

2017 North Idaho Douglas-fir Tussock Moth Monitoring Report



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2017 NORTH IDAHO DOUGLAS-FIR TUSSOCK MOTH MONITORING REPORT

Erika Eidson, Forest Health Specialist
Tom Eckberg, Forest Health Program Manager
Stephani Penske, Gypsy Moth Data Coordinator
Patrick Halseth, Forest Health Resource Foreman I
Idaho Department of Lands

Lee Pederson, Entomologist
Andrew Richards, Biological Technician
USDA Forest Service, Northern Region, Coeur d'Alene

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Background and History

Douglas-fir tussock moth (DFTM) is a native defoliator of true firs, Douglas-fir, and occasionally other conifers in western North America. Adult males are common-looking gray-brown moths with feathery antennae ([figure 1](#)). Females are heavy-bodied and flightless ([figure 2](#)), and release sex pheromones to attract males to mate. After mating, females lay egg masses ([figure 3](#)) on host tree branches in late summer or fall. Egg hatch coincides with bud burst the following spring, and developing larvae ([figure 4](#)) feed on host foliage ([figure 5](#)). Development timing can vary with temperature and elevation, but pupation typically occurs in late July or August, and new adult moths emerge in late summer or fall.

In most years, DFTM populations are low and do not cause visible defoliation, but populations can periodically irrupt in cyclical outbreaks. In northern Idaho, there is a long history of periodic outbreaks causing widespread defoliation ([figure 6](#)). In southern Idaho, large outbreaks have also occurred, but on a more irregular basis. Since 1977, Idaho has participated in the DFTM Early Warning System (EWS), which uses a series of permanent pheromone trap sites to identify increasing populations prior to undesirable tree defoliation (system adapted from Daterman et al. (1979)). Pheromone lures that mimic female moths are placed in sticky traps before the DFTM flight period, and the number of captured adult males is recorded each year. Sharp increases in trap catches provide land managers advance warning of an impending outbreak.

Although the DFTM EWS is currently implemented in both northern and southern Idaho, this report will primarily focus on DFTM monitoring in northern Idaho. Three periods of DFTM outbreaks have been detected in northern Idaho since implementing the EWS. The first outbreak

occurred in the 1980s in Latah County and McCroskey State Park ([figure 6](#)). According to records, outbreaks of DFTM have occurred in this general area approximately every 8-10 years since at least the 1940's. The 1980s outbreak was preceded by high numbers of moth captures, but defoliation was only recorded by aerial observers in 1986 (figures [7](#) & [8](#)).

The next northern Idaho outbreak occurred in the early 2000s, and resulted in three years of defoliation on State and private lands between Plummer and Moscow, and on adjacent Clearwater National Forest lands. Similar to the 1980s outbreak, trap captures averaged over 40 moths per trap prior to visible defoliation (figures [7](#) & [8](#)).

The most recent outbreak occurred between 2010 and 2012 and did not follow the same trends in location or moth captures. Defoliation was centered farther north than previous outbreaks, with limited defoliation near Moscow Mountain. Most of the defoliation was in Kootenai County near Signal Point, in Benewah County near Plummer, and in McCroskey State Park. The average number of moths/trap captured prior to observed defoliation was much lower relative to the two earlier periods of outbreaks. In 2010, the average number of moths/trap was 11.8, a slight decrease from 11.9 the previous year, but over 8,500 acres of defoliation were mapped in aerial surveys. Defoliation peaked in 2011 at over 68,500 acres, and an average of 43.8 moths/trap were captured that same year. Averages >40 moths/trap would normally be expected the year prior to observed defoliation. In 2012, only 6.3 moths/trap were captured and approximately 31,000 acres of defoliation were detected.

The disconnect between trap capture patterns and observed defoliation in the 2010-2012 outbreak confirms the need for additional population sampling of other life stages to improve outbreak forecasting. Egg mass and larval sampling are two additional methods for predicting local DFTM outbreak intensity, and can be used to supplement EWS monitoring of adult moth populations (Mason and Torgersen, 1983, Kegley et al., 2004). Observations of damage to ornamentals are another indicator that outbreaks of DFTM will soon develop in forested settings (Sturdevant, 2000; Tunnock et al., 1985). Prior to the 2010-2012 outbreaks, defoliation of spruce was first observed at the USFS Coeur d'Alene nursery in 2007 and 2008, and grand fir yard trees were defoliated at Twin Lakes and Mica Flats in 2009 and 2010.

Monitoring Methods

Pheromone Traps

The Idaho Department of Lands (IDL) and U.S. Forest Service Region 1 (USFS R1; northern Idaho) and Region 4 (USFS R4; southern Idaho) cooperatively manage EWS DFTM monitoring sites throughout the state. IDL maintains trap sites from Coeur d'Alene south to Moscow and east to Harvard ([figure 9](#)). Forest Health Protection, Coeur d'Alene Field Office (USFS-R1), maintains trap sites from Potlatch to Lucille ([figure 10](#)), while Forest Health Protection, Boise Field Office (USFS-R4), maintains trap sites in southern Idaho ([figure 11](#)).

Each year, five pheromone-baited sticky traps are installed along a transect at each trap site, with ~75 feet between traps. Traps are placed in young, open-grown host trees (grand fir or Douglas-fir) in late July to early August, to coincide with DFTM flight timing. Traps are collected in October and the number of male moths captured in each trap is recorded. The common threshold used to predict defoliation the following years is an average of 25 moths/trap at a site.

However, EWS pheromone trapping is not designed to predict the exact location of future defoliation.

Egg Mass Sampling

When trap captures are high (near the 25 moths/trap threshold), egg mass sampling may be used to estimate the potential for defoliation in a specific area the following year. Egg mass sampling is conducted in fall by examining grand fir and Douglas-fir trees for a total of ten working minutes (i.e., 10 minutes for a single person, 5 minutes for two people working simultaneously), and counting the number of egg masses observed. Sampling sites are selected within high trap capture or defoliated areas and outward to delimit the area of infestation. One plot per section (640 acres) is sampled where host material is present and accessible by road. Areas where high numbers of egg masses are observed during sampling are considered to be likely locations of defoliation the following year.

Larval Sampling

At sites where the moths/trap threshold (25 moths/trap) is reached, larval sampling may be conducted the following spring to pinpoint injurious population densities (Daterman et al., 1979) and locate areas for treatment, if necessary. Larval sampling may also be conducted at sites with a history of DFTM-caused defoliation occurring before trap counts reach the threshold. Sequential sampling for DFTM larvae in the lower crown is performed according to procedures outlined in Mason, 1979. Sequential surveys are most useful before widespread defoliation occurs, and are of limited use during an outbreak (Mason, 1979).

Results

Trapping

A total of 178 sites were monitored in northern Idaho (145 by IDL and 33 by USFS-R1), and 24 sites were monitored in southern Idaho (USFS-R4) during 2017 (figures [9](#), [10](#), & [11](#)). Additional traps were installed by USFS R4 in the Boise and Payette National Forests in 2014, 2016, and 2017, in areas that experienced widespread DFTM outbreaks during 1990-1992 ([figure 6](#)).

The overall mean trap capture for the IDL traps in 2017 was 0.17 moths/trap, compared with 0.05, 0.03, and 0.02 moths/trap in 2016, 2015, and 2014, respectively ([appendix 1](#)). An average of 0.1 moths/trap were caught in USFS-R1 traps in 2017, compared with 0, 0, and 0.01 moths/trap in 2016, 2015 and 2014, respectively ([appendix 2](#)). The 2017 USFS-R4 average for southern Idaho was 12.92 moths/trap compared to 20.48, 10.71, and 3.04 moths/trap in 2016, 2015 and 2014, respectively ([appendix 3](#)). Four sites in R4 had trap averages over 25 per trap ([figure 11](#)), compared to nine in 2016. USFS R4 also received many reports of 'tussockosis,' a skin rash caused by DFTM larval hairs, from people recreating in the forest. A number of these incidents were likely caused by the rusty tussock moth, a DFTM relative that feeds on broad-leaved hosts, but some may be due to increasing DFTM populations in the area.

Trap lure trials

Due to concerns about the availability pheromone lures in the future, lures supplied by four manufacturers were evaluated for comparison at three locations beginning in 2016. In 2016, two

locations on the Boise National Forest (Little Sagehen and Tamarack Flat) and one site on the Sawtooth National Forest (Couch Summit) ([figure 12](#)) were selected to test pheromone lures produced by Scotts/ConTech, Synergy, Great Lakes, and WestGreen Global. Sixty total sticky traps were baited with one of the four lures and placed in a random order on a 20 x 3 grid pattern at each site in July. Traps were collected in mid-October and the number of male moths captured in each trap was recorded and compared.

In 2017, trials were repeated at the Little Sagehen and Tamarack Flat sites ([figure 12](#)) using lures manufactured by Scotts/ConTech, Synergy, and WestGreen Global. Trials were not repeated using the Great Lakes lure because 2016 findings indicated that it was significantly stronger relative to the lures produced by the other manufacturers. This suggests that using the Great Lakes lure in future sampling would produce results that are not comparable to those from previous years of DFTM EWS monitoring. Full results of the lure trial will be reported elsewhere.

Larval Surveys

Larval sampling was conducted at 20 IDL-monitored sites in northern Idaho in 2017 ([appendix 1](#)). No larvae were observed at any of the IDL-sampled sites. Larval sampling was also conducted in southern Idaho by USFS R4, but southern Idaho larval sampling results are not included in this report.

Egg Mass Sampling

No egg mass sampling was conducted in northern Idaho in 2017, but IDL sampled several locations in southern Idaho for egg masses. High densities of egg masses were located in stands of isolated Douglas-fir at Craters of the Moon National Monument and Preserve ([figure 13](#)). Severe DFTM-caused defoliation was already visible in this area by October, 2017 ([figure 14](#)). Egg masses were also observed while sampling IDL Endowment Lands in the Smiths Ferry area. Tussockosis had been reported in this area earlier in the season. USFS R4 personnel sampled additional areas in southern Idaho for DFTM egg masses, but the results are not included in this report.

Defoliation

No Douglas-fir tussock moth defoliation was observed in northern Idaho in 2017, but several small areas of defoliation, totaling ~130 acres, were recorded in southern Idaho ([figure 6](#)). These areas included outbreaks near Craters of the Moon, as well as an area in the Owyhee mountains, an area near Deadwood Reservoir, and an area north of Challis.

Conclusions

The DFTM-EWS has been generally effective at predicting outbreaks in Idaho. If DFTM populations behave according to past trends, populations can be expected to increase to damaging levels in northern Idaho again in approximately three years.

Four sites in southern Idaho exceeded the moth capture threshold of 25 moths per trap, and six others were between 12 and 25 per trap. Averages have decreased relative to results from last year's sampling, but visible defoliation is starting to occur. The highest averages in 2017 were in the Smiths Ferry area, and high densities of DFTM egg masses were also observed at several

locations in this area. Visible defoliation is likely to continue in 2018. Western spruce budworm is active in many of the same areas and may obscure any damage from tussock moths.

The DFTM-EWS **is not designed nor is it intended** to predict the exact location of future defoliation. Follow-up sampling is conducted in areas that are selected based on historical experience and the potential impact of DFTM defoliation on management objectives. The defoliation observed in 2010 was not preceded by increasingly higher average trap captures as in the two previous outbreak periods; in fact, the trap averages did not reach the historic high levels until fall 2011 (the second year of defoliation). The unusual nature of the 2010-2012 outbreaks illustrates the importance of an integrated sampling plan utilizing pheromone traps, supplemental sampling (larval and egg mass), as well as aerial detection. Characterizing the full extent of outbreaks is difficult without an aerial survey, because defoliation may occur in areas that have not experienced outbreaks in the recent past.

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Figure 1. Male Douglas-fir tussock moth

Photo by Ladd Livingston



Figure 2. Female Douglas-fir tussock moth constructing egg mass



Figure 3. Douglas-fir tussock moth egg masses



Figure 4. Late-instar Douglas-fir tussock moth larva



Figure 5. Douglas-fir tussock moth-caused defoliation



Figure 6. Aerially-mapped defoliation by Douglas-fir tussock moth for 1970-2017.

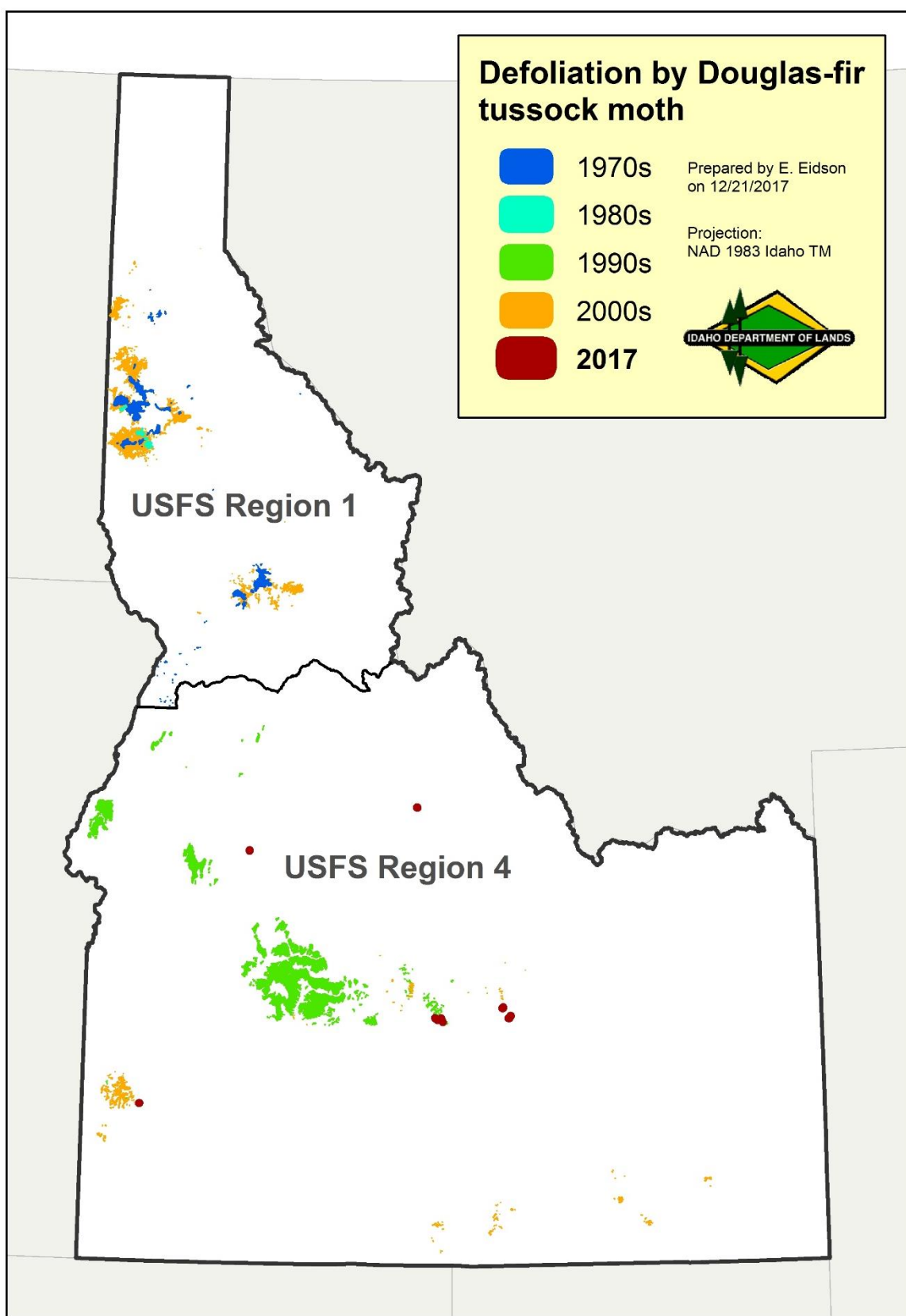


Figure 7. Mean trap catches of Douglas-fir tussock moth on plots monitored by IDL from 1977-2017.

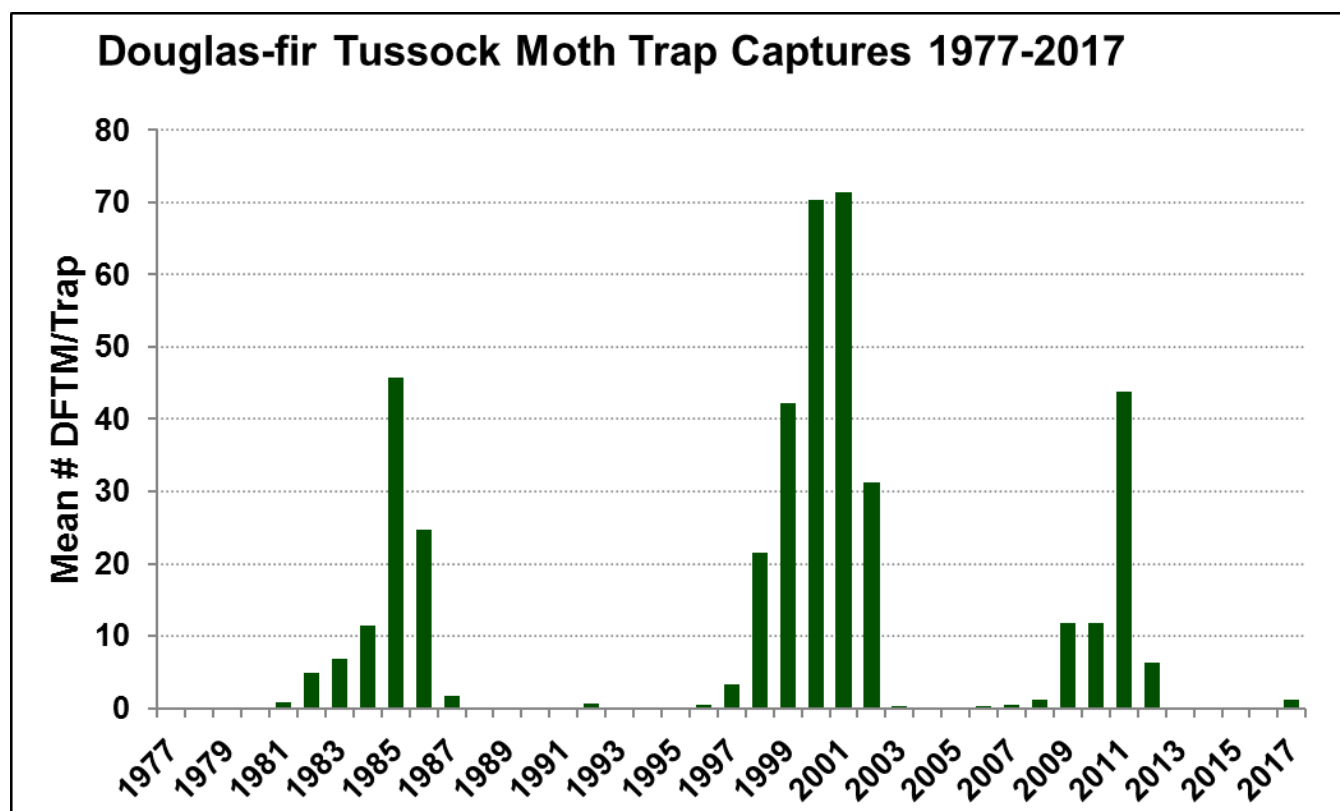


Figure 8. Aerially detected defoliation in northern Idaho from 1972-2017.

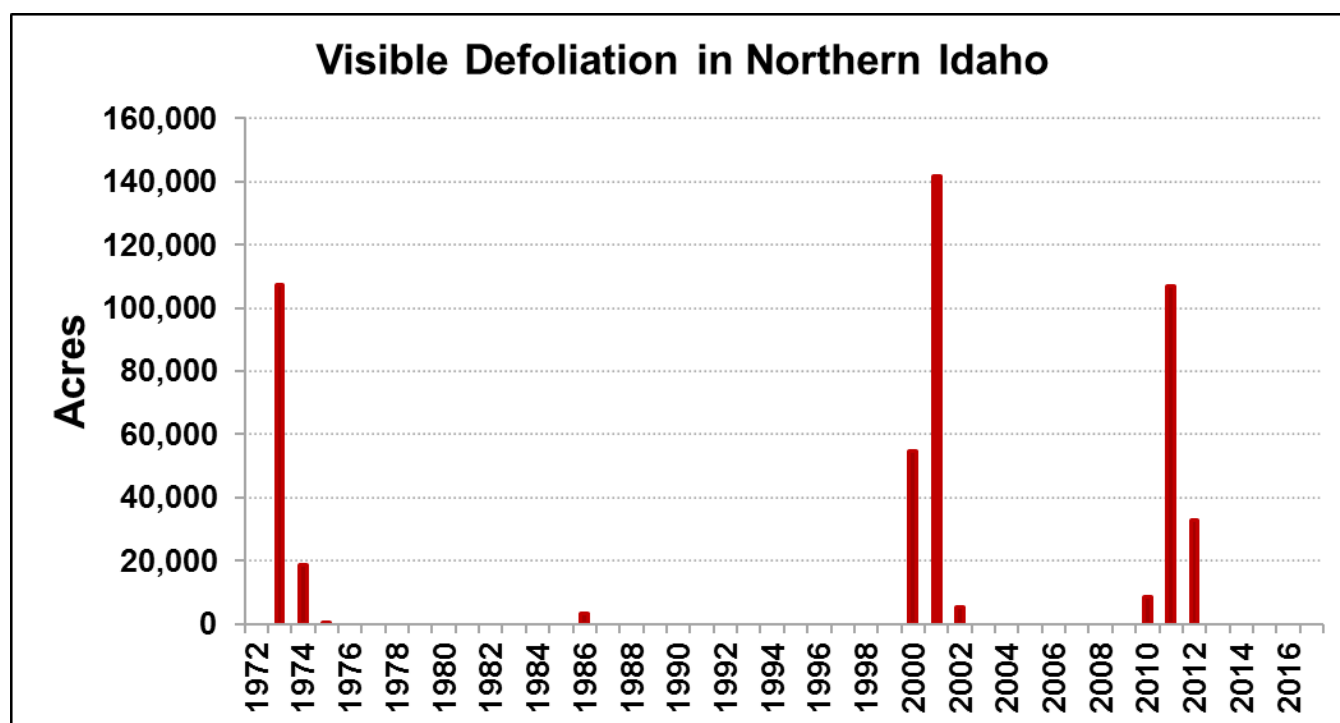


Figure 9. Map of sites trapped by IDL for Douglas-fir tussock moth in 2017.

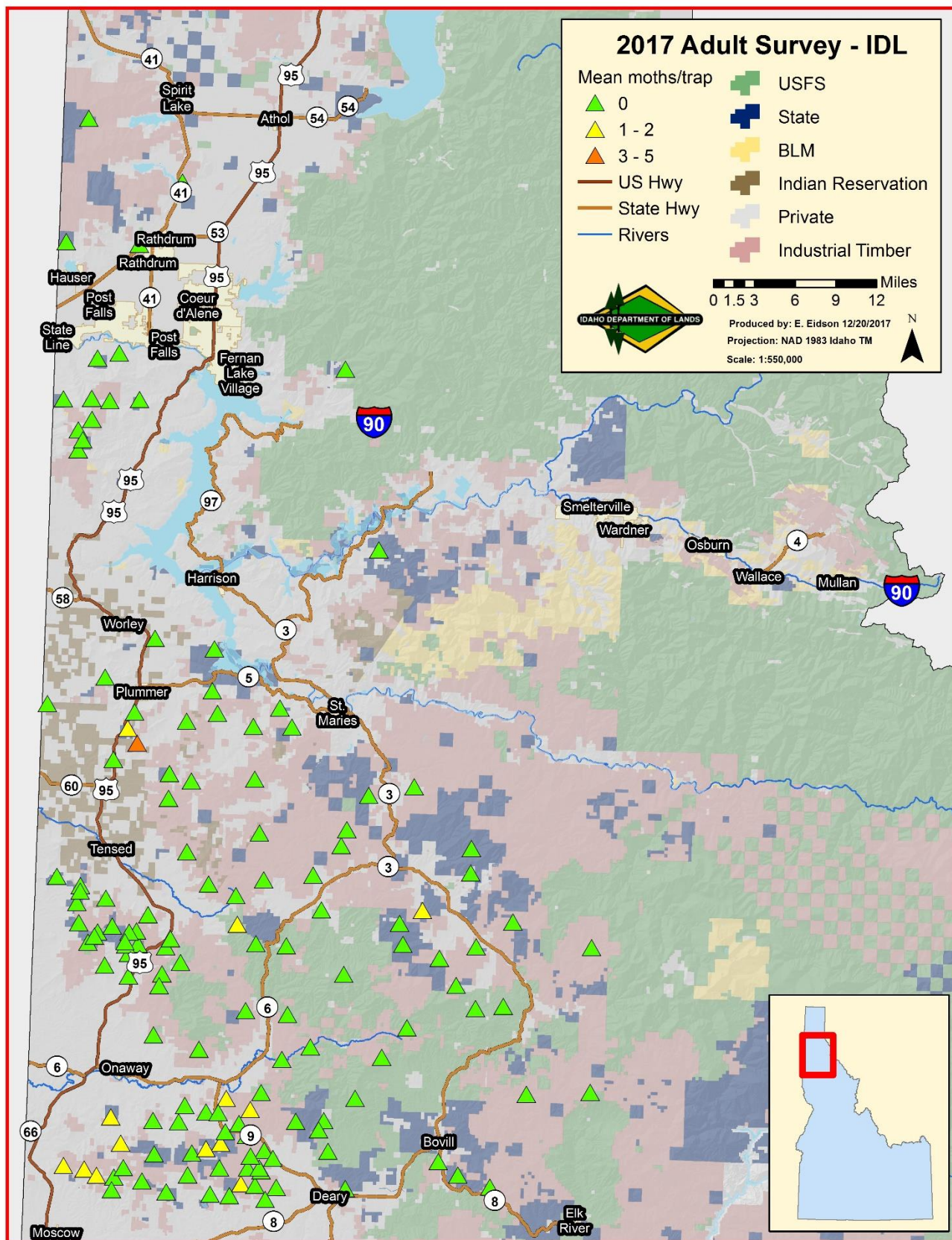


Figure 10. Map of sites trapped by USFS Region 1 for Douglas-fir tussock moth in 2017.

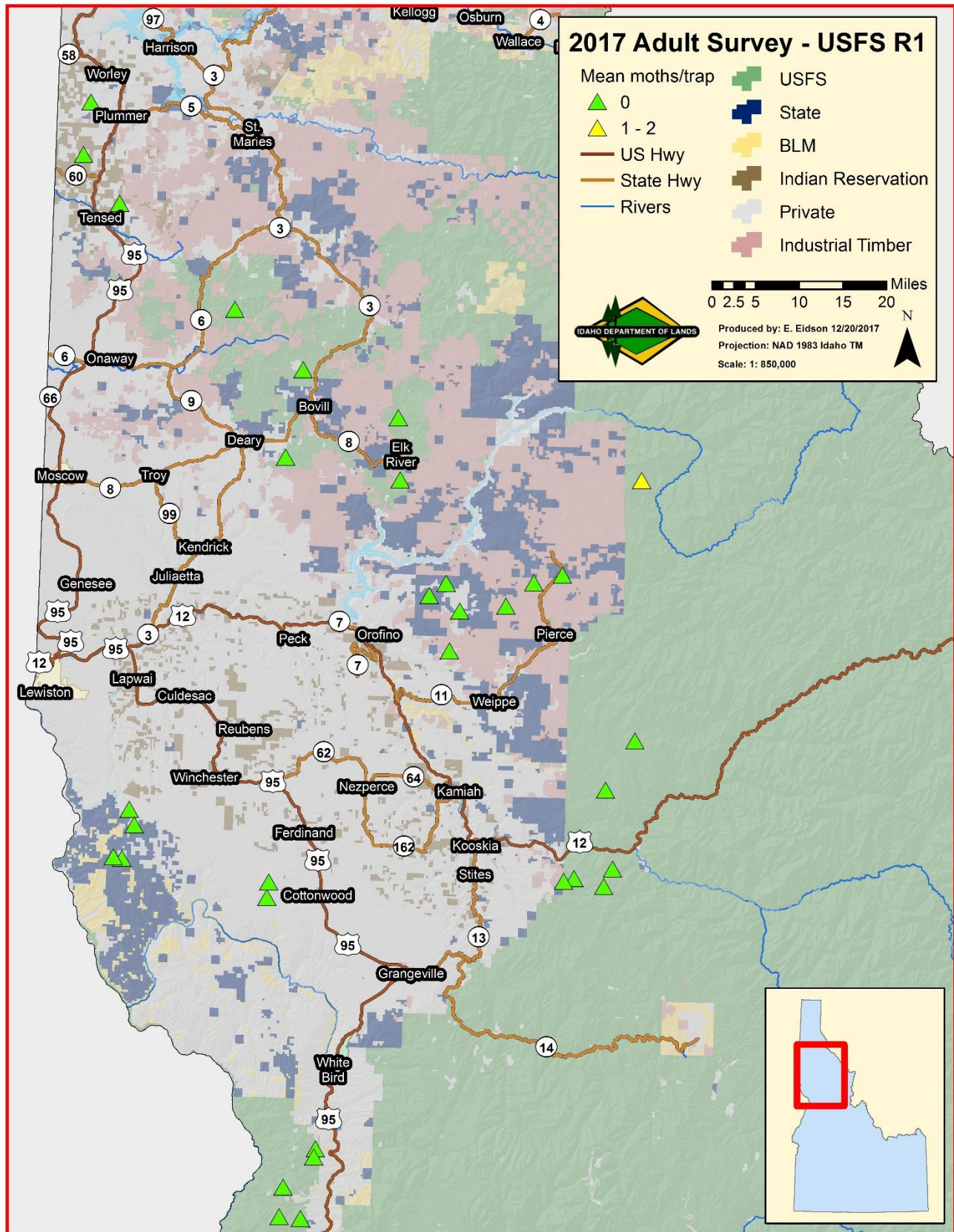


Figure 11. Map of sites trapped by USFS Region 4 for Douglas-fir tussock moth in 2017.

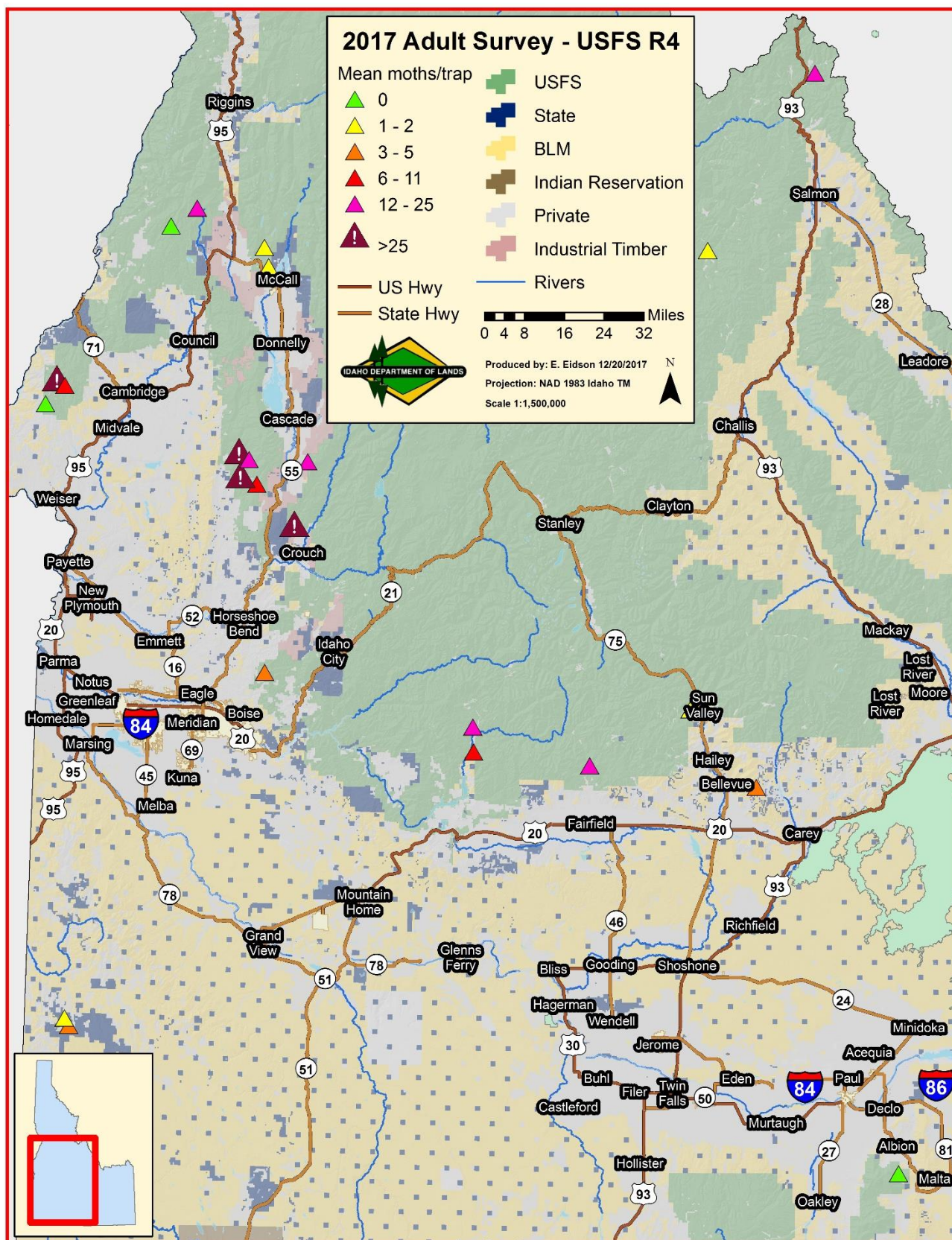


Figure 12. Locations of Douglas-fir tussock moth lure trials in southern Idaho.

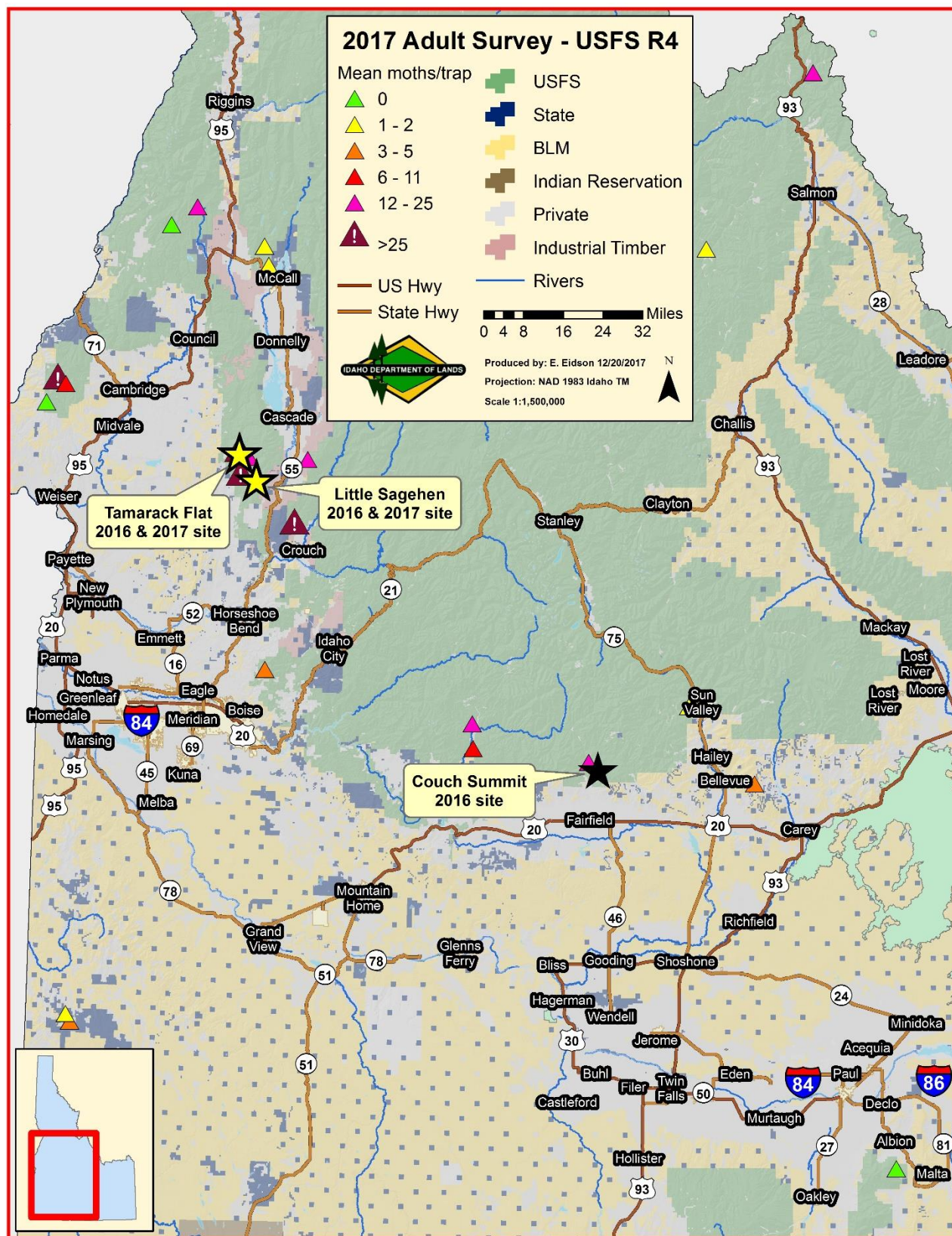


Figure 13. Douglas-fir tussock moth outbreak in Craters of the Moon National Monument & Preserve; July, 2017.

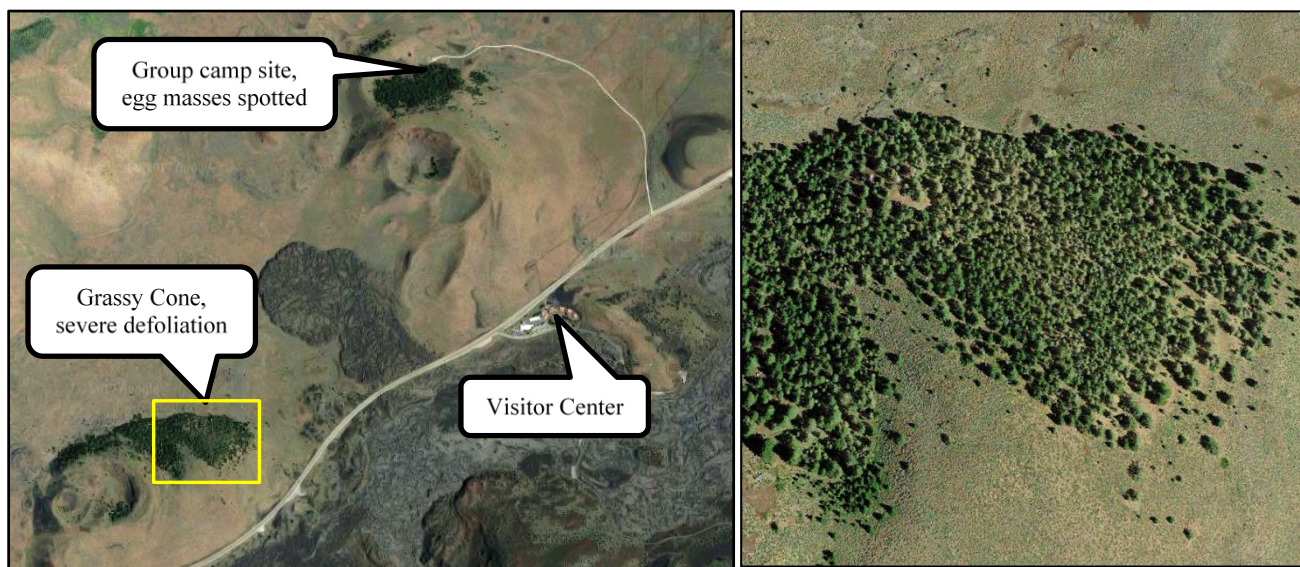


Figure 14. Severe Douglas-fir tussock moth-caused defoliation at Grassy Cone, Craters of the Moon National Monument & Preserve; October, 2017.



Appendix 1. 2007 to 2017 Douglas-fir tussock moth trap results at IDL monitored sites.

Mean Number of Moths per Trap												
Plot #	Site Name	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
3	Lolo Pass	0	0	0.2	0 [†]	0.2 [†]	26.8	30.2 [†]	26.4 [†]	5.2	0.4	0 [†]
4	Charles Butte	0	0	0 [†]	0.2	0	0.4	81.4 [†]	32.2 [†]	5.4	0	0 [†]
5	Peterson Point	0	0	0	0	0	2.4	52.8 [†]	8.6	2.2	0	0 [†]
6	East Dennis	0	0	0	0	0	0.2	33.2	2.3 ^{†4}	9.0	0.2	0.2 [†]
7	East Gold Hill	0	0	0	0	0	3.0 ³	38.0	2.0 ¹	3.4 [†]	0.8	0 [†]
8	Flat Creek	0.6	0	0	0	0	0.2	48.0	8.0	1.0	0.2	0 [†]
9	Long Creek	0	0	0	0	0	5.0	56.2 [†]	10.2 [†]	20.6 [†]	3.4 [†]	3 [†]
10	Paradise Point	0.6	0	0	0	0	0.2	44.6	9.8	2.0 [†]	1.2	0.2 [†]
11	Mineral Mountain	0	0	0	0	0 [†]	22.2	11.6 [†]	10.8 [†]	25.0 ^{†2}	4.2 [†]	0.5 ^{†4}
12	Mission Mountain	0	0	0	0	0	5.0	66.4 [†]	8.0 [†]	20.8	0.6	0.2 [†]
13	Spring Valley Creek	0	0	0	0	0	0	6.2	1.0	0.6	0	0 [†]
14	Vassar Meadows	0	0	0	0	0	1.0	53.6 [†]	17.0 [†]	12.8	0 [†]	0.4 [†]
15	Fairview Knob	0.6	0	0	0	0 [†]	8.2	86.4	6.6 [†]	9.2 [†]	0.8 [†]	0.4 [†]
21	West Twin	1.8	0	0	0	0	0.4	55.0 [†]	4.0 [†]	5.3 ^{†4}	1.2 [†]	0.4
22	Moscow Mtn	0.2	0	0	0	0	0.2	17.0	0.0 ⁴	3.6	0	0
101	Benewah	0	0	0	0	0	1.0	51.4 [†]	16.4 [†]	5.0	0	0.2 [†]
102	Windfall Pass	0	0	0 ⁴	0	0 [†]	10.4	83.0 [†]	29.4 [†]	32.0 ^{†3}	12.5 ^{†4}	0.75 [†]
103	Squaw Creek	0.2	0	0	0 [†]	0 [†]	23.6	41.0	2.6	1.8	0	0
104	Moses Mountain	0.2	0	0 [†]	0	0 [†]	10.2	51.8 [†]	7.5 ⁴	3.4	0.2	0
105	Little John Creek	0.4	0	0	0	0	1.6	51.2	0.0 ²	2.2	0 [†]	0.6
106	Emida Peak	0	0	0	0	1.0 ²	2.5	65.8	1.4	1.6	0 [†]	0.4
107	North-South Ski Area	0.2	0	0	0	0	1.4	74.8	2.3 ⁴	m	0	0
108	Bald Mountain	0.4	0	0	0	0 ⁴	*	*	*	*	*	*
109	Laird Park	0	0	0	0	0	0.2	42.0	1.4	2.2	m	0
110	N Fk Palouse River	0	0	0	0	0	0	12.0	0.0	0.4	0	0
111	Mica Mountain	0	0	0	0	0	3.2	63.2	16.6 [†]	20.8	0.2	0.2

*Indicates Sites Not Trapped
¹Indicates 1/5 traps collected

m indicates traps missing
²Indicates 2/5 traps collected

[†]Indicates larval survey
³Indicates 3/5 traps collected

Italics indicates egg mass sample
⁴Indicates 4/5 traps collected

Appendix 1. (continued) 2007 to 2017 Douglas-fir tussock moth trap results at IDL monitored sites.

Plot #	Site Name	Mean Number of Moths per Trap										
		2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
112	Schwartz Creek	0.2	0	0	0	0	2.6	59.4	16.2 [‡]	7.0	0.4	0
113	Big Bear Creek	0	0	0 [‡]	0.2	0	3	39.8 [‡]	15.2 [‡]	11.6 [‡]	1.8 [‡]	0.6 [‡]
114	Big Meadow Creek	0	0	0	0	0	0.2	41.5 [‡]	0.8 ^{‡4}	0.4	0	0 ^{‡4}
115	East Twin Mountain	0.2	0	0	0	0	0	66.8	6.8	5.4 [‡]	1.2 [‡]	0.4 [‡]
116	Crane Point	0.2	0	0	0	0	3.8	43.0	6.8	0 ⁴	0.2	0
117	Sheep Creek	0.2	0	0	0 [‡]	0.2	1.8	50.8 [‡]	21.0 [‡]	20.8 [‡]	2.0	0 [‡]
118	W. Fork Mission Ck	0	0	0	0	0	1.8	64.2	7.0 ^{‡3}	6.8 [‡]	1.4	0.2
119	1 Mi N. Mineral Mt	0 [‡]	0.2	0	0	0	43.6	61.6 [‡]	24.6	2.2	0.2	0
200	2 mi W of Plummer	0	0	0	0	0	4.8	28.8 [‡]	7.0 [‡]	34.2 [‡]	2.2 [‡]	2.6
201	Coon Creek	0	0	0	0	0 [‡]	9.8	97.4 [‡]	18.0 [‡]	21.8 ^{‡4}	1.8 [‡]	3 [‡]
202	3 mi E of Benewah	0	0	0 [‡]	0.2	0	*	*	*	*	*	**
203	Benewah Point	0	0	0	0	0	0.6	47.0	8.4	3.4	0 [‡]	0.4
204	John's Point	0.2	0 ⁴	0	0 [‡]	0.2	*	*	*	*	*	*
205	3 m E Charles Butte	0 ³	0	0 [‡]	0	0	2.2	52.4	6.5 ⁴	2.0	0 [‡]	0.8 [‡]
206	Sunset Mountain	0	0	0	0	*	*	*	*	*	*	*
207	W Fork Emerald Ck	0	0	0	0	0	0.2	4.6	0.0	0.4	0.2	0
208	Cedar Butte	0	0	0	0 [‡]	0.2	0	41.4	1.4 ⁴	0.4	0	0
209	Abe's Knob	0	0	0	0	0	0.2	54.4	5.6	2.4	0.2	0.2
210	West Fork Deep Creek	0.2	0	0	0 [‡]	0 [‡]	37.8	83.2 [‡]	29.6	4.6	0	0.2 [‡]
211	Cherry Butte	0	0	0	0	0	0.2	55.4	2.8	0.6	0	0 [‡]
212	Jackson Mountain	0	0	0	0	0	0	15.4	1.6	1.0 [‡]	1.0	0.2
216	1 mi NW of Mineral Mtn	0.2 [‡]	0.2	0	0 [‡]	0.4 [‡]	47.4	70.6 [‡]	27.6 [‡]	32.4 [‡]	0.8	0 [‡]
217	Head of Sheep Creek	0.2 [‡]	0.2	0	0	0 [‡]	33.4	38.4 [‡]	8.8 [‡]	36.8 [‡]	7.8	0 [‡]
300	Mission Mountain (#2)	0.2	0	0	0	0	4.0	38.8 [‡]	13.8 [‡]	22.4 [‡]	2.2	0
301	1.5 mi S of Mineral Mtn	0	0	0.4	0 [‡]	0 [‡]	81.0	66.6 [‡]	62.8 [‡]	37.6 [‡]	2.4	0 [‡]
302	Mid. Fork of Deep Ck 1	0.2 [‡]	0.2	0	0 [‡]	0 [‡]	75.8	61.6 [‡]	48.6 [‡]	38.0 ^{‡3}	3.6 [‡]	1

*Indicates Sites Not Trapped m indicates traps missing †Indicates larval survey *Italics indicates egg mass sample*
¹Indicates 1/5 traps collected ²Indicates 2/5 traps collected ³Indicates 3/5 traps collected ⁴Indicates 4/5 traps collected

Appendix 1. (continued) 2007 to 2017 Douglas-fir tussock moth trap results at IDL monitored sites.

		Mean Number of Moths per Trap										
Plot #	Site Name	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
303	Mid. Fork of Deep Ck 2	0	0	0	0 [‡]	0.2 [‡]	33.8	71.6 [‡]	27.2 [‡]	33.0 ^{‡3}	1.6	0.2
400	3 mi S of Mineral Mt	0.2	0	0	0	0 [‡]	28.0	42.8 [‡]	23.8	1.0	0 [‡]	0.6 [‡]
401	Flynn Butte	0	0	0	0	0	1.2	41.6	3.4	0.6	0	0
402	2 mi SE of Browns Mdw	0	0	0	0	0	2	43.2	3.0	4.8 ⁴	0	0.2 [‡]
500	3 mi SW of Harvard	0	0	0	0	0	1.4	45.0 [‡]	13.4	1.0	0	0 [‡]
501	3 mi S of Moon Hill	0	0	0	0	0	0.2	48.6	1.4	1.0	0	0
502	3 mi W of Crane Point	0.2	0	0	0	0	1.4	71.8 [‡]	15.2 [‡]	6.2	0	0.2
503	3 mi N of Stanford Point	0	0	0	0	0 [‡]	13.0	50.0 [‡]	17.5 ^{‡4}	17.6 [‡]	1.0 [‡]	1
504	2 mi N of Stanford Point	0	0	0	0	0	1.4	49.6 [‡]	12.2 [‡]	10.2	0.0	0 [‡]
505	1 mi SW of Stanford Pt	0.6 [‡]	0.2	0	0	0	0.8	47.2	4.5 [‡]	9.2 [‡]	1.6	0.2 [‡]
506	1 mi S of Stanford Pt	0.2	0	0	0	0	3.0	50.4	5.8 [‡]	44.4 [‡]	4.0 [‡]	1
507	1 mi NE of Stanford Pt	0	0	0	0	0	0	17.6	1.6	2.0	0.8	0
508	1 mi W of Stanford Pt	0 ¹	0	0	0	0	6.4	52.8 [‡]	23.4 [‡]	27.0	0 [‡]	0.4
509	2 mi NW of Stanford Pt	0	0	0	0	0	1.6	45.4 [‡]	13.8 [‡]	26.6 [‡]	0.8 [‡]	1.2 [‡]
510	Moon Hill	2.4 [‡]	0.6	0	0	0 [‡]	12.8	53.6 [‡]	36.0 ^{‡4}	18.2 [‡]	1.2	0 [‡]
511	2 mi SE of Moon Hill	0	0	0	0	0 [‡]	12.0	47.8 [‡]	20.4 [‡]	21.0 [‡]	2.4	0
512	3 mi S of Mineral Mtn	0.2	0	0	0 [‡]	0.2 [‡]	17.2	70.8 [‡]	5.6 [‡]	9.4	0	0
513	2 mi SW of Moon Hill	0	0	0	0	0	3.4	55.4 [‡]	13.0	1.2	0 [‡]	1.4
514	1.5 mi NW of Avon	0.4	0	0	0 ³	0	2.8	42.8	6.2	3.0	0	0
600	3.4 mi NNW of Princeton	0.2	0	0	0	0	0	38.8	4.8	4.0	2	0.25 [‡]
601	Macumber Meadows	0	0	0	0 [‡]	0.2	0.8	52.2	1.6	0.6	0	0 [‡]
602	S of Shay Hill	0	0	0	0	0	0.4	1.4	0.2	4.4 [‡]	1.2	0.2
603	3 mi. S of Chatcolet	0	0	0	0	0	5.0	101.8 ^{‡4}	10.8 [‡]	29.2 [‡]	3.6	0
701	Four mile Creek	1.6	0	0.2	0.4	0	0.2	53.0 [‡]	28.2 [‡]	12.2 [‡]	2.2 [‡]	0.4
702	North of Granite Point	0 [‡]	0.2	0	0	0	1.2	40.8 [‡]	10.2	3.4	0.6	0
703	Bergs Creek	*	0	0	0	0	0.2	12.4	3.2	2.4	0	0

*Indicates Sites Not Trapped

¹Indicates 1/5 traps collected

m indicates traps missing

²Indicates 2/5 traps collected

[‡] Indicates larval survey

³Indicates 3/5 traps collected

Italics indicates egg mass sample

⁴Indicates 4/5 traps collected

Appendix 1. (continued) 2007 to 2017 Douglas-fir tussock moth trap results at IDL monitored sites.

Mean Number of Moths per Trap												
Plot #	Site Name	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
704	West Fork Big Bear Ck	0	0	0 [†]	0	0	0.6	49.6	8.8 [†]	9.4 [†]	0.8	0 [†]
705	2 Mi NW of Stanford PT	0	0	0	0	0 [†]	18.2	53.2 [†]	34.2 [†]	43.0 [†]	3.0 [†]	1.5 [†]
706	1 Mi S. of Iron Mtn	0	0	0	0	0	0.4	77.2 [†]	27.8	2.0	0.2 [†]	0.8 [†]
707	Iron Mtn	0.2	0	0	0	0	*	*	*	*	*	*
708	Little Bear Creek	0	0	0	0	0	2.2	46.6 [†]	12.4 [†]	7.3 ⁴	0 [†]	0.4 [†]
709	Ruby Creek	0	0	0	0 [†]	0.2 [†]	10.0	47.2 [†]	10.6	2.4 [†]	4.0	0
710	Turnbow Creek	0.4	0	0	0	0 [†]	16.2	53.8 [†]	33.0 [†]	15.8	0 [†]	2.4 [†]
711	East Fork Flat Creek	2	0	0	0 [†]	0.4 [†]	12.2	55.4 [†]	20.8 ^{†4}	17.6	0 [†]	2 [†]
712	Turnbow Point	0	0	0	0	0	0.2	37.4 [†]	1.2	0.2	0.4	0.2
713	3 Mi S. of Potlatch	0.8 [†]	0.4	0.2 [†]	0.2	0	0.6	47.8	13.0 [†]	8.8 [†]	5.8	0 [†]
714	Rocky Point	0.8 [†]	0.2	0 [†]	0 [†]	0.4 [†]	23.4	20.6 [†]	25.6 [†]	46.6	0 [†]	0.8
715	Hatter Creek	0	0	0	0	0	0	11.6	0.0	0.2	0	0 [†]
716	Head of Hatter Creek	0.2	0	0	0	0	0	48.2	0.4	0 ⁴	0	0 ¹
717	Nora Creek	0	0	0	0	0	0.2	14.2	0.2	0.2 [†]	1.4	0
718	Crummaring Creek	0	0	0	0	0	0	49.0 [†]	13.6 [†]	6.4	0.4	0.2
719	Basalt Hill	0	0	0 [†]	0.2	0	3.4	47.2 [†]	10.4 [†]	7.3 ⁴	1.2	0.2
720	Browns Meadow	0.6	0	0 [†]	0	0	3.4	55.8 [†]	30.0 [†]	18.2	0 [†]	0.4
721	Smith Creek	0	0	0	0 [†]	0.2	2.2	46.6	2.6	0	0.4	0
722	Prospect Peak	0	0	0	0	0	3.6	47.4 [†]	14.4	2.8	0.4	0
723	W Fork Mission Creek	0 [†]	0.2	0	0 [†]	0.4 [†]	15.4	50.4 [†]	15.8 ^{†4}	38.4	0	0
724	Huckleberry Mtn	0.4	0	0	0	0	1.4	75.0 [†]	30.2 [†]	14.8	0.2	0 [†]
725	North Fork Pine Creek	0	0	0	0	0	1.4	62.4 [†]	43.6 [†]	13.6 [†]	1.2 [†]	0.75
726	Mineral Creek	0.2	0	0	0 [†]	0.3 ³	25.6	65.4	5.4 [†]	10.4	0	0 ¹
727	South of Sanders	0	0	0	0	0 [†]	29.2	59.8	3.6	0.8	0	0
800	Mason Butte	0	0	0	0 ⁴	0 [†]	8.8 ⁴	5.4	13.2 [†]	38.2 [†]	9.0 [†]	7.25 ⁴
801	1 m SW Moctelme Butte	0 [†]	0.4	0.4 [†]	0.2	0	5.5	21.4 [†]	6.8 [†]	9.8 [†]	2.8	0.2

*Indicates Sites Not Trapped m indicates traps missing [†]Indicates larval survey *Italics indicates egg mass sample*
¹Indicates 1/5 traps collected ²Indicates 2/5 traps collected ³Indicates 3/5 traps collected ⁴Indicates 4/5 traps collected

Appendix 1. (continued) 2007 to 2017 Douglas-fir tussock moth trap results at IDL monitored sites.

Mean Number of Moths per Trap												
Plot #	Site Name	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
802	1.9 mi S of Plummer	0	0	0	0 [‡]	0.2	2.4	<i>80.0[‡]</i>	<i>40.0[‡]</i>	<i>39.6[‡]</i>	1.6	0
803	Little Plummer Creek	3 [‡]	0.8	0.2 [‡]	0 ⁴	0 [‡]	10.6	<i>115.4[‡]</i>	<i>14.2[‡]</i>	<i>57.0[‡]</i>	17.6 [‡]	5.8
804	Syringa Creek	0	0	0	0	0	0.4	11.0	1.3 ⁴	0.4	0	0
805	John Point	0.4	0	0	0	0 ⁴	*	*	*	*	*	*
806	2 mi W of Pettis Point	0	0	0	0	0	0.8	36.6	3.6 ⁴	0.4	0.2	0
807	Davis Creek	0	0	0	0 [‡]	0.4	0.2	26.4	3.0	m [‡]	1.0	0
808	Renfro Creek	0 [‡]	0.2	0	0	0	0.0	37.8	3.0	0.4	0	0
809	Crystal Creek	0	0	0	0	0	0.4	9.8	0.6	0.4	0	0.2
810	Child Creek	0	0	0 [‡]	0	0	0.8	25.2	0.6	0.6	0.2	0
811	Hobo Pass	0.2	0	0	0 [‡]	0.4	2.2	13.6	2.5	m [‡]	2.4 [‡]	0.6
812	Hemlock Butte	0	0	0.2	0	0	0.2	37.0	1.8 ⁴	0.5	0.2 [‡]	0.4
813	Carpenter Peak	0	0	0	0	0	0.0	12.6	3.6	1.6	0	0
814	Tyson Creek	0	0	0	0	0	0.6	1.4	1.0	2.8	0	0
815	Heinaman Creek	0	0	0	0	0	0.0	2.4	0.6	m	0.6	0
816	Green Mtn	0.6 [‡]	1.4	0.6	0 [‡]	0.4	2.2	38.4	4.8 [‡]	5.2	0.4	0
817	Willow Creek	0	0	0 [‡]	0.4 [‡]	0.2	2.8	32.0	1.4 [‡]	6.2 [‡]	2.6 [‡]	1.2
818	Head of Emerald Ck	0.2	0	0	0	0	2.0	46.4	5.8	3.6	0	0.6
819	East Fork Emerald Ck	0.2	0	0	0	0	0.4	2.6	1.0	0.2	0	0
820	Head of Bobs Creek	0	0	0	0	0	0.4	9.8	2.0	0.6	0	0
821	E Fk of Potlatch River	0	0	0	0	0	0.4	50.8	5.0 ³	3.8	0.2	0
822	Head of Moose Creek	0.2	0	0	0 [‡]	0.2 [‡]	9.2	45.6 [‡]	14.8	2.2	0	0.2
823	Beals Butte	0	m	0	0	0	0.4	58.2	1.2	2.2	0	0
900	Hauser	0	0	0	0	0	0.8	6.0	1.8 ⁴	2.4 [‡]	1.4	*
901	Cougar Bay	0	0	0	0	0	0	29.4	6.4 [‡]	5.2 [‡]	1.4	*
902	Marie Creek	0	0	0.2	0	0	0.3 ⁴	2.3 ⁴	2.0	1.2 [‡]	0.8	*
903	Canary Creek	0	0	0	0	0	0	12.8	3.8	2.8	0	*

*Indicates Sites Not Trapped
¹Indicates 1/5 traps collected

m indicates traps missing
²Indicates 2/5 traps collected

[‡]Indicates larval survey
³Indicates 3/5 traps collected

Italics indicates egg mass sample
⁴Indicates 4/5 traps collected

Appendix 1. (continued) 2007 to 2017 Douglas-fir tussock moth trap results at IDL monitored sites.

		Mean Number of Moths per Trap										
Plot #	Site Name	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
904	Rathdrum	0	0	0	0	0	0	23.2 [‡]	17.2	2.6	*	*
905	State Line (Post Falls) [‡]	0.2	0	0	0.2 [‡]	0.2	0	6.6	0.6	2.0 ⁴	*	*
906	Sig. Point (Post Falls)	0	0	0	0	0	0.4	3.2 [‡]	9.4 [‡]	41.8	*	*
907	Blake Draw Creek	0	0	0.4	0	0 [‡]	11.8	27.4 [‡]	6.6 [‡]	7.0	*	*
908	Coon Creek	0	0	0	0	0 ^{‡3}	11.0	47.4 [‡]	33.2 [‡]	71.6	*	*
909	Heyburn Park	0.2	0	0	0	0	1.6	56.4 [‡]	11.4 [‡]	9.6	*	*
910	Coyote Lane PF	0	0	0	0 [‡]	0.2	0.2	54.0 [‡]	18.6 [‡]	67.6	*	*
911	State Line (Meredith)	0	0	0	0	0	0.4	58.8 [‡]	14.4 [‡]	23.2	*	*
912	Lovell Valley	1 [‡]	1	0.8 [‡]	0	0	5.6	65.8 [‡]	55.2 [‡]	69.6	*	*
913	Twin Lakes	0.2 [‡]	0.2	0.4	0	0	0.2	66.8 [‡]	35.6	*	*	*
914	McGovern Tree Farm	0	0	0	0	0	0.2	4.6	*	*	*	*
915	Signal Point #1	0	0	0 [‡]	0	0	0	39.4 [‡]	*	*	*	*
916	Signal Point #2	0	0	0	0	0	0	54.2 [‡]	*	*	*	*
917	Signal Point #3	0	0	0	0	0	0	22.8 [‡]	*	*	*	*
918	Signal Point #4	0	0	0	0	0 ¹	0	60.0 [‡]	*	*	*	*
919	Signal Point #5	0	0	0	0	0	0	35.4 [‡]	*	*	*	*
920	Spirit Lake	0	0	0	0	0	0	10.8	*	*	*	*
Number of Sites Trapped:		145	146	146	146	146	141	141	134	133	124	120
Mean # of Moths per Trap:		.17	0.05	0.03	0.02	0.05	6.3	43.8	11.8	11.9	1.1	0.4

*Indicates Sites Not Trapped
¹Indicates 1/5 traps collected

m indicates traps missing
²Indicates 2/5 traps collected

[‡]Indicates larval survey
³Indicates 3/5 traps collected

Italics indicates egg mass sample
⁴Indicates 4/5 traps collected

Appendix 2. 2007 to 2017 Douglas-fir tussock moth trap results for USFS-R1 monitored sites.

Mean Number of Moths per Trap													
ID	Plot #	Site Name	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
1-1	5001	Lodge Pt	0	0	0	0	0	0	2.2	0.2	3.0	0.0 ^{4‡}	0.0
1-3	5002	Pine Knob	0	0 ⁴	0	0	0	0	41.8	8.6	16.4	0.0 ^{4‡}	0.2
1-4	5003	Potato Hill	0	0	0	0	0	0	18.6	0.4	1.4	0.0 ^{4‡}	0.0
1-5	5004	Big Tinker	0	0	0	0	0	0	4.6	0.2	0.0	0.0 ^{4‡}	0.0
2-1	5005	Rhett Cr	0 ⁴	0	0	0	0	0	0.2	0.0	0.0	0.3 ^{3§}	0.0
2-2	5006	Center Ridge	0	0	0	0	0	0	4.6	1.6	1.4	0.7 ^{3§}	0.0
2-5	5007	S. Cow Cr	0	0	0	0	0	0	0.2	0.8	1.4	0.0 ^{3§}	0.0
2-6	5030	Spring Mtns	0	0	0	0	0	0	0	0.0 ³	1.4	0.0 ^{3§}	0.0
2-7	5031	Crook's Corral	0 ³	0.25 ⁴	0 ³	0 ³	0	0	0.2	0.4	*	*	*
3-1	5008	Keuterville Cottonwood Butte	0	0	0 ³	0 ³	0	0	3.8	1.2	0.4	0.0 ^{3§}	0.0
3-2	5009		0	0	0	0	0	0	0.4	0.2	0.4	0.0 ^{4‡}	0.0
4-1	5010	Lake Waha	0	0	0	0	0	0	1.6	0.0	0.0	0.0 ^{3§}	0.0
4-2	5026	Black Pine	0	0	0	0	0	0	3.4	0.6	4.0	1.3 ^{4‡}	0.2
4-3	5012	Junction	0	0	*	*	0	0	1	0.8	0.8	0.0 ^{3§}	0.0
4-4	5013	Captain John	0	0	*	*	0	0	0.8	0.0	1.0	0.3 ^{3§}	0.0
4-7	5011	No Name	*	*	*	0	0	0	4.6	1.2 ⁴	9.4	0.0 ^{3§}	*
5-2	5014	Angel Butte	0	0	0	0	0	0	0.6	0.2	0.6	0.0	*
5-3	5015	Grangemont	0	0	0	0	0.2	0	9.6	1.2	1.0	0.8	1.4
5-4	5016	Bargamin Ck.	0.2	0	0	0	0	0.2	14	*	2.0	0.6	4.6
5-5	5017	Bald Mtn	0.4	0	0	0	0	0	10.4	1.2	1.6	0.2	3.4
5-6	5018	Summit Landing	0.2	0 ⁴	0	0	0	0	0.6	1.2	1.8	1.0	3.2

*Indicates Sites Not Trapped m indicates traps missing † Indicates larval survey *Italics indicates egg mass sample*
¹Indicates 1/5 traps collected ²Indicates 2/5 traps collected ³Indicates 3/5 traps collected ⁴Indicates 4/5 traps collected
[‡] Indicates only 4 traps put out [§] Indicates only 3 traps put out

Appendix 2. (continued) 2007 to 2017 Douglas-fir tussock moth trap results for USFS-R1 monitored sites.

			Mean Number of Moths per Trap										
ID	Plot #	Site Name	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
5-7	5019	Shin Pt	*	0	0	0	0	0	3	1.0	0.2	0.3 ⁴	0.0
5-8	5029	Swanson Ck.	1.6	0	0	0	0	0	2.4	0.8	0.8 ⁴	0.4	0.8 ⁴
5-11	5027	Cooper Rd./Cook Ck.	0	0	*	*	0	0	2.8	2.0 ⁴	3.6	*	*
5-12	5028	Whiskey Ck.	0	0	*	*	0	0	3	0.0	1.0	*	*
6-1	5020	Canyon Jct	0	0 ⁴	0 ⁴	0 ⁴	0	0	13.2	0.4	1.2	0.3 ^{4†}	0.4
6-3	5032	Mud Cr.	0 ³	0	0	0	0	0	1	0.8	0.0 ⁴	0.0	*
7-2	5021	Little Bald Mt	.2	0 ³	0	0	0	0.2	61.6	1.4	3.6	*	0.0
7-3	5022	Little Boulder Cr.	0	0	0	0	0	0.2 ³	7.8	2.2	1.0	0.2	0.0
7-4	5023	W. Fk Potlatch	.4	0	0	0	1.0 ⁴	0.2	8.6	2.0	1.2	0.8	0.0 ²
7-5	5024	Elk Cr Falls	0	0	0 ³	0	0	0.2	0	1.8	2.0	0.8	0.2
7-6	5025	Morris Cr.	0	0	0	0	0.8	2.0	16.8	*	1.4	0.8 ⁴	0.0
8-1	5033	Sinkler Rd./Rose Cr.	0	0	0	0	0	2.3 ³	*	*	*	*	*
8-2	5034	Wise Lane	0	0	0	0.2	0	1.6	*	*	*	*	*
8-3	5035	E. of Old Tensed Ln	0	0	0	0	0	1.4	*	*	*	*	*
Number of Sites Trapped:			33	35	30	31	35	35	32	32	31	29	31
Mean # of Moths per Trap:			0.10	0.00	0.00	0.01	0.03	0.24	7.61	1.08	2.06	0.30	0.47

*Indicates Sites Not Trapped

¹Indicates 1/5 traps collected

m indicates traps missing

²Indicates 2/5 traps collected

[‡] Indicates only 4 traps put out

[‡] Indicates larval survey

³Indicates 3/5 traps collected

[§] Indicates only 3 traps put out

Italics indicates egg mass sample

⁴Indicates 4/5 traps collected

Appendix 3. 2007 to 2017 Douglas-fir tussock moth trap results for USFS-R4 monitored sites

Mean Number of Moths per Trap												
Plot #	Site Name	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
4001	South Fork Boulder Creek	5.4	0.2	0	0	0.6	0.5 ⁴	0.4	0	0.2	0.2	*
4002	Mill Creek	1.4	0.4	0.4	0	1.6	1	0	0.2	0.2	0.2	*
4003	New York Summit	*	2	2.0	0.4	3.2	1.2	0.6	0	1.6	1.2	*
4012	Baldy Mt.	2.2	*	*	*	*	*	0	0.2	0.8	1	*
4004	Upper Wolfstone Creek	*	39.0	15.4	5	*	*	1.2	0	0.8	1.4	*
4005	Brundage Mt Resort	0.8	0.4	0	0.2	*	0	5.4	0.2	1.6 ⁴	1 ⁴	*
4006	Bogus Basin Resort	3.4	10.4	2.8	1	*	0.6	0.4	0.2	15.2	15.4	*
4007	Sharps Canyon	3.8	58	49.2	27.4	*	2.2	1.8	*	*	*	*
4008	Lower Scriver Cr	37.2	26.8	5.2	0	*	1.4	5.8	*	*	*	*
4009	Paradise Springs	5.8	5.8	0.8 ⁴	0.2	*	0.2	0.4	*	*	*	*
4010	Lost Man	*	*	*	*	*	*	2.4	*	*	*	*
4011	Couch Summit	13.2	48.0	30.4	9	*	0	0	*	*	*	*
4013	Tamarack Flat	60.8	31.2	11.2	0.2	*	*	*	*	*	*	*
4014	Antelope Trail	*	65.2	*	0.6	*	*	*	*	*	*	*
4015	Little Sage Hen	6.8	25.8	26.2	0.2	*	*	*	*	*	*	*
4016	Cottonwood	42.8	27.4	8.2	1	*	*	*	*	*	*	*
4017	Skunk Creek	15.8	11.0	4.0	0.4	*	*	*	*	*	*	*
4018	Cow Creek	17	29.2	15.2	2.3 ⁴	*	*	*	*	*	*	*
4019	Howell Canyon	0	0.2	0.7 ⁴	*	*	*	*	*	*	*	*
4020	Porphyry Ck.	1.2	4.75 ⁴	*	*	*	*	*	*	*	*	*
4021	Lick Ck.	15.4	8	*	*	*	*	*	*	*	*	*
4022	Adams Ck.	0	0.2	*	*	*	*	*	*	*	*	*
4023	Antelope Flat	22.4	*	*	*	*	*	*	*	*	*	*
4024	Bear Basin	1.8	*	*	*	*	*	*	*	*	*	*
4025	Barrinaga Co	0	*	*	*	*	*	*	*	*	*	*
4026	Ant Basin	11.6	*	*	*	*	*	*	*	*	*	*
4027	Bear Saddle	31.2	*	*	*	*	*	*	*	*	*	*
4028	Mann Creek	10	*	*	*	*	*	*	*	*	*	*
Number of Sites Trapped:		24	19	16	16	3	9	12	7	7	7	*
Mean # of Moths per Trap:		12.92	20.48	10.71	3.04	1.80	0.79	1.75	0.11	2.95	2.97	*

*Indicates Sites Not Trapped m indicates traps missing †Indicates larval survey *Italics indicates egg mass sample*
¹Indicates 1/5 traps collected ²Indicates 2/5 traps collected ³Indicates 3/5 traps collected ⁴Indicates 4/5 traps collected
[‡]Indicates only 4 traps put out [§]Indicates only 3 traps put out **Red font indicates new trap locations since 2013**