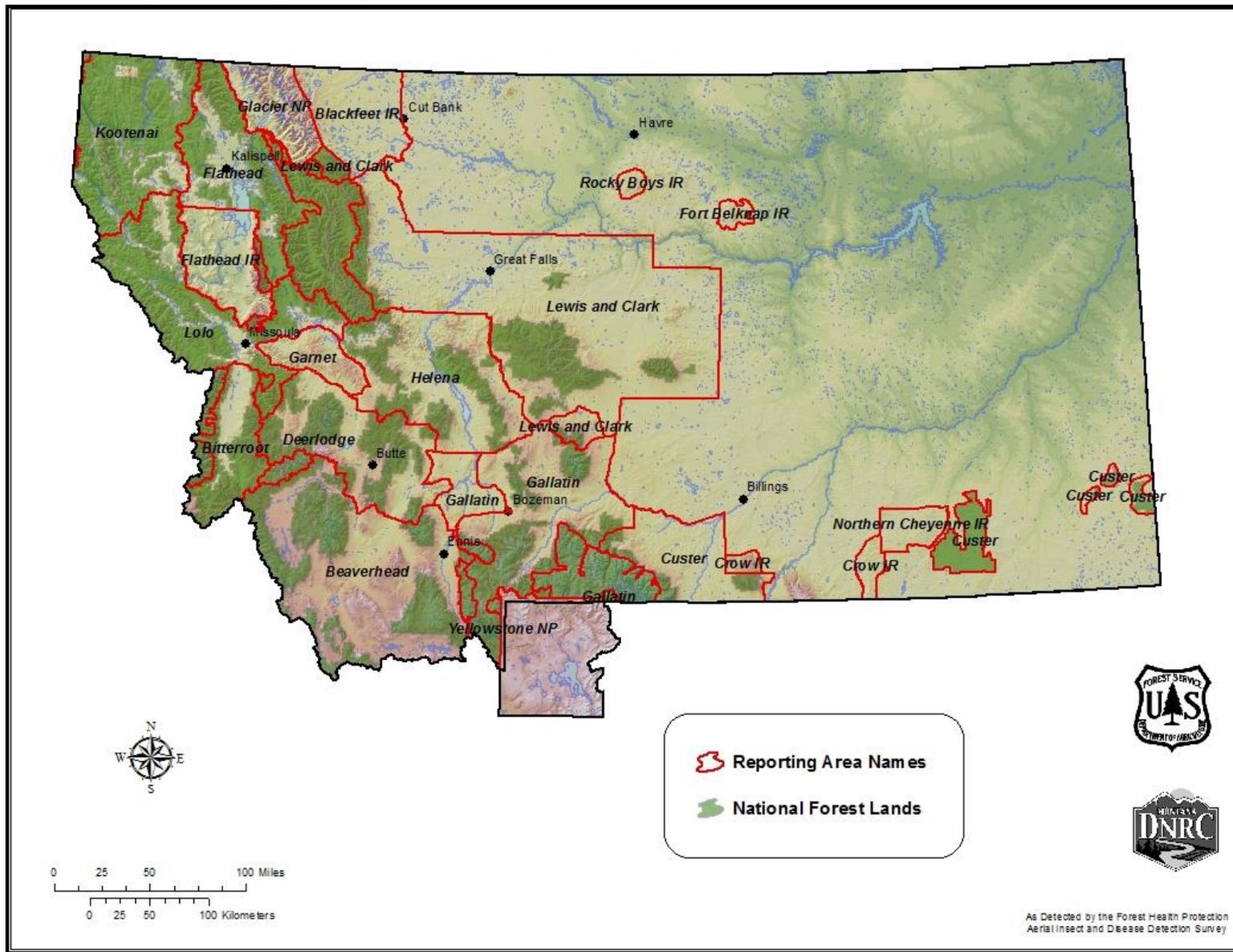
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Figure 1. Reporting Area Boundaries and National Forest Lands in Montana



**Figure 2. Areas Surveyed in 2016 by Forest Health Protection Aerial Detection Survey in Montana**

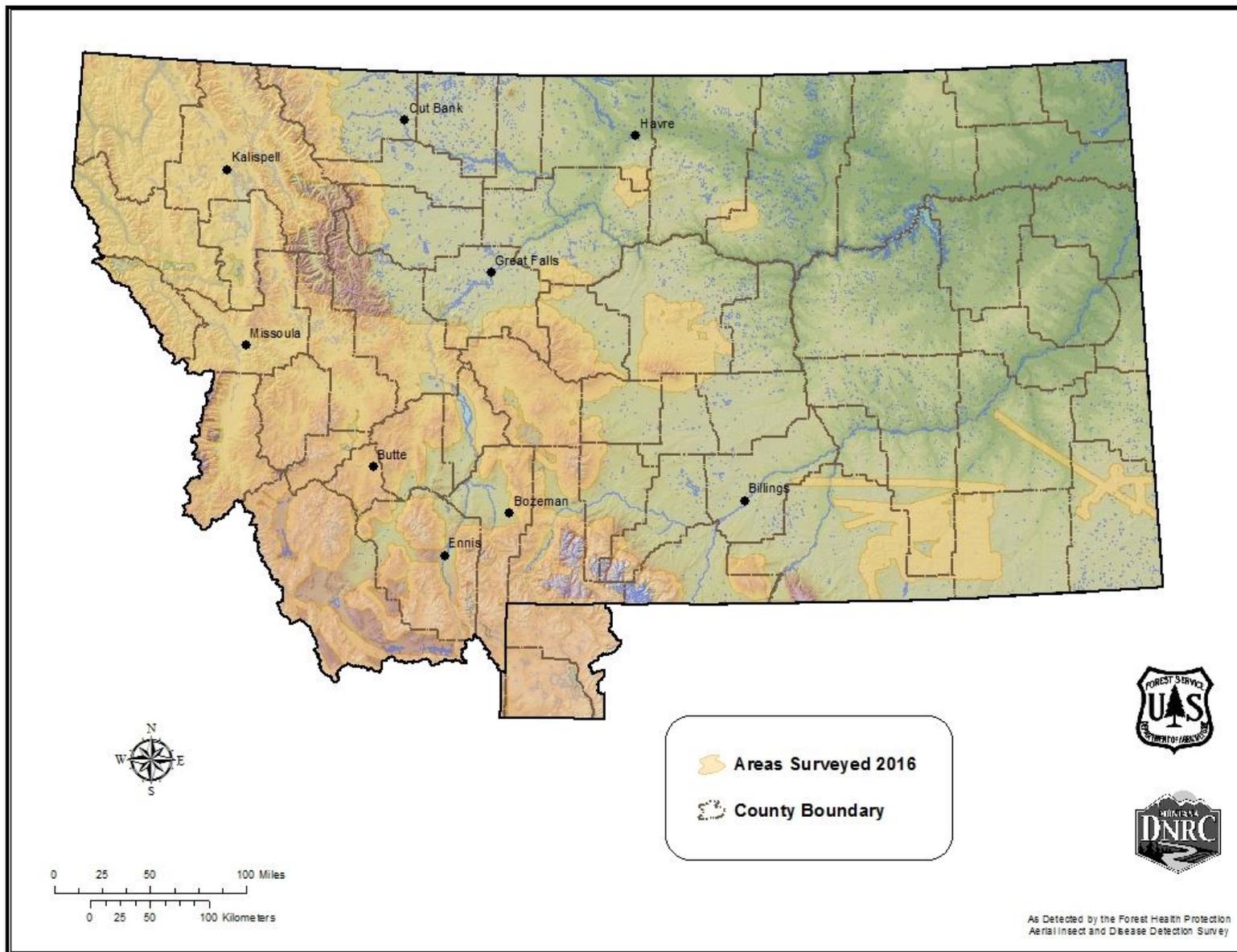
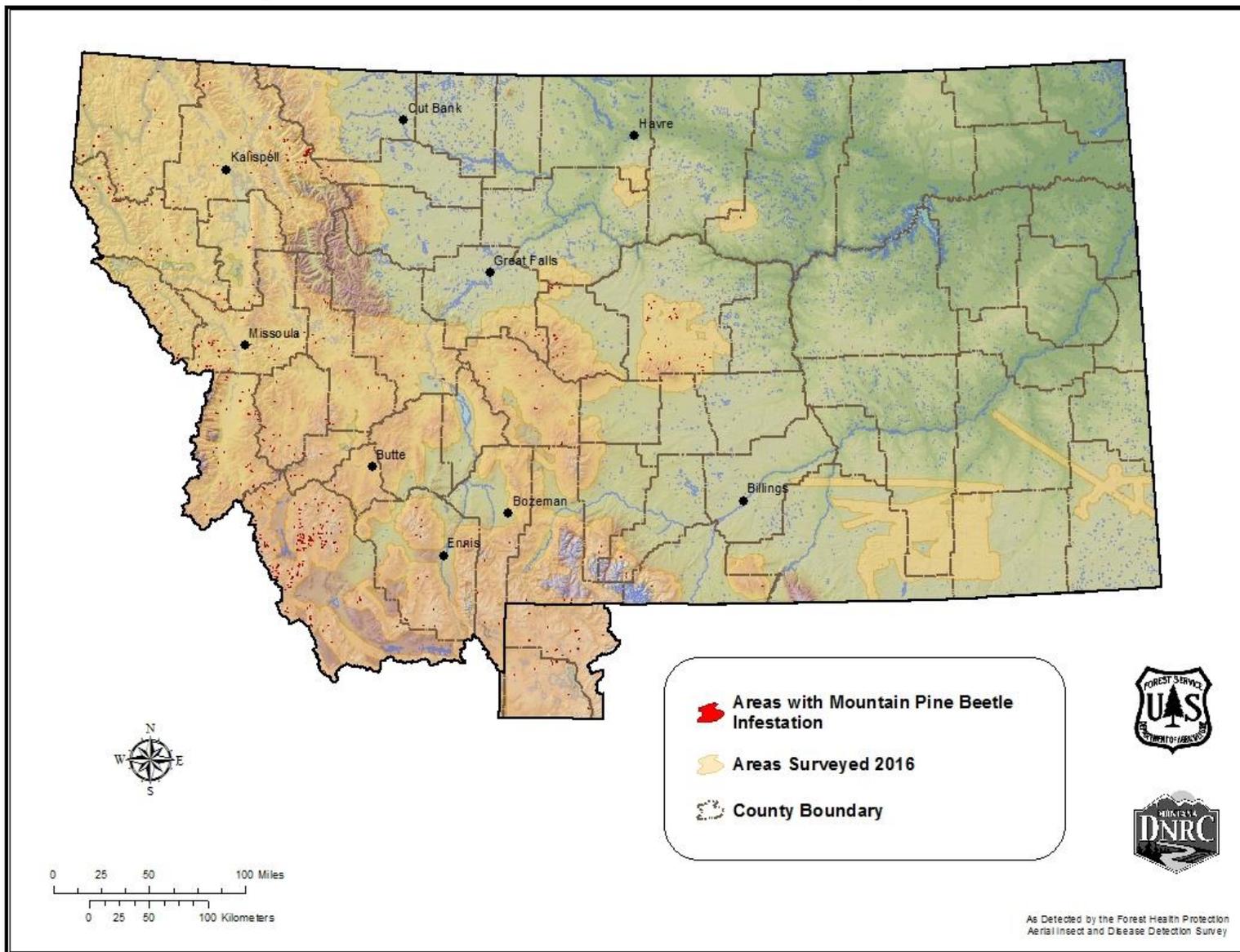


Figure 3. Mountain Pine Beetle-Caused Mortality in Montana 2016



**Figure 4. Western Spruce Budworm Defoliation in Montana 2016**

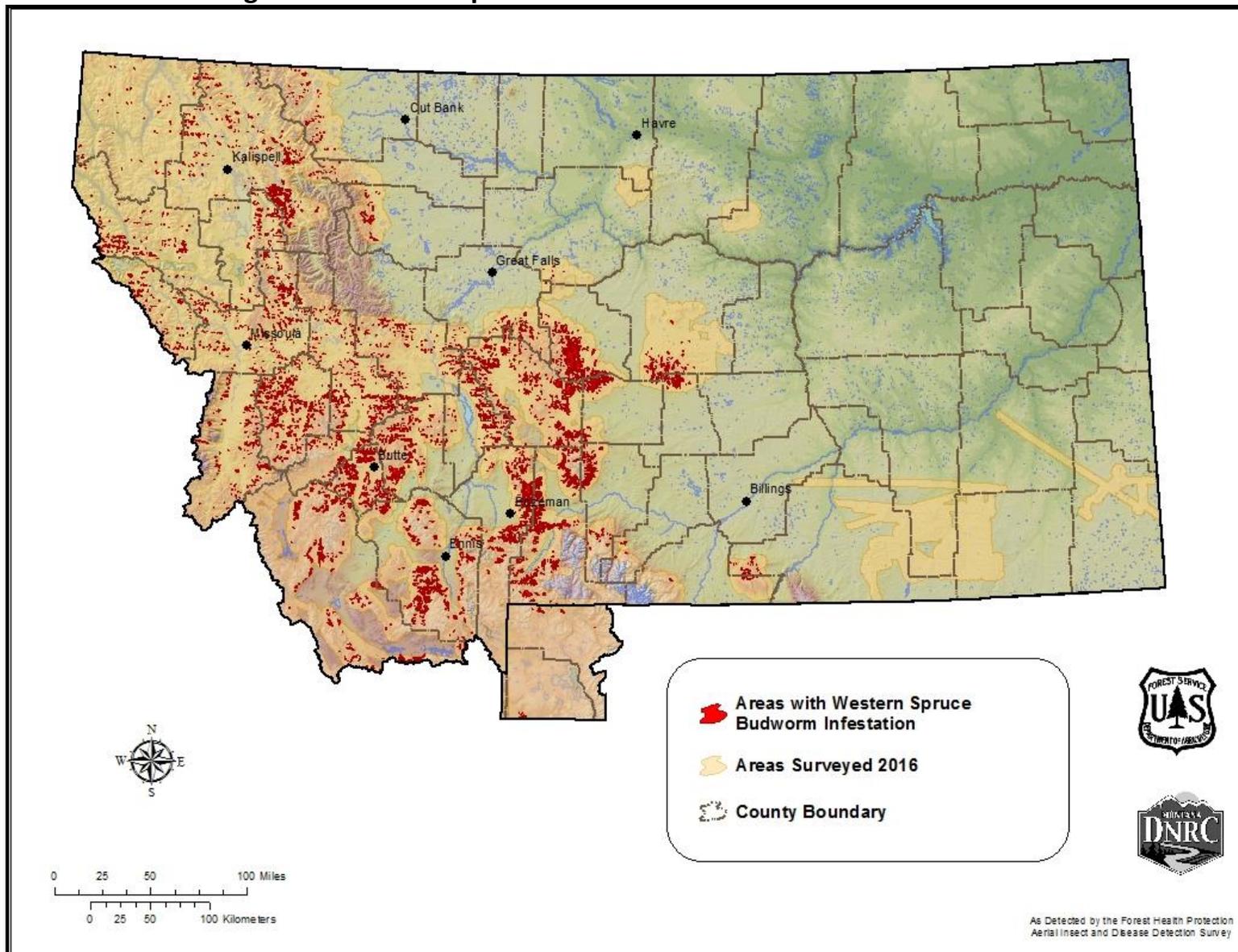


Figure 5. Douglas-Fir Beetle Infestations in Montana 2016

