

2019 Idaho Douglas-fir Tussock Moth Monitoring Report



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2019 NORTH IDAHO DOUGLAS-FIR TUSSOCK MOTH MONITORING REPORT

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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, and release sex pheromones to attract males to mate. After mating, females lay egg masses ([figure 2](#)) on host tree branches in late summer or fall. Egg hatch coincides with bud burst the following spring, and developing larvae ([figure 3](#)) feed on host foliage ([figure 4](#)). 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. During an outbreak, DFTM populations build rapidly over several years, then quickly collapse as starvation, predation, parasitism, and infection by a DFTM-specific nuclear polyhedrosis virus (NPV) cause high levels of DFTM mortality. In northern Idaho, there is a long history of periodic outbreaks causing widespread defoliation ([figure 5](#)). In southern Idaho, large outbreaks have also occurred, but on a more irregular basis. Tree defoliation during a DFTM outbreak can appear very dramatic, but trees with light or moderate defoliation can recover following the outbreak.

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) ([figure 6](#)). Pheromone lures that mimic female moths are placed in sticky traps before the DFTM flight period and the number of captured adult males caught throughout the flight period is recorded each year ([figure 7](#)). Sharp increases in trap catches provide land managers advance warning of an impending outbreak.

North Idaho Outbreaks and EWS trapping

In northern Idaho, three periods of DFTM outbreaks have been detected since implementing the EWS just after major outbreaks in the mid-1970s. The first outbreak detected by EWS traps occurred in the 1980s in Latah County and McCroskey State Park ([figure 5](#)). According to records, outbreaks of DFTM have occurred in this general area approximately every 8-10 years since at least the 1940s. The 1980s outbreak was preceded by high numbers of moth captures, but defoliation was only recorded by aerial observers in 1986 ([figure 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 ([figure 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 106,000 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 ([figure 8](#)).

South Idaho Outbreaks and EWS trapping

Records of EWS trapping date back to 1980 in southern Idaho, but trapping has been carried out inconsistently over the decades, and early aerial survey data is not consolidated in this region. Trap catch records indicate there may have been DFTM outbreaks in the early 1980s in Region 4, but there were no acres of defoliation recorded at that time. From 1990-1992, a major DFTM outbreak in southern Idaho caused defoliation on over 400,000 acres, primarily affecting areas east of Highway 21 on the Boise and Sawtooth National Forests ([figure 5](#)). Much smaller outbreaks in the early 2000s affected the most southern reaches of the state, as well as large areas in the Owyhee Mountains. Trap catch numbers began increasing significantly again in 2014, and in 2017, heavy defoliation was noted in stands of Douglas-fir in Craters of the Moon National Monument and several other areas. Beginning in 2018 and continuing in 2019, a large outbreak affected the Round Valley area around Lake Cascade (figures [5](#) & [9](#)).

Outbreak Forecasting

Early Warning System trapping is often effective for predicting when DFTM outbreaks will occur, but it is not intended to predict the location or extent of tree defoliation. Therefore, in addition to EWS trapping of adult male DFTMs, population sampling of other life stages is needed 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 ornamental trees in landscaped settings are another indicator that outbreaks of DFTM will soon develop in forested settings (Tunnock *et al.*, 1985; Sturdevant, 2000). These ‘sentinel trees’ are often spruce, although spruce are a lesser-preferred DFTM host species during outbreaks in natural forests. Prior to the 2010-2012 outbreaks in northern Idaho, defoliation of ornamental 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 ([figure 6](#)). IDL maintains trap sites from Coeur d’Alene south to Moscow and east to Harvard ([figure 10](#)). Forest Health Protection, Coeur d’Alene Field Office (USFS-R1), maintains trap sites from Potlatch to Lucille ([figure 11](#)), while Forest Health Protection, Boise Field Office (USFS-R4), maintains trap sites in southern Idaho ([figure 12](#)).

Each year, five pheromone-baited sticky traps ([figure 7](#)) 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 late September or 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, but we have learned over time that even 15 males on average indicate a potential outbreak and more surveys are recommended. 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 average moths/trap threshold), fall egg mass sampling may be used to estimate the potential for defoliation in a specific area the following year. Two egg mass sampling methods are used in Idaho: (1) the “timed plot technique” and (2) methods described in Shepherd *et al.*, 1985. The “timed plot technique” works well for smaller crews and is conducted 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. The Shepherd *et al.*, 1985 method works well with larger crews and involves sampling three branches each on between 20 and 82 trees, depending on the cumulative number of egg masses found ([figure 13](#)). The mean number of egg masses per

tree is then calculated. Areas where high numbers or densities of egg masses are observed during sampling are considered to be likely locations of defoliation the following year. However, it is important to note that egg masses are exposed to winter injury, predation, and parasitism prior to hatching the following spring, and first instar larvae may be susceptible to starvation if many egg masses are observed in areas that have already been heavily defoliated.

Larval Sampling

At sites where the EWS average 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 useful 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. A stretched canvas 'beat sheet' is placed below a host tree branch and the branch is hit several times with a stick. Larvae that fall from the branch onto the sheet are inspected and counted. Sequential larval surveys are most useful before widespread defoliation occurs, and are of limited use during an outbreak (Mason, 1979).

Results of 2019 Survey Season

Trapping

A total of 204 sites were monitored in northern Idaho (144 by IDL and 31 by USFS-R1), and 28 sites were monitored in southern Idaho (USFS-R4) during 2019 (figures [10](#), [11](#), & [12](#)). In 2018, four sites that were traditionally monitored by IDL were transferred to USFS R1 (209, 211, 212, and 821) and four sites that were traditionally monitored by USFS R1 were transferred to IDL (5021, 5033, 5034, and 5035) to reduce travel times and improve efficiency in trap monitoring efforts. The transfer of these sites was maintained in 2019 and is expected to be maintained into the future.

The overall mean trap capture for the IDL traps in 2019 was 7.28 moths/trap, compared with 1.51, 0.17, and 0.05 moths/trap in 2018, 2017, and 2016, respectively ([appendix 1](#)). An average of 4.44 moths/trap were caught in USFS-R1 traps in 2019, compared with 1.15, 0.1, and 0 moths/trap in 2018, 2017 and 2016, respectively ([appendix 2](#)). The increasing trap catch numbers for IDL and USFS R1 traps suggest an upcoming outbreak in northern Idaho.

The 2019 USFS-R4 average for southern Idaho was 18.31 moths/trap compared to 19.73, 12.92, and 20.48 moths/trap in 2018, 2017 and 2016, respectively ([appendix 3](#)). In southern Idaho, 2019 was the third year of defoliation in the current outbreak, and outbreaks usually last three years. Continued high trap captures is not unusual during outbreak collapse, since male DFTMs (the sex targeted in traps) develop faster than females and therefore are exposed to fewer natural enemies. Despite the survival of some males, however, high mortality in female moths nonetheless results in a population crash.

Larval Surveys

In northern Idaho, larval sampling was conducted at seven IDL-monitored EWS sites in 2019 ([appendix 1](#)). Sites were selected for larval sampling because they were easily accessible and had high numbers of moths/trap relative to other IDL-monitored sites in 2018; however, only two larvae were observed (one at site 3 and one at site 301) and no defoliation was observed in forest settings. Several landowners reported DFTM larvae on trees in landscaped settings, and two reports were confirmed by IDL south of Coeur d'Alene. Tussock moth larvae were also reported around the St. Joe and Nez Perce-Clearwater National Forests, but observations by IDL and USFS entomologists indicated that these were rusty tussock moths rather than DFTMs. Rusty tussock moths look very similar to DFTMs, but feed on broadleaved shrubs like huckleberry rather than conifers. Areas where rusty tussock moths were observed overlapped with a severe western hemlock looper outbreak that caused defoliation of conifers from Elk City to Avery.

In southern Idaho, extensive larval sampling was conducted around areas defoliated in 2018 ([figure 9](#)). Initial monitoring early in the season found high numbers of healthy-looking DFTM larvae at every location surveyed. Over the course of the season, the outbreak expanded from 100,000 acres of defoliation in 2018 to over 200,000 acres of defoliation in 2019 ([figure 9](#)). In late August, IDL and USFS entomologists returned to the outbreak area to complete follow-up larval surveys to assess the impact of natural enemies on DFTM development and survival. By this time, DFTM larvae had been severely impacted by natural enemies, and high levels of NPV infection and parasitism were observed. Many dead larvae were observed hanging from foliage by their prolegs, characteristic of death by NPV infection ([figure 14](#)). Cocoons were also inspected, and many were thin and wispy due to NPV infection ([figure 14](#)), or contained wasp or fly maggots, indicative of parasitism ([figure 15](#)). Heavy NPV infection and parasitism were evident at every survey point, with the exception of several points where we did not find life stages, perhaps indicating high rates of starvation or predation.

Egg Mass Sampling

In northern Idaho, egg mass sampling was formally conducted at 15 sites monitored by IDL in 2019, as well as informally at a number of sites monitored by USFS R1. No DFTM egg masses were observed in northern Idaho 2019 ([figure 16](#)).

In southern Idaho, egg mass sampling was conducted at 134 sites ([figure 16](#)). Although many old egg masses from 2018 were observed ([figure 17](#)), there were very few current, viable egg masses. At 116 sites, no current egg masses were observed; at nine sites, only one current egg mass was observed at each site; six sites had fewer than 10 current egg masses each, one site had 13 current egg masses, and two sites had 40 and 42 current egg masses ([figure 16](#)). Exposure to parasitism, winter mortality, and predation prior to egg hatch in early summer could further reduce populations in 2020.

Defoliation

No Douglas-fir tussock moth defoliation was recorded in aerial detection surveys in northern Idaho in 2019. However, defoliated spruce trees in urban areas were observed in northern Idaho and eastern Washington, and are suspected sentinel trees indicating a building outbreak in the region. Additionally, a small area of DFTM-caused defoliation was mapped near Mica peak in Spokane county, Washington (near the Idaho border), and defoliation was also mapped in western Montana in 2019.

In southern Idaho, over 200,000 acres of DFTM-caused defoliation were mapped in 2019, as compared to 100,000 acres of defoliation mapped in 2018 ([figure 9](#)). This outbreak has been especially damaging due to drought conditions. Partially-chewed needles from 2018 defoliation quickly dried out and dropped, and many damaged trees did not re-leaf in 2019. The heavy defoliation (up to 90% in some areas) along with poor tree recovery prompted several salvage harvests on the Packer John State Forest ([figure 18](#)). The Boise and Payette NFs have incorporated DFTM damage considerations into marking guidelines for several landscape-level projects in the near future. Increased bark beetle attacks will continue to be a concern for defoliated areas in droughty years through 2025.

Additional Monitoring at Craters of the Moon National Monument

Douglas-fir tussock moth populations were very high within Douglas-fir stands north of the visitor center of Craters of the Moon National Monument (CTM) from 2017-2019. To assess tree condition following defoliation in CTM, USFS Region 4 entomologists monitored three stands within the National Monument from 2017 – 2019. Stand locations ([figure 19](#)) and total stand density basal area measurements were:

Stand 1 (43.45738, -113.5772): 334 ft² per acre; 86% of basal area Douglas-fir

Stand 2 (43.45623, -113.58051): 193 ft² per acre; 100% Douglas-fir

Stand 3 (43.47247, -113.56695): 188 ft² per acre; 100% Douglas-fir

In each stand, any incidence of bark beetle damage was recorded, and McMahan *et al.* (2019) FINDITS protocols were used to capture stand defoliation levels: low (0-32% defoliated), moderate (33-50%), heavy (51-89%), very heavy (>90%), and dead as a result of defoliation. During surveys, trees that had not set bud by September 2019 were considered dead.

Due to dry site conditions at CTM, a large percentage of very heavily defoliated (>90%) Douglas-fir trees were predicted to die. Stands 1 and 2 were defoliated much more severely than stand 3 earlier in the outbreak episode ([figure 20](#)). By September 2019, over 80% of the very heavily defoliated Douglas-fir trees in stand 1 were dead, almost 60% were dead in stand 2, and no dead trees were found in stand 3 ([figure 20](#)). Unlike stands 1 and 2, stand 3 had no heavily-defoliated trees in 2018, but a high proportion of heavily-defoliated trees in 2019 at the time of the last measurement. Therefore, tree mortality in stand 3 is likely in 2020.

Stressed, defoliated trees are often more susceptible to attacks by bark beetles. Models outlined in Weatherby *et al.* 1997 predict that in very heavily defoliated trees (>90%), 46% are predicted die from DFTM and 19% are predicted to die from bark beetles. USFS Region 4 entomologists estimate that in stands 1, 2, and 3 respectively, 246.7 ft² (86%), 33.3 ft² (17%),

and 0 ft² of basal area per acre have been killed as a direct result of defoliation. Additional tree mortality due to bark beetles is still possible following the DFTM outbreak.

In mature stands of Douglas-fir, the bark beetle species that poses the greatest threat is typically the Douglas-fir beetle. To protect surviving trees within CTM from Douglas-fir beetle attack, the National Monument deployed MCH (3-methylcyclohex-2-en-1-one), a repellent pheromone specific to Douglas-fir beetle, across the defoliated areas in 2019. The 2019 MCH anti-aggregation treatments across the stands have been successful based on no new bark beetle attacks recorded in 2019. Tree protection using MCH is effective for one year, and trees are still at risk to Douglas-fir beetle attack in 2020. Re-application of MCH pouches would be required for continued protection in 2020.

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 in 2020 or 2021. In addition to EWS trapping, sentinel trees in north Idaho and eastern Washington suggest an outbreak is on the horizon.

In southern Idaho, despite continued high trap captures of male DFTMs, the current outbreak is crashing. Ground surveys indicate that high levels of parasitism and NPV infection have resulted in a DFTM population collapse in most areas. The Cuddy Mountain area, where high numbers of DFTM egg masses were observed in surveys this fall, may experience defoliation in 2020. It is possible that DFTM populations in this area are not in sync with the rest of southern Idaho, and may instead be in sync with rising populations in neighboring areas in Oregon.

Although additional defoliation in the 2017-2019 outbreak zone is not anticipated in 2020 (except in the Cuddy Mountain area), damaged trees should be monitored. Trees with light or moderate defoliation may recover, but stress resulting from DFTM-caused defoliation can result in increased bark beetle activity, leading to further tree mortality in the area.

For additional information (including data, maps, reports, photos, or videos) please contact the Idaho Department of Lands Forest Health Program

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Figure 1. Adult Douglas-fir tussock moth male (left) and female (right). Female moth is pictured on an egg mass.

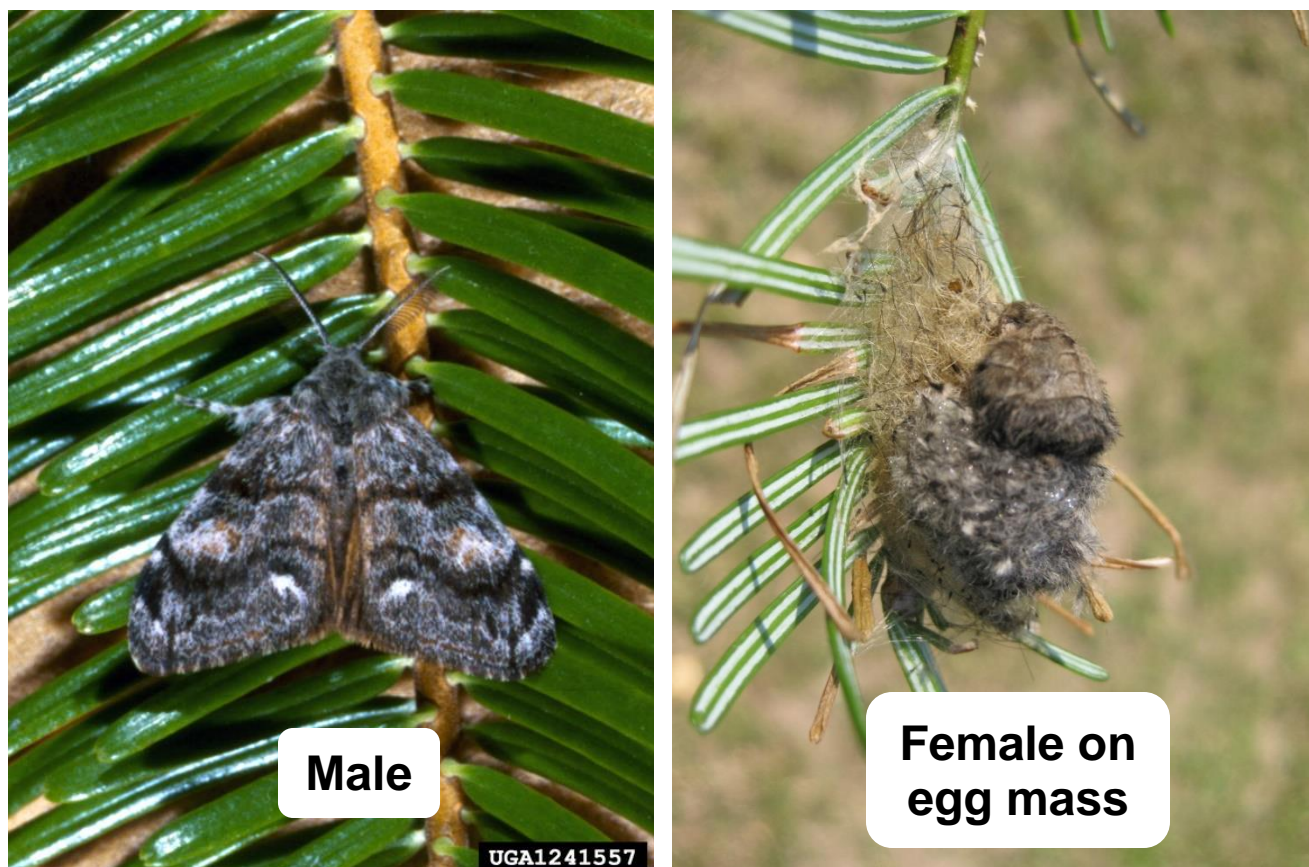


Figure 2. Douglas-fir tussock moth egg masses.



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Figure 3. Newly hatched (left) and fully grown (right) Douglas-fir tussock moth larvae.

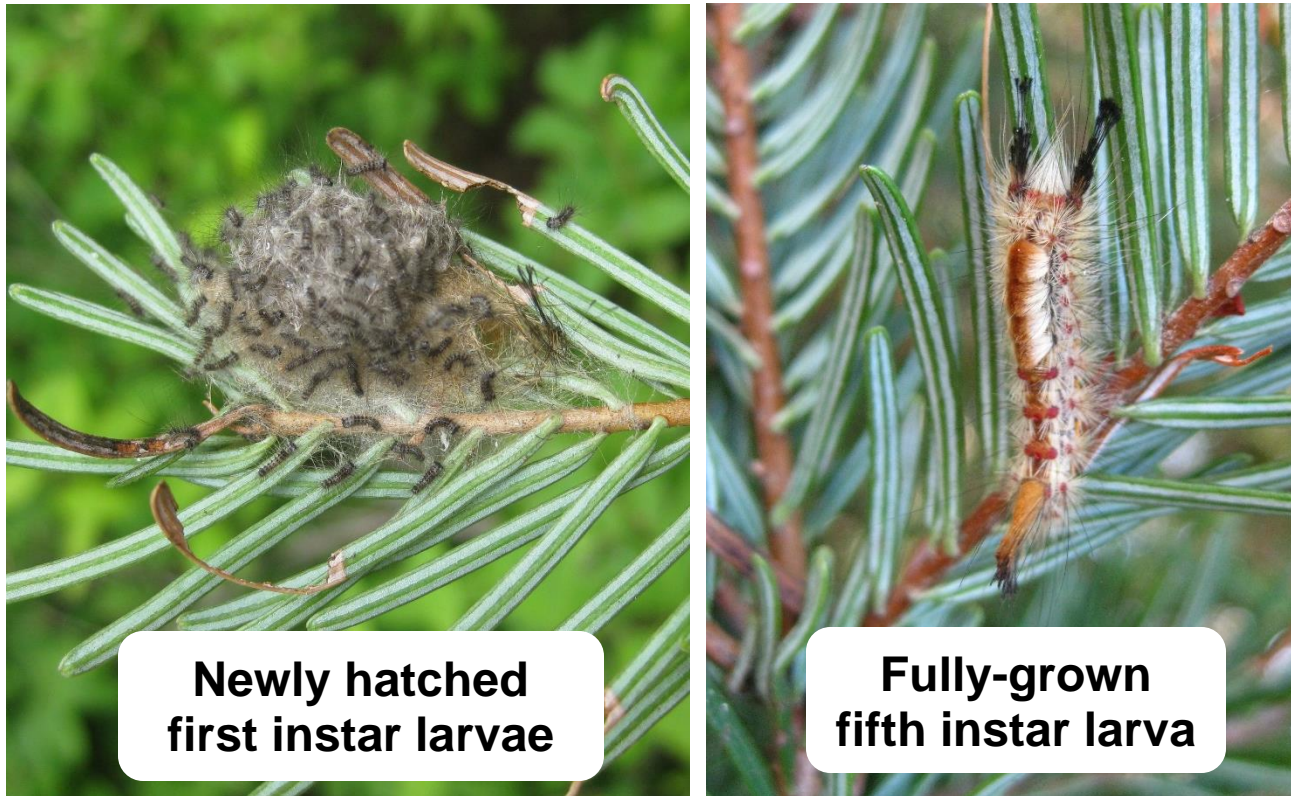


Figure 4. Douglas-fir tussock moth (DFTM)-caused tree defoliation.



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Figure 5. Aerially-mapped defoliation by Douglas-fir tussock moth for 1970-2019.

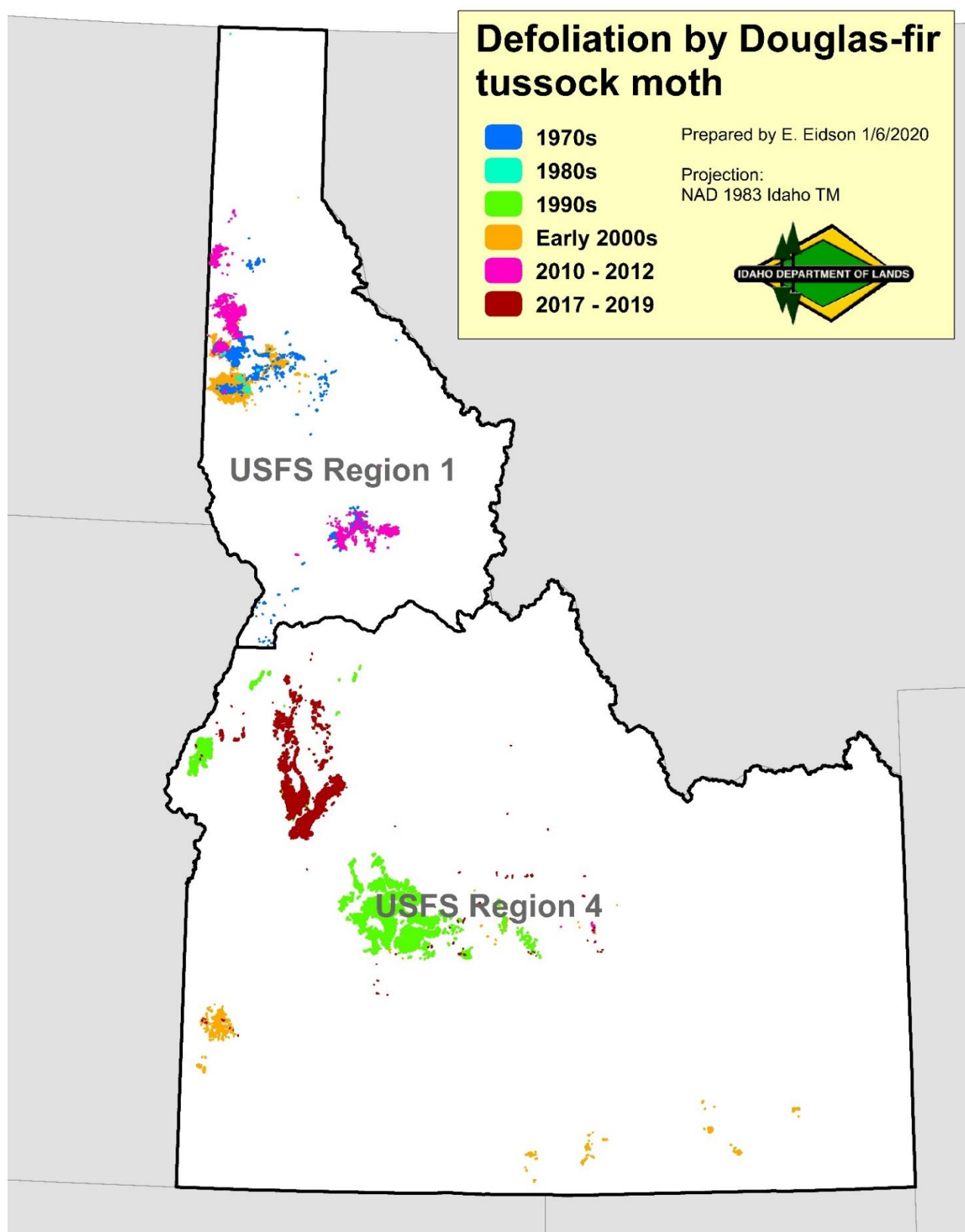
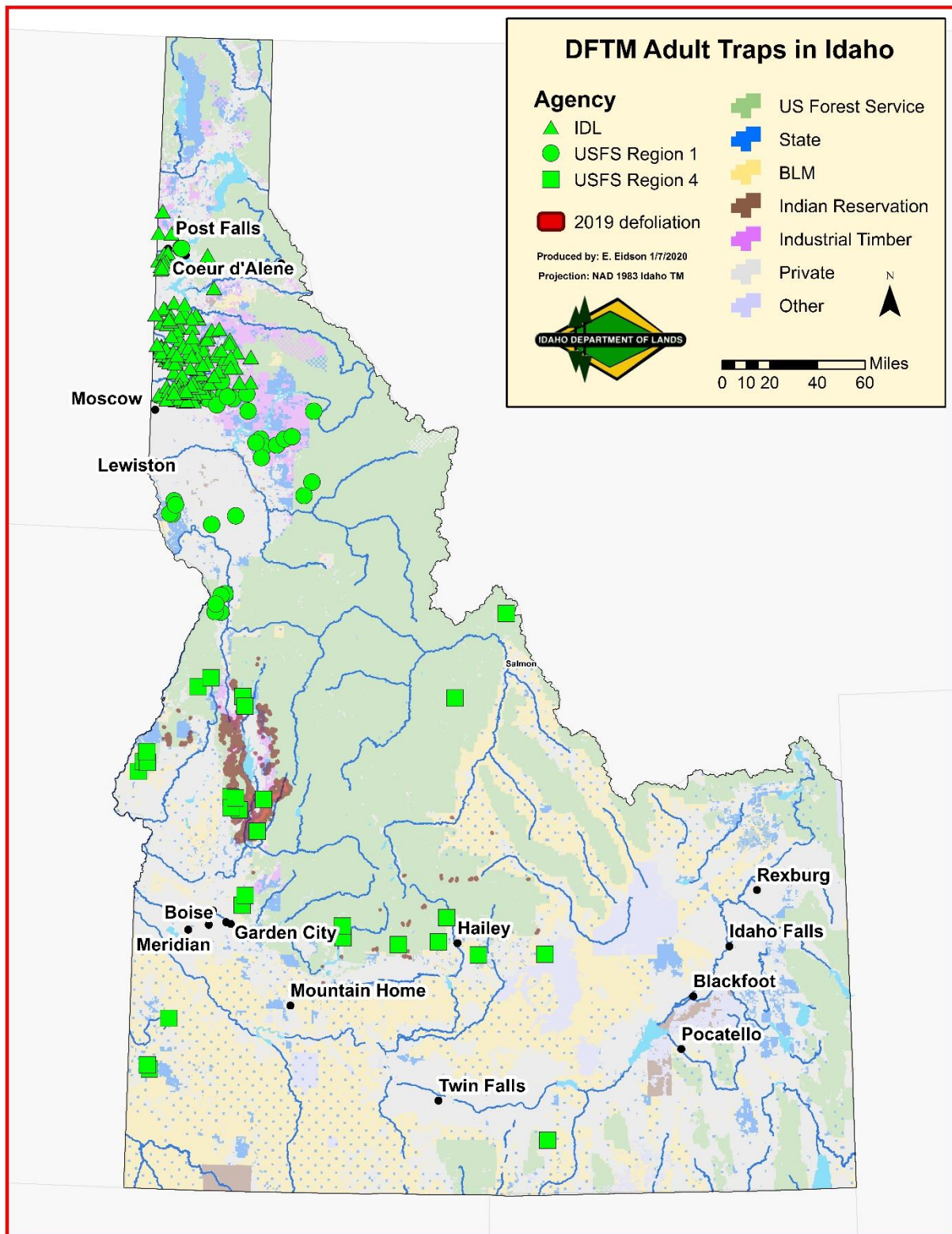


Figure 6. Early Warning System trap distribution in Idaho.



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Figure 7. Early Warning System (EWS) pheromone-baited stick trap and captured adult male DFTMs.

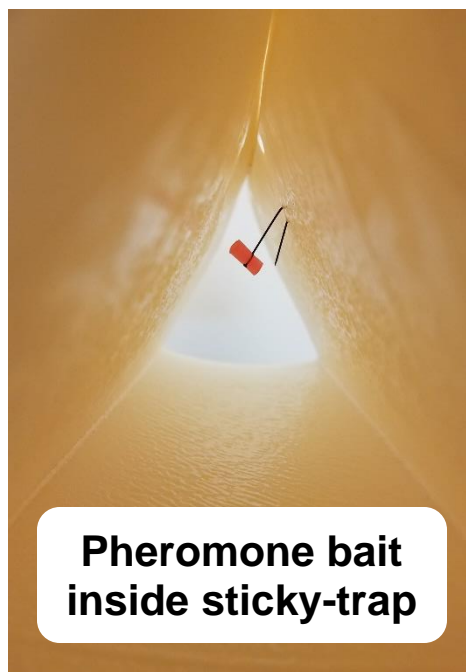


Figure 8. Mean trap catches of Douglas-fir tussock moth on plots monitored by IDL (top) and visible defoliation in northern Idaho (bottom) from 1977 – 2019.

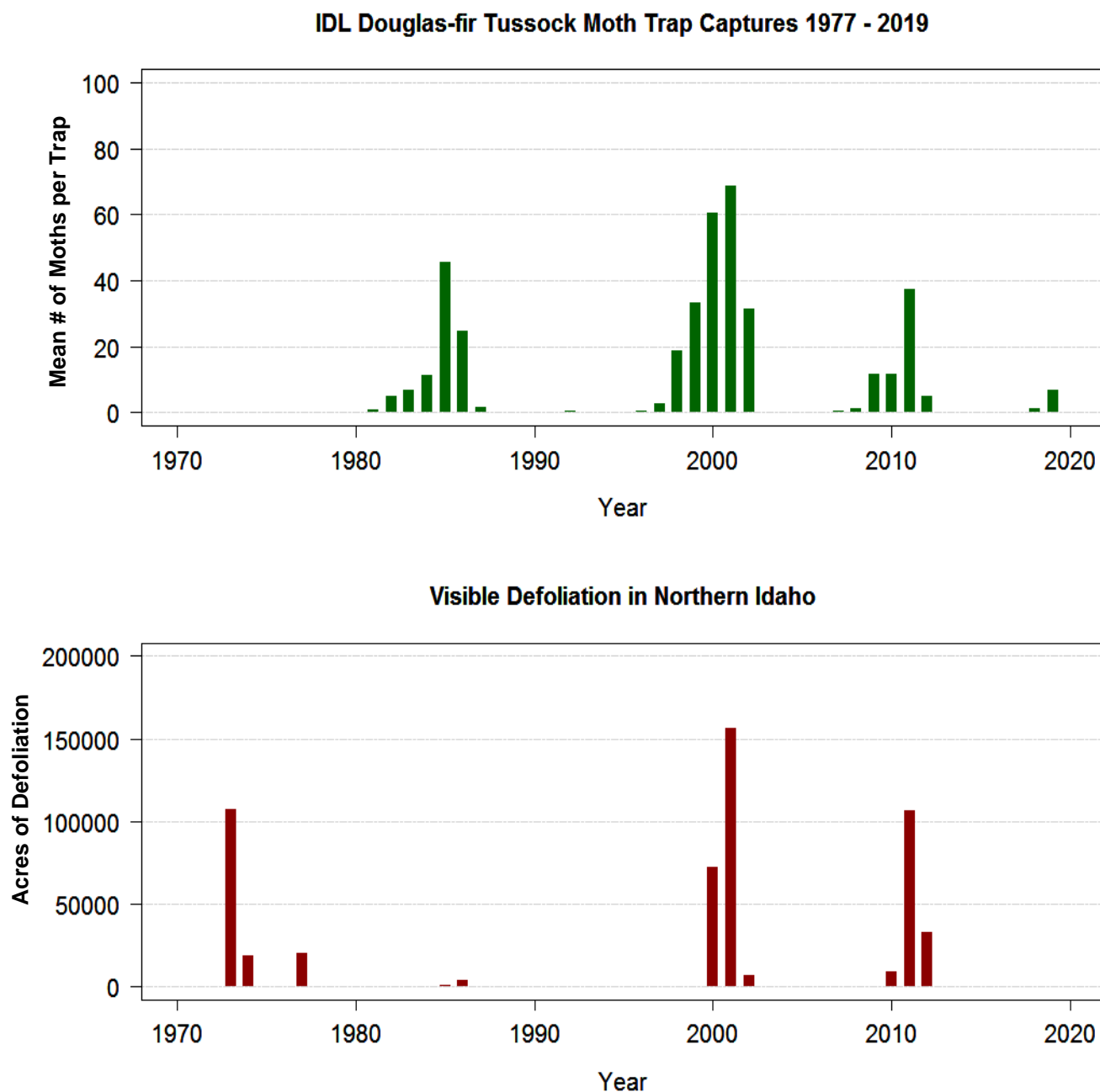
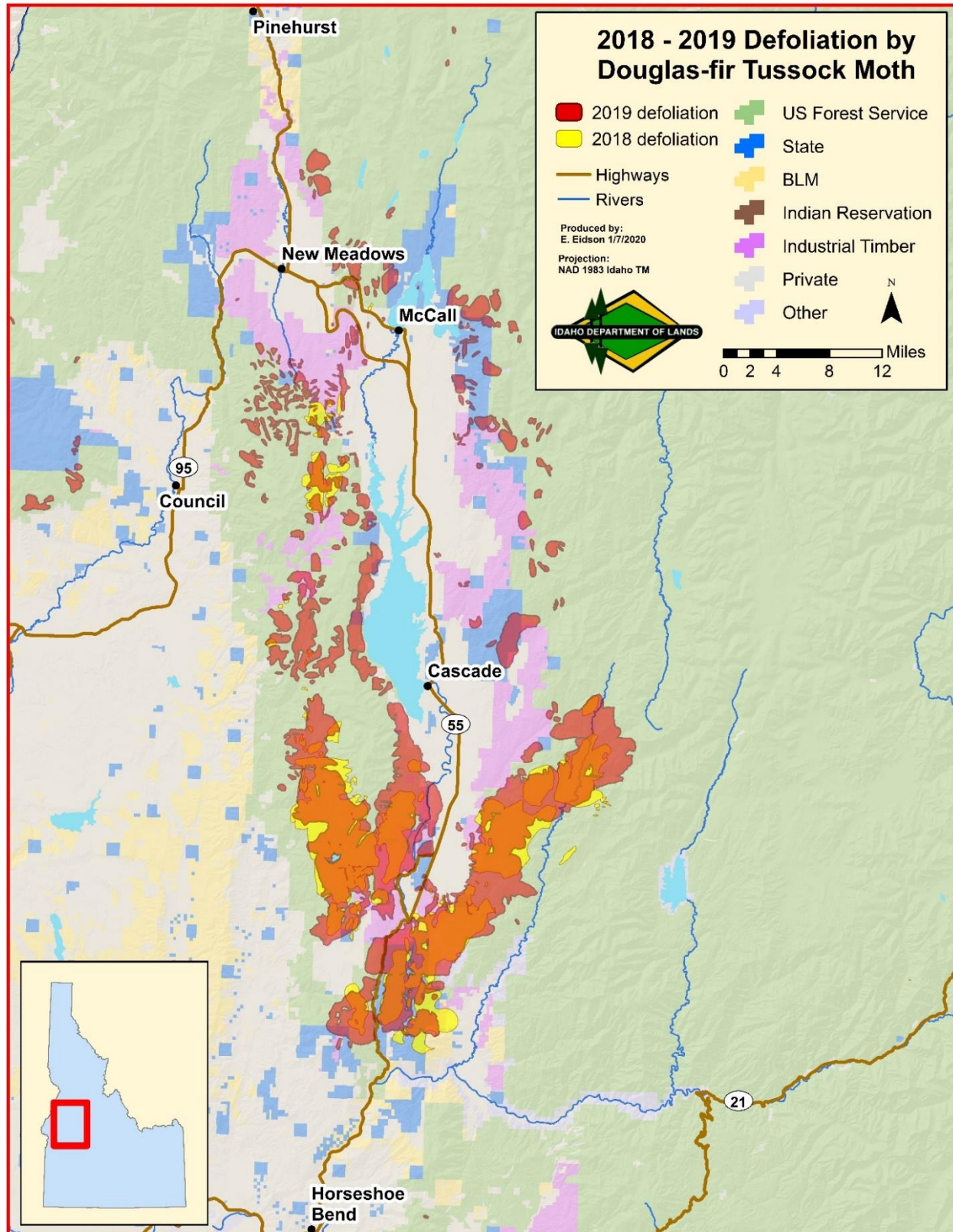


Figure 9. Douglas-fir tussock moth-caused defoliation in southern Idaho, 2018 - 2019.



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Figure 10. Map of sites trapped by IDL for Douglas-fir tussock moth in 2019.

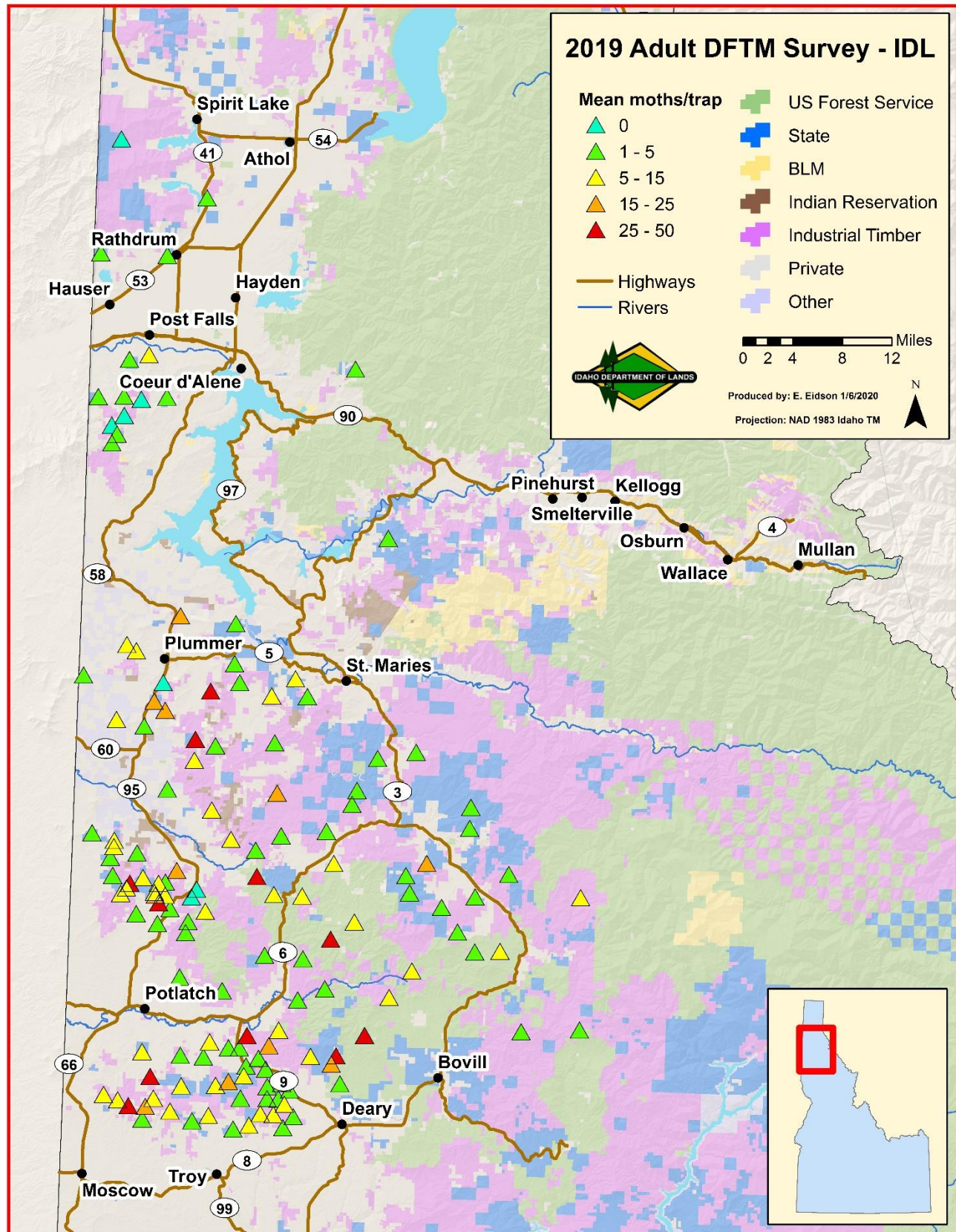


Figure 11. Map of sites trapped by USFS Region 1 for Douglas-fir tussock moth in 2019.
Two additional sites, not shown on this map, were trapped by USFS Region 1 in Coeur d'Alene at the USFS Forest Service Nursery.

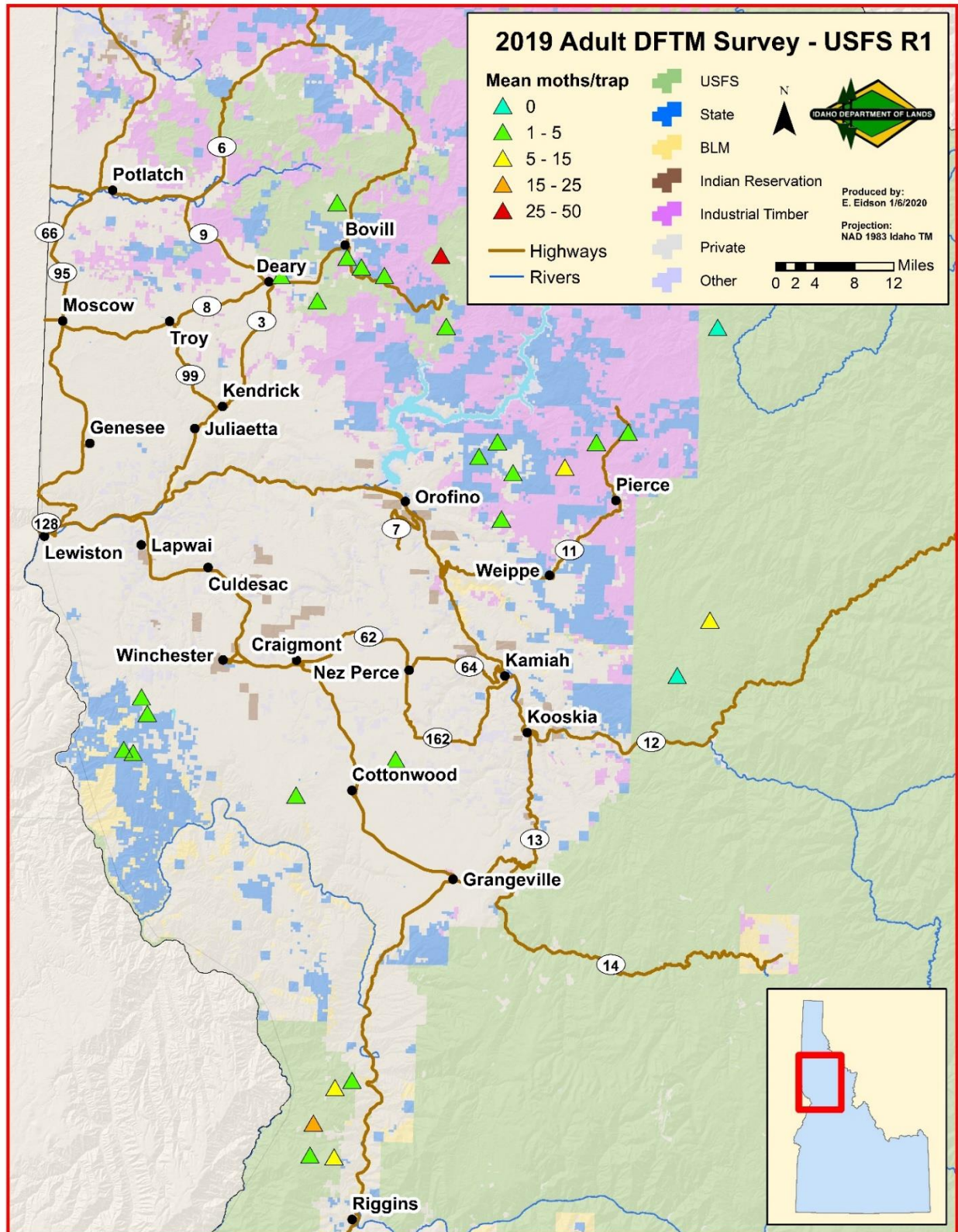


Figure 12. Map of sites trapped by USFS Region 4 for Douglas-fir tussock moth in 2019.

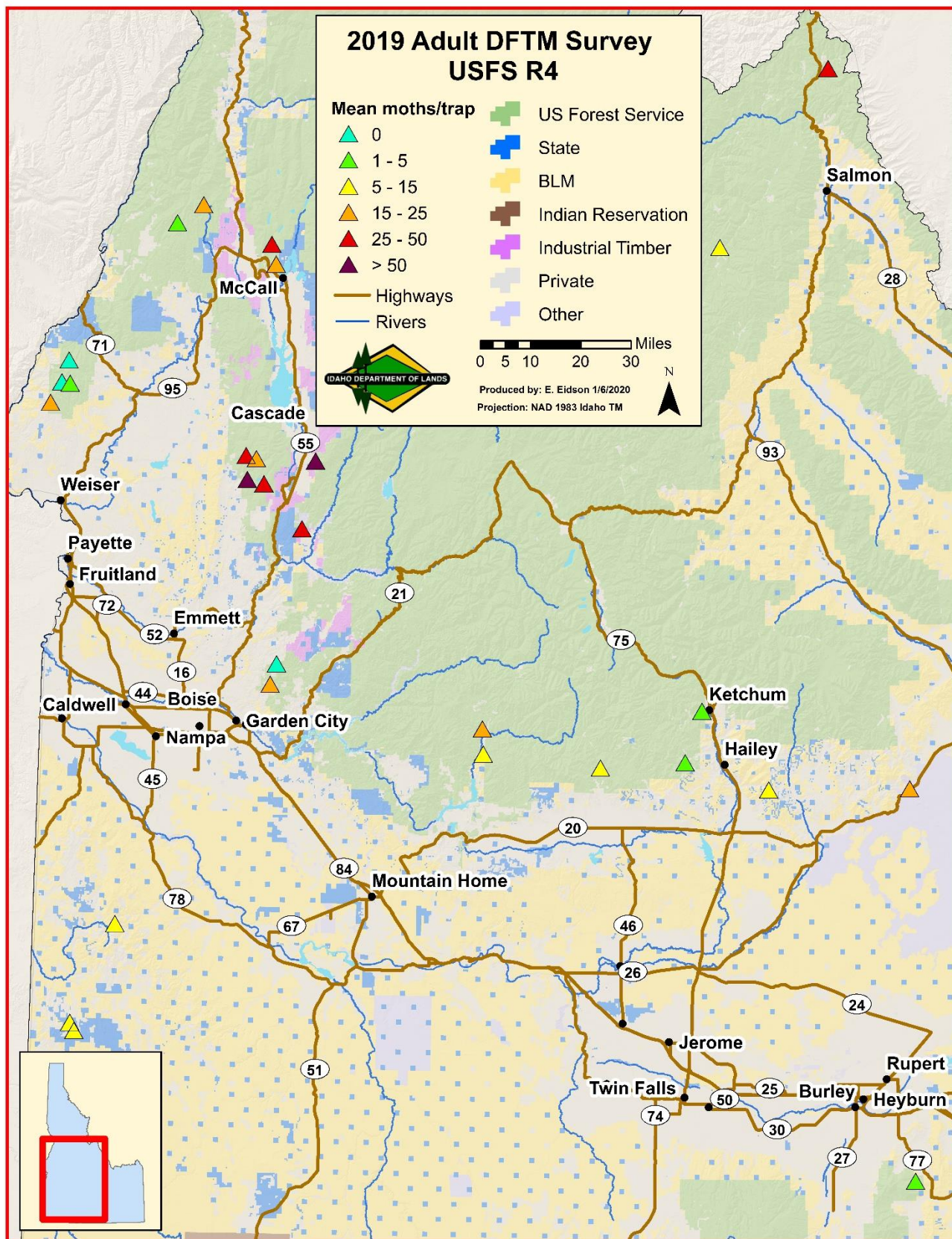


Figure 13. Data sheet for Shepherd *et al.*, 1985 Douglas-fir tussock moth egg mass sampling method. Data sheet shows number of host trees to be sampled (by inspecting three branches per tree) based on cumulative egg masses observed at a site. If the Lower Stop number of cumulative egg masses has been observed when a given Tree # is reached, sampling at the site is complete and the average number of egg masses per tree is calculated.

Douglas-fir tussock moth egg-mass survey

Plot # _____ Location _____
 Observer _____ Date _____

Tree #	# Egg Masses	Cumulative # Egg Masses	Lower Stop #	Tree #	# Egg Masses	Cumulative # Egg Masses	Lower Stop #
2			—	44			18
4			—	46			19
6			—	48			20
8			—	50			21
10			—	52			22
12			—	54			23
14			—	56			24
16			—	58			26
18			—	60			27
20			5	62			28
22			5	64			29
24			6	66			30
26			8	68			31
28			9	70			33
30			10	72			34
32			11	74			35
34			12	76			36
36			13	78			37
38			14	80			38
40			15	82			39
42			17				

Stop sampling when cumulative egg masses reaches 40 or is equal to or below lower stop number.

Total # egg masses _____
 # trees _____

Predicted Defoliation		
L	M	S
Map overleaf		

Figure 14. Douglas-fir tussock moth larva and cocoons that have been fatally infected by NPV.



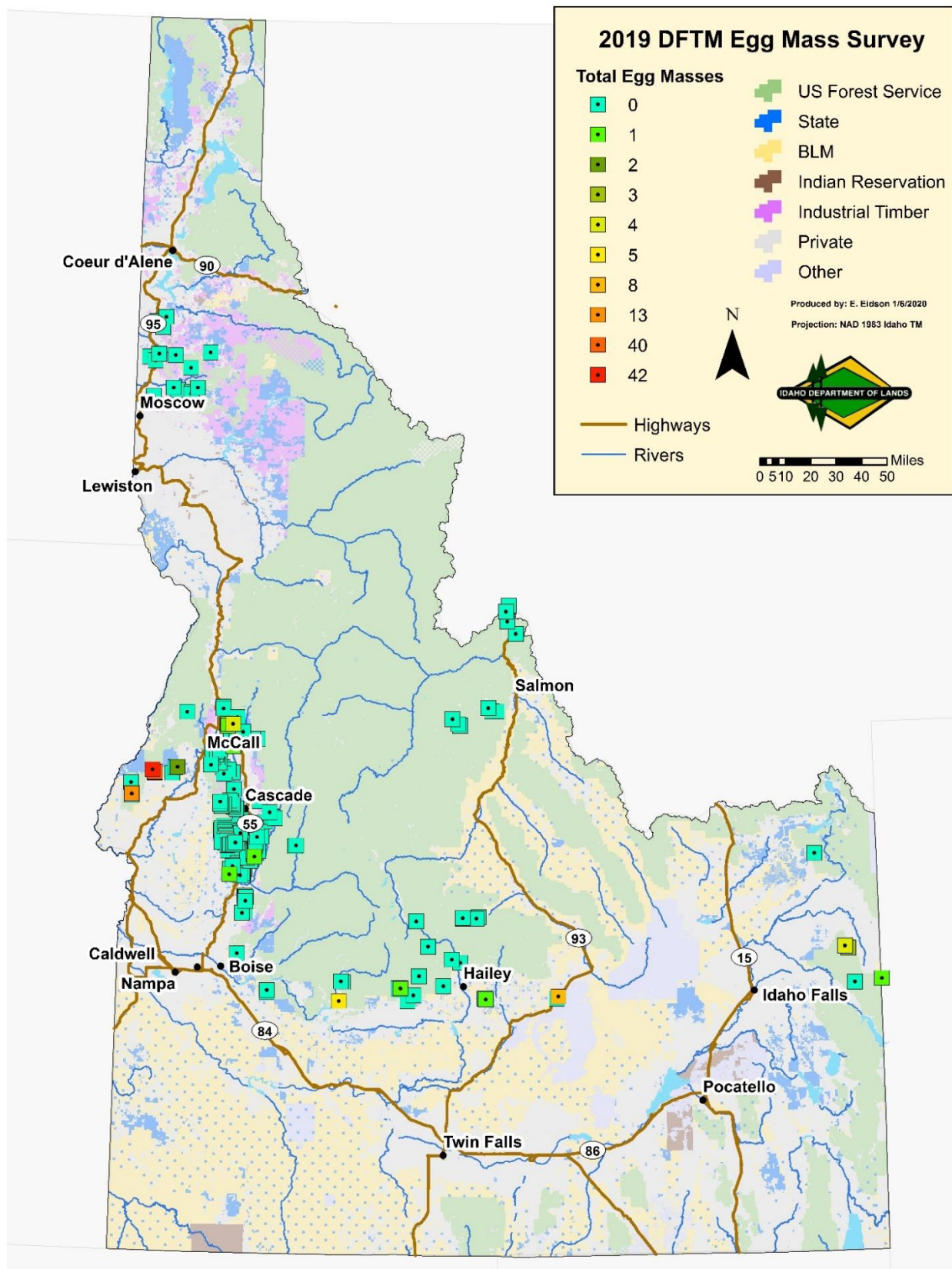
Figure 15. Douglas-fir tussock moth cocoons that have been fatally parasitized.



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Figure 16. Map of sites surveyed for Douglas-fir tussock moth egg masses in 2019.

Additional USFS R1 sites were sampled for egg masses, but data was not recorded. No egg masses were found at any of the USFS R1 sites that were informally sampled.



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Figure 17. Comparison of old and current Douglas-fir tussock moth egg masses.
Only current egg masses are potentially viable, and old egg masses are not counted in surveys.



Figure 18. Heavy Douglas-fir tussock moth-caused defoliation on the Packer John State Forest on September 17th, 2019.

Besides the spruce in the draw, these trees have little chance of recovery and salvage operations are planned for 2020.



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Figure 19. Locations of three defoliated stands in Craters of the Moon National Monument that were monitored by USFS Region 4 from 2017 – 2019.

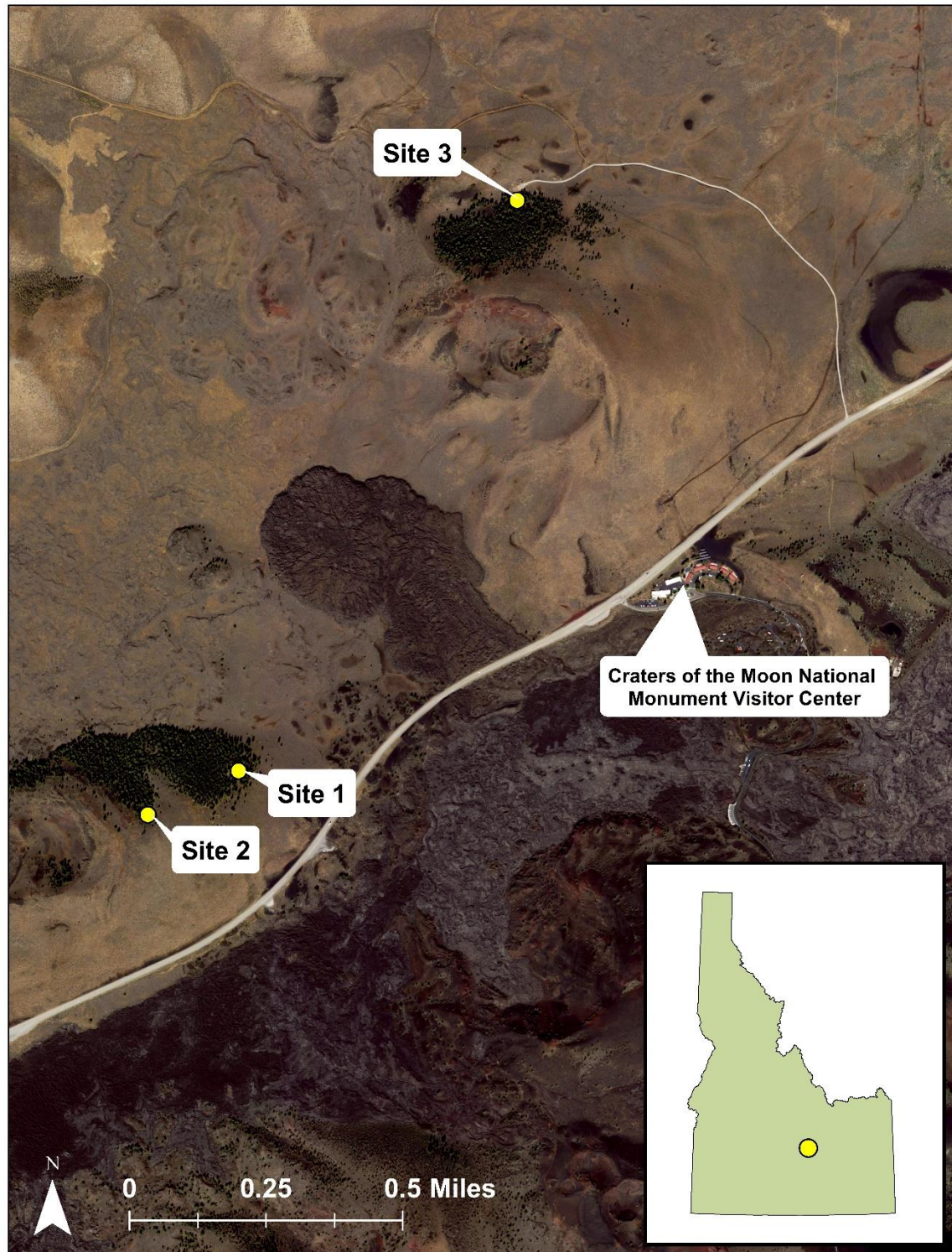
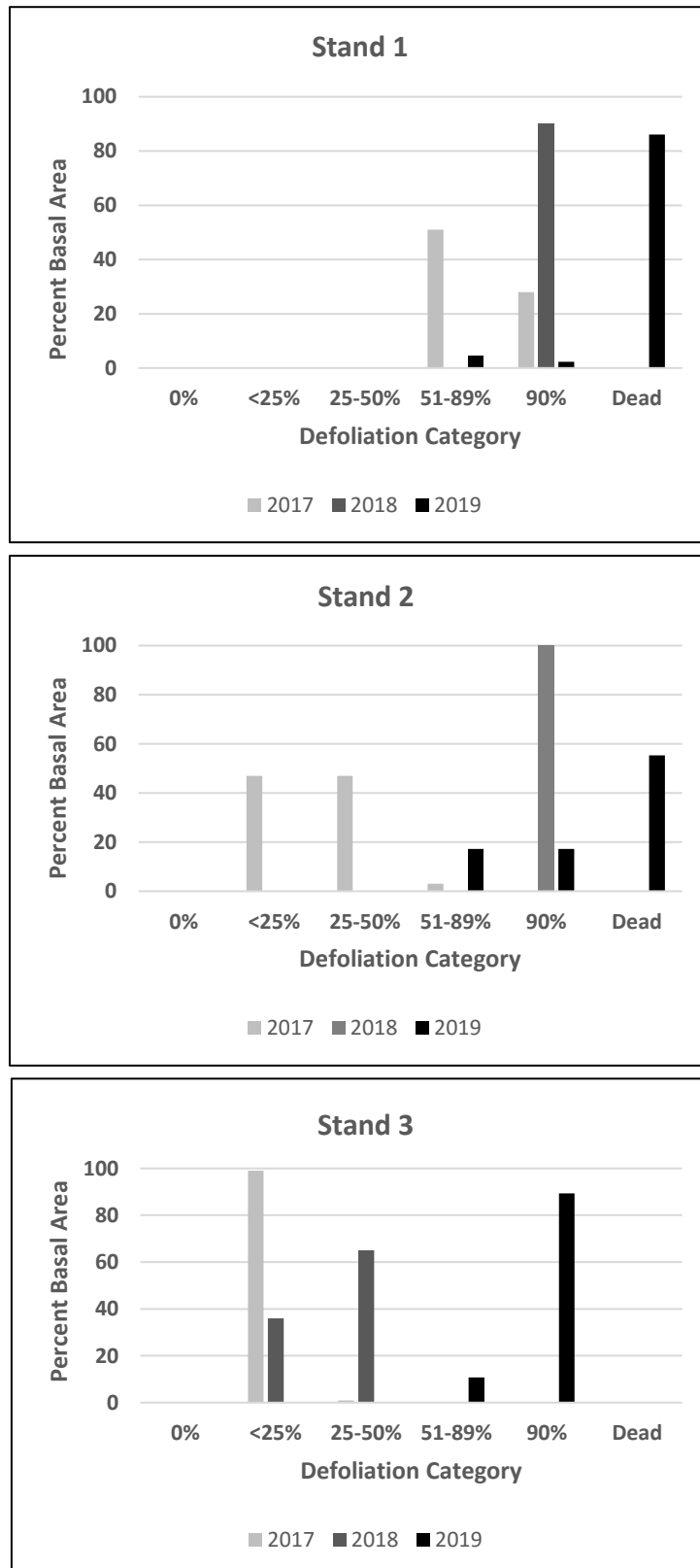


Figure 20. Percent basal area of Douglas-fir (>5"DBH) defoliated in each defoliation category and percent basal area of host killed by the defoliation across three forested stands within Craters of the Moon National Monument, 2017 - 2019.



Appendix 1. 2009 to 2019 Douglas-fir tussock moth trap results at IDL monitored sites.

Mean Number of Moths per Trap												
Plot #	Site Name	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
3	Lolo Pass	11 [‡]	5.8	0	0	0.2	0 [‡]	0.2 [‡]	26.8	30.2 [‡]	26.4 [‡]	5.2
4	Charles Butte	0.8	0	0	0	0 [‡]	0.2	0	0.4	81.4 [‡]	32.2 [‡]	5.4
5	Peterson Point	4	1.2	0	0	0	0	0	2.4	52.8 [‡]	8.6	2.2
6	East Dennis	11.6	0.2	0	0	0	0	0	0.2	33.2	2.3 ¹⁴	9
7	East Gold Hill	4.8	1.25 ⁴	0	0	0	0	0	3.0 ³	38	2.0 ¹	3.4 [‡]
8	Flat Creek	9.2	1.6 [‡]	0.6	0	0	0	0	0.2	48	8	1
9	Long Creek	10	3	0	0	0	0	0	5	56.2 [‡]	10.2 [‡]	20.6 [‡]
10	Paradise Point	14	0.6 [‡]	0.6	0	0	0	0	0.2	44.6	9.8	2.0 [‡]
11	Mineral Mountain	11.2	1.8	0	0	0	0	0 [‡]	22.2	11.6 [‡]	10.8 [‡]	25.0 ^{‡2}
12	Mission Mountain	8.8	0	0	0	0	0	0	5	66.4 [‡]	8.0 [‡]	20.8
13	Spring Valley Creek	0.8	0.2	0	0	0	0	0	0	6.2	1	0.6
14	Vassar Meadows	1.8	0.2	0	0	0	0	0	1	53.6 [‡]	17.0 [‡]	12.8
15	Fairview Knob	27	1.8 [‡]	0.6	0	0	0	0 [‡]	8.2	86.4	6.6 [‡]	9.2 [‡]
21	West Twin	27.2	1.6 [‡]	1.8	0	0	0	0	0.4	55.0 [‡]	4.0 [‡]	5.3 ¹⁴
22	Moscow Mtn	11.8	0.8	0.2	0	0	0	0	0.2	17	0 ⁴	3.6
101	Benewah	0.8	0	0	0	0	0	0	1	51.4 [‡]	16.4 [‡]	5
102	Windfall Pass	30 [‡]	2.6	0	0	0 ⁴	0	0 [‡]	10.4	83.0 [‡]	29.4 [‡]	32.0 ^{‡3}
103	Squaw Creek	7 ⁴	0.6	0.2	0	0	0 [‡]	0 [‡]	23.6	41	2.6	1.8
104	Moses Mountain	6.3 ⁴	2	0.2	0	0 [‡]	0	0 [‡]	10.2	51.8 [‡]	7.5 ⁴	3.4
105	Little John Creek	1	0.2 [‡]	0.4	0	0	0	0	1.6	51.2	0 ²	2.2
106	Emida Peak	6.8	1	0	0	0	0	1.0 ²	2.5	65.8	1.4	1.6
107	North-South Ski Area	10.4	0.2	0.2	0	0	0	0	1.4	74.8	2.3 ⁴	m
108	Bald Mountain	8.8	1.6 [‡]	0.4	0	0	0	0 ⁴	*	*	*	*
109	Laird Park	2.4	0.2	0	0	0	0	0	0.2	42	1.4	2.2
110	N Fk Palouse River	0.6	0 ⁴	0	0	0	0	0	0	12	0	0.4
111	Mica Mountain	34.4	2.6	0	0	0	0	0	3.2	63.2	16.6 [‡]	20.8

*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) 2009 to 2019 Douglas-fir tussock moth trap results at IDL monitored sites.

Plot #	Site Name	Mean Number of Moths per Trap										
		2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
112	Schwartz Creek	24.2	4.8	0.2	0	0	0	0	2.6	59.4	16.2 [‡]	7
113	Big Bear Creek	4.6	0.6	0	0	0 [‡]	0.2	0	3	39.8 [‡]	15.2 [‡]	11.6 [‡]
114	Big Meadow Creek	3.6	1.4	0	0	0	0	0	0.2	41.5 [‡]	0.8 ^{‡4}	0.4
115	East Twin Mountain	15.4	2	0.2	0	0	0	0	0	66.8	6.8	5.4 [‡]
116	Crane Point	6.6	0.6	0.2	0	0	0	0	3.8	43	6.8	0 [‡]
117	Sheep Creek	26.3 [‡]	3	0.2	0	0	0 [‡]	0.2	1.8	50.8 [‡]	21.0 [‡]	20.8 [‡]
118	W. Fork Mission Ck	3.2	1.6	0	0	0	0	0	1.8	64.2	7.0 ^{‡3}	6.8 [‡]
119	1 Mi N. Mineral Mt	2.4	1.8	0 [‡]	0.2	0	0	0	43.6	61.6 [‡]	24.6	2.2
200	2 mi W of Plummer	7.4	1.2	0	0	0	0	0	4.8	28.8 [‡]	7.0 [‡]	34.2 [‡]
201	Coon Creek	2	0.4	0	0	0	0	0 [‡]	9.8	97.4 [‡]	18.0 [‡]	21.8 ^{‡4}
202	3 mi E of Benewah	1.6	0.2	0	0	0 [‡]	0.2	0	*	*	*	*
203	Benewah Point	2.4	0.2	0	0	0	0	0	0.6	47	8.4	3.4
204	John's Point	2.2	0	0.2	0 [‡]	0	0 [‡]	0.2	*	*	*	*
205	3 m E Charles Butte	0.6	0.6	0 ³	0	0 [‡]	0	0	2.2	52.4	6.5 ^{‡4}	2
207	W Fork Emerald Ck	1.4	0	0	0	0	0	0	0.2	4.6	0	0.4
208	Cedar Butte	15	0.4	0	0	0	0 [‡]	0.2	0	41.4	1.4 ^{‡4}	0.4
209	Abes Knob	Now USFS R1	Now USFS R1	0	0	0	0	0	0.2	54.4	5.6	2.4
210	West Fork Deep Creek	2.2	1	0.2	0	0	0 [‡]	0 [‡]	37.8	83.2 [‡]	29.6	4.6
211	Cherry Butte	Now USFS R1	Now USFS R1	0	0	0	0	0	0.2	55.4	2.8	0.6
212	Jackson Mountain	Now USFS R1	Now USFS R1	0	0	0	0	0	0	15.4	1.6	1.0 [‡]
216	1 mi NW of Mineral Mtn	11.8	0.4	0.2 [‡]	0.2	0	0 [‡]	0.4 [‡]	47.4	70.6 [‡]	27.6 [‡]	32.4 [‡]
217	Head of Sheep Creek	8.4	2	0.2 [‡]	0.2	0	0	0 [‡]	33.4	38.4 [‡]	8.8 [‡]	36.8 [‡]
300	Mission Mountain (#2)	14.8	2.2	0.2	0	0	0	0	4	38.8 [‡]	13.8 [‡]	22.4 [‡]
301	1.5 mi S of Mineral Mtn	25.6 [‡]	8.4	0	0	0.4	0 [‡]	0 [‡]	81	66.6 [‡]	62.8 [‡]	37.6 [‡]
302	Mid. Fork of Deep Ck 1	15.5 ^{‡4}	1.4	0.2 [‡]	0.2	0	0 [‡]	0 [‡]	75.8	61.6 [‡]	48.6 [‡]	38.0 ^{‡3}

*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) 2009 to 2019 Douglas-fir tussock moth trap results at IDL monitored sites.

Mean Number of Moths per Trap												
Plot #	Site Name	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
303	Mid. Fork of Deep Ck 2	5.2	0.2	0	0	0	0 [‡]	0.2 [‡]	33.8	71.6 [‡]	27.2 [‡]	33.0 ^{‡3}
400	3 mi S of Mineral Mt	2.4	0.6	0.2	0	0	0	0 [‡]	28	42.8 [‡]	23.8	1
401	Flynn Butte	1	0	0	0	0	0	0	1.2	41.6	3.4	0.6
402	2 mi SE of Browns Mdw	4.8	0.8	0	0	0	0	0	2	43.2	3	4.8 ⁴
500	3 mi SW of Harvard	1	0.2	0	0	0	0	0	1.4	45.0 [‡]	13.4	1
501	3 mi S of Moon Hill	3	0.6	0	0	0	0	0	0.2	48.6	1.4	1
502	3 mi W of Crane Point	0.4	0.2	0.2	0	0	0	0	1.4	71.8 [‡]	15.2 [‡]	6.2
503	3 mi N of Stanford Point	1.2	0.2	0	0	0	0	0 [‡]	13	50.0 [‡]	17.5 ^{‡4}	17.6 [‡]
504	2 mi N of Stanford Point	0.4	1	0	0	0	0	0	1.4	49.6 [‡]	12.2 [‡]	10.2
505	1 mi SW of Stanford Pt	9.6	2.4 [‡]	0.6 [‡]	0.2	0	0	0	0.8	47.2	4.5 [‡]	9.2 [‡]
506	1 mi S of Stanford Pt	11.2	1	0.2	0	0	0	0	3	50.4	5.8 [‡]	44.4 [‡]
507	1 mi NE of Stanford Pt	6	0	0	0	0	0	0	0	17.6	1.6	2
508	1 mi W of Stanford Pt	0.4	0.2	0 ¹	0	0	0	0	6.4	52.8 [‡]	23.4 [‡]	27
509	2 mi NW of Stanford Pt	3.2	0.4	0	0	0	0	0	1.6	45.4 [‡]	13.8 [‡]	26.6 [‡]
510	Moon Hill	25.6	6.8 [‡]	2.4 [‡]	0.6	0	0	0 [‡]	12.8	53.6 [‡]	36.0 ^{‡4}	18.2 [‡]
511	2 mi SE of Moon Hill	2.8	0	0	0	0	0	0 [‡]	12	47.8 [‡]	20.4 [‡]	21.0 [‡]
512	3 mi S of Mineral Mtn	3.2	1.8	0.2	0	0	0 [‡]	0.2 [‡]	17.2	70.8 [‡]	5.6 [‡]	9.4
513	2 mi SW of Moon Hill	0.2	0.2	0	0	0	0	0	3.4	55.4 [‡]	13	1.2
514	1.5 mi NW of Avon	3.2	0.4 [‡]	0.4	0	0	0 ³	0	2.8	42.8	6.2	3
600	3.4 mi NNW of Princeton	0.6	0.6	0.2	0	0	0	0	0	38.8	4.8	4
601	Macumber Meadows	0.4	0.2	0	0	0	0 [‡]	0.2	0.8	52.2	1.6	0.6
602	S of Shay Hill	0.8	0.2	0	0	0	0	0	0.4	1.4	0.2	4.4 [‡]
603	3 mi. S of Chatcolet	14.2	2.2	0	0	0	0	0	5	101.8 ^{‡4}	10.8 [‡]	29.2 [‡]
701	Four mile Creek	12.2	2.6 [‡]	1.6	0	0.2	0.4	0	0.2	53.0 [‡]	28.2 [‡]	12.2 [‡]
702	North of Granite Point	13.6	1.4	0 [‡]	0.2	0	0	0	1.2	40.8 [‡]	10.2	3.4
703	Bergs Creek	*	*	*	0	0	0	0	0.2	12.4	3.2	2.4

*Indicates Sites Not Trapped
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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

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Appendix 1. (continued) 2009 to 2019 Douglas-fir tussock moth trap results at IDL monitored sites.

		Mean Number of Moths per Trap										
Plot #	Site Name	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
704	West Fork Big Bear Ck	1.8	0.2	0	0	0 [†]	0	0	0.6	49.6	8.8 [‡]	9.4 [‡]
705	2 Mi NW of Stanford PT	2.4	0.8	0	0	0	0	0 [†]	18.2	53.2 [‡]	34.2 [‡]	43.0 [‡]
706	1 Mi S. of Iron Mtn	7.4	0.4	0	0	0	0	0	0.4	77.2 [‡]	27.8	2
707	Iron Mtn	8.6	3.4	0.2	0	0	0	0	*	*	*	*
708	Little Bear Creek	7.8	0.8	0	0	0	0	0	2.2	46.6 [‡]	12.4 [‡]	7.3 ⁴
709	Ruby Creek	7.4	0.6	0	0	0	0 [†]	0.2 [‡]	10	47.2 [‡]	10.6	2.4 [‡]
710	Turnbow Creek	14.4	6.8 [‡]	0.4	0	0	0	0 [†]	16.2	53.8 [‡]	33.0 [‡]	15.8
711	East Fork Flat Creek	21.5 ⁴	10.8 [‡]	2	0	0	0 [†]	0.4 [‡]	12.2	55.4 [‡]	20.8 ^{‡4}	17.6
712	Turnbow Point	2	0.6	0	0	0	0	0	0.2	37.4 [‡]	1.2	0.2
713	3 Mi S. of Potlatch	6.2	4.2 [‡]	0.8 [‡]	0.4	0.2 [‡]	0.2	0	0.6	47.8	13.0 [‡]	8.8 [‡]
714	Rocky Point	26	5.2 [‡]	0.8 [‡]	0.2	0 [†]	0 [†]	0.4 [‡]	23.4	20.6 [‡]	25.6 [‡]	46.6
715	Hatter Creek	0.2	0	0	0	0	0	0	0	11.6	0	0.2
716	Head of Hatter Creek	8.8	0.4	0.2	0	0	0	0	0	48.2	0.4	0 ⁴
717	Nora Creek	11.2	0	0	0	0	0	0	0.2	14.2	0.2	0.2 [‡]
718	Crummaring Creek	2	2	0	0	0	0	0	0	49.0 [‡]	13.6 [‡]	6.4
719	Basalt Hill	9.4	2.4	0	0	0 [†]	0.2	0	3.4	47.2 [‡]	10.4 [‡]	7.3 ⁴
720	Browns Meadow	15.6	2.8 [‡]	0.6	0	0 [†]	0	0	3.4	55.8 [‡]	30.0 [‡]	18.2
721	Smith Creek	0	0	0	0	0	0 [†]	0.2	2.2	46.6	2.6	0
722	Prospect Peak	1	0	0	0	0	0	0	3.6	47.4 [‡]	14.4	2.8
723	W Fork Mission Creek	2.6	0.8	0 [†]	0.2	0	0 [†]	0.4 [‡]	15.4	50.4 [‡]	15.8 ^{‡4}	38.4
724	Huckleberry Mtn	3.6	1.4 [‡]	0.4	0	0	0	0	1.4	75.0 [‡]	30.2 [‡]	14.8
725	North Fork Pine Creek	2	2.2	0	0	0	0	0	1.4	62.4 [‡]	43.6 [‡]	13.6 [‡]
726	Mineral Creek	21.6	*	0.2	0	0	0 [†]	0.3 ³	25.6	65.4	5.4 [‡]	10.4
727	South of Sanders	0	0.2	0	0	0	0	0 [†]	29.2	59.8	3.6	0.8
800	Mason Butte	16.8	0.2	0	0	0	0 ⁴	0 [†]	8.8 ⁴	5.4	13.2 [‡]	38.2 [‡]
801	1 m SW Moctelme Butte	1.6 [‡]	2.6	0 [†]	0.4	0.4 [‡]	0.2	0	5.5	21.4 [‡]	6.8 [‡]	9.8 [‡]

*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) 2008 to 2018 Douglas-fir tussock moth trap results at IDL monitored sites.

Mean Number of Moths per Trap												
Plot #	Site Name	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
802	1.9 mi S of Plummer	0	0.4	0	0	0	0 [‡]	0.2	2.4	<i>80.0[‡]</i>	<i>40.0[‡]</i>	<i>39.6[‡]</i>
803	Little Plummer Creek	<i>22.8[‡]</i>	<i>33.6[‡]</i>	<i>3[‡]</i>	0.8	0.2 [‡]	0 ⁴	0 [‡]	10.6	<i>115.4[‡]</i>	<i>14.2[‡]</i>	<i>57.0[‡]</i>
804	Syringa Creek	0.2	0.2	0	0	0	0	0	0.4	11	1.3 ⁴	0.4
805	John Point	16.2	2.2 [‡]	0.4	0	0	0	0 ⁴	*	*	*	*
806	2 mi W of Pettis Point	3.5 ⁴	0	0	0	0	0	0	0.8	36.6	3.6 ⁴	0.4
807	Davis Creek	*	*	0	0	0	0 [‡]	0.4	0.2	<i>26.4</i>	3	m [‡]
808	Renfro Creek	4	0	0 [‡]	0.2	0	0	0	0	<i>37.8</i>	3	0.4
809	Crystal Creek	1.2	0	0	0	0	0	0	0.4	9.8	0.6	0.4
810	Child Creek	2.5 ⁴	0.6	0	0	0 [‡]	0	0	0.8	25.2	0.6	0.6
811	Hobo Pass	8.8	0.2	0.2	0	0	0 [‡]	0.4	2.2	13.6	2.5	m [‡]
812	Hemlock Butte	3.6	0	0	0	0.2	0	0	0.2	<i>37</i>	1.8 ⁴	0.5
813	Carpenter Peak	0.4	0	0	0	0	0	0	0	<i>12.6</i>	3.6	1.6
814	Tyson Creek	0.8	0.2	0	0	0	0	0	0.6	<i>1.4</i>	1	2.8
815	Heinaman Creek	2.4	0.6	0	0	0	0	0	0	<i>2.4</i>	0.6	m
816	Green Mtn	<i>21.8</i>	<i>3[‡]</i>	<i>0.6[‡]</i>	1.4	0.6	0 [‡]	0.4	2.2	<i>38.4</i>	<i>4.8[‡]</i>	5.2
817	Willow Creek	3.8	1	0	0	0 [‡]	0.4 [‡]	0.2	2.8	<i>32</i>	1.4 [‡]	6.2 [‡]
818	Head of Emerald Ck	9.6	0.8	0.2	0	0	0	0	2	<i>46.4</i>	5.8	3.6
819	East Fork Emerald Ck	2.2	0.4	0.2	0	0	0	0	0.4	2.6	1	0.2
820	Head of Bobs Creek	1.8	0	0	0	0	0	0	0.4	9.8	2	0.6
821	E Fk of Potlatch River	Now USFS R1	Now USFS R1	0	0	0	0	0	0.4	<i>50.8</i>	5.0 ³	3.8
822	Head of Moose Creek	<i>37.4</i>	2.6	0.2	0	0	0 [‡]	0.2 [‡]	9.2	<i>45.6[‡]</i>	14.8	2.2
823	Beals Butte	12.2	2	0	m	0	0	0	0.4	<i>58.2</i>	1.2	2.2
900	Hauser	0.4	0.8	0	0	0	0	0	0.8	6	1.8 ⁴	2.4 [‡]
901	Cougar Bay	1.4	0	0	0	0	0	0	0	<i>29.4</i>	6.4 [‡]	5.2 [‡]
902	Marie Creek	1.2	0.2	0	0	0.2	0	0	0.3 ⁴	2.3 ⁴	2	1.2 [‡]
903	Canary Creek	2	0.2	0	0	0	0	0	0	12.8	3.8	2.8

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

m indicates traps missing
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[‡]Indicates larval survey
³Indicates 3/5 traps collected

Italics indicates egg mass sample
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Appendix 1. (continued) 2009 to 2019 Douglas-fir tussock moth trap results at IDL monitored sites.

		Mean Number of Moths per Trap										
Plot #	Site Name	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
904	Rathdrum	1.6	1.4	0	0	0	0	0	0	23.2 [‡]	17.2	2.6
905	State Line (Post Falls) [‡]	1.2	0.6	0.2	0	0	0.2 [‡]	0.2	0	6.6	0.6	2.0 ⁴
906	Sig. Point (Post Falls)	4	0.6	0	0	0	0	0	0.4	3.2 [‡]	9.4 [‡]	41.8
907	Blake Draw Creek	7	1.2	0	0	0.4	0	0 [‡]	11.8	27.4 [‡]	6.6 [‡]	7
908	Coon Creek	31.8 [‡]	4.2	0	0	0	0	0 ^{‡3}	11	47.4 [‡]	33.2 [‡]	71.6
909	Heyburn Park	2.4	0.4	0.2	0	0	0	0	1.6	56.4 [‡]	11.4 [‡]	9.6
910	Coyote Lane PF	9.4	1.8	0	0	0	0 [‡]	0.2	0.2	54.0 [‡]	18.6 [‡]	67.6
911	State Line (Meredith)	0.2	0.4	0	0	0	0	0	0.4	58.8 [‡]	14.4 [‡]	23.2
912	Lovell Valley	15.6 [‡]	9.2 [‡]	1 [‡]	1	0.8 [‡]	0	0	5.6	65.8 [‡]	55.2 [‡]	69.6
913	Twin Lakes	0.6	0.6	0.2 [‡]	0.2	0.4	0	0	0.2	66.8 [‡]	35.6	*
914	McGovern Tree Farm	0	0	0	0	0	0	0	0.2	4.6	*	*
915	Signal Point #1	0.4	0	0	0	0 [‡]	0	0	0	39.4 [‡]	*	*
916	Signal Point #2	0 ³	0	0	0	0	0	0	0	54.2 [‡]	*	*
917	Signal Point #3	0	0	0	0	0	0	0	0	22.8 [‡]	*	*
918	Signal Point #4	1.33 ³	0	0	0	0	0	0 ¹	0	60.0 [‡]	*	*
919	Signal Point #5	0.6	0	0	0	0	0	0	0	35.4 [‡]	*	*
920	Spirit Lake	0	0	0	0	0	0	0	0	10.8	*	*
5021	Little Bald Mtn.	31.8	3	Took over from USFS R1								
5033	Sinkler RD/Rose Creek	7.4	1.4	Took over from USFS R1								
5034	Wise Lane	12.8	2	Took over from USFS R1								
5035	E. of Old Tensed Rd	3.6	1.2	Took over from USFS R1								
Number of Sites Trapped:		144	143	145	146	146	146	146	141	141	134	133
Mean # of Moths per Trap:		7.28	1.51	.17	0.05	0.03	0.02	0.05	6.3	43.8	11.8	11.9

*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. 2009 to 2019 Douglas-fir tussock moth trap results for USFS-R1 monitored sites.

			Mean Number of Moths per Trap										
ID	Plot #	Site Name	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
	209	Abes Knob	4.2	0.4	Took over from IDL								
	211	Cherry Butte	0.2	0	Took over from IDL								
	212	Jackson Mountain	0.6	0	Took over from IDL								
	821	E Fk of Potlatch River	1.4	0.2	Took over from IDL								
1-1	5001	Lodge Pt	*	3.2	0	0	0	0	0	0	2.2	0.2	3.0
1-3	5002	Pine Knob	*	2.6	0	0 ⁴	0	0	0	0	41.8	8.6	16.4
1-4	5003	Potato Hill	*	0.2	0	0	0	0	0	0	18.6	0.4	1.4
1-5	5004	Big Tinker	*	0.2	0	0	0	0	0	0	4.6	0.2	0.0
2-1	5005	Rhett Cr	1.8	0.2	0 ⁴	0	0	0	0	0	0.2	0.0	0.0
2-2	5006	Center Ridge	5.4	2.2	0	0	0	0	0	0	4.6	1.6	1.4
2-5	5007	S. Cow Cr	10.6	4.4	0	0	0	0	0	0	0.2	0.8	1.4
3-1	5008	Keuterville	2 ⁴	0	0	0	0 ³	0 ³	0	0	3.8	1.2	0.4
3-2	5009	Cottonwood Butte	1.2	1	0	0	0	0	0	0	0.4	0.2	0.4
4-1	5010	Lake Waha	1.2	*	0	0	0	0	0	0	1.6	0.0	0.0
4-7	5011	No Name	*	*	*	*	*	0	0	0	4.6	1.2 ⁴	9.4
4-3	5012	Junction	0.2	2.6	0	0	*	*	0	0	1	0.8	0.8
4-4	5013	Captain John	0.2	2.8	0	0	*	*	0	0	0.8	0.0	1.0
5-2	5014	Angel Butte	2.4	0	0	0	0	0	0	0	0.6	0.2	0.6
5-3	5015	Grangemont	0.8	1.4	0	0	0	0	0.2	0	9.6	1.2	1.0
5-4	5016	Bargamin Ck.	6	*	0.2	0	0	0	0	0.2	14	*	2.0
5-5	5017	Bald Mtn	2.2	*	0.4	0	0	0	0	0	10.4	1.2	1.6
5-6	5018	Summit Landing	3.6	0	0.2	0 ⁴	0	0	0	0	0.6	1.2	1.8

*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

Egg mass surveys were not recorded for R1 in 2019, but 0 egg masses were found during all informal sampling.

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Appendix 2. (continued) 2009 to 2019 Douglas-fir tussock moth trap results for USFS-R1 monitored sites.

			Mean Number of Moths per Trap										
ID	Plot #	Site Name	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
5-7	5019	Shin Pt	*	2.2	*	0	0	0	0	0	3	1.0	0.2
6-1	5020	Canyon Jct	12.2	2.6	0	0 ⁴	0 ⁴	0 ⁴	0	0	13.2	0.4	1.2
7-2	5021	Little Bald Mt	Now IDL	Now IDL	.2	0 ³	0	0	0	0.2	61.6	1.4	3.6
7-3	5022	Little Boulder Cr.	3	0	0	0	0	0	0	0.2 ³	7.8	2.2	1.0
7-4	5023	W. Fk Potlatch	1.4	0	.4	0	0	0	1.0 ⁴	0.2	8.6	2.0	1.2
7-5	5024	Elk Cr Falls	1.8	0	0	0	0 ³	0	0	0.2	0	1.8	2.0
7-6	5025	Morris Cr.	33.6	0	0	0	0	0	0.8	2.0	16.8	*	1.4
4-2	5026	Black Pine	0.4	0.8	0	0	0	0	0	0	3.4	0.6	4.0
5-11	5027	Cooper Rd./Cook Ck.	2.2	0.4	0	0	*	*	0	0	2.8	2 ⁴	3.6
5-12	5028	Whiskey Ck.	1	0.2	0	0	*	*	0	0	3	0.0	1.0
5-8	5029	Swanson Ck.	*	2.8 ⁴	1.6	0	0	0	0	0	2.4	0.8	0.8 ⁴
2-6	5030	Spring Mtns	0.8	0.8	0	0	0	0	0	0	0	0 ³	1.4
2-7	5031	Crook's Corral	19.4	4.4	0 ³	0.3 ⁴	0 ³	0 ³	0	0	0.2	0.4	*
6-3	5032	Mud Cr.	*	0.4	0 ³	0	0	0	0	0	1	0.8	0 ⁴
8-1	5033	Sinkler Rd./Rose Cr.	Now IDL	Now IDL	0	0	0	0	0	2.3 ³	*	*	*
8-2	5034	Wise Lane	Now IDL	Now IDL	0	0	0	0.2	0	1.6	*	*	*
8-3	5035	E. of Old Tensed Ln	Now IDL	Now IDL	0	0	0	0	0	1.4	*	*	*
8-4	5036	CDA Nursery 1	9.25 ⁴	*	*	*	*	*	*	*	*	*	*
8-5	5037	CDA Nursery 2	13 ³	*	*	*	*	*	*	*	*	*	*
Number of Sites Trapped:			31	31	33	35	30	31	35	35	32	32	31
Mean # of Moths per Trap:			4.44	1.15	0.10	0.00	0.00	0.01	0.03	0.24	7.61	1.08	2.06

*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

Egg mass surveys were not recorded for R1 in 2019, but 0 egg masses were found during all informal sampling

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Appendix 3. 2009 to 2019 Douglas-fir tussock moth trap results for USFS-R4 monitored sites

Plot #	Site Name	Mean Number of Moths per Trap										
		2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
4001	South Fork Boulder Creek	11.4	5.4	5.4	0.2	0	0	0.6	0.5 ⁴	0.4	0	0.2
4002	Mill Creek	11.4	6	1.4	0.4	0.4	0	1.6	1	0	0.2	0.2
4003	New York Summit	11.6	8.4	*	2	2	0.4	3.2	1.2	0.6	0	1.6
4004	Upper Wolfstone Creek	2.6	*	*	39	15.4	5	*	*	1.2	0	0.8
4005	Brundage Mt Resort	36.8 ⁴	6	0.8	0.4	0	0.2	*	0	5.4	0.2	1.6 ⁴
4006	Bogus Basin Resort	*	*	3.4	10.4	2.8	1	*	0.6	0.4	0.2	15.2
4007	Sharps Canyon	5.6	24.6	3.8	58	49.2	27.4	*	2.2	1.8	*	*
4008	Lower Scriber Cr	48.6	96.6	37.2	26.8	5.2	0	*	1.4	5.8	*	*
4009	Paradise Springs	11.2	8.4	5.8	5.8	0.84	0.2	*	0.2	0.4	*	*
4010	Lost Man	*	*	*	*	*	*	*	*	2.4	*	*
4011	Couch Summit	9.4	47.4	13.2	48	30.4	9	*	0	0	*	*
4012	Baldy Mt.	2	5.6	2.2	*	*	*	*	*	0	0.2	0.8
4013	Tamarack Flat	44	*	60.8	31.2	11.2	0.2	*	*	*	*	*
4014	Antelope Trail	*	*	*	65.2	*	0.6	*	*	*	*	*
4015	Little Sage Hen	33.4	*	6.8	25.8	26.2	0.2	*	*	*	*	*
4016	Cottonwood	57.2	*	42.8	27.4	8.2	1	*	*	*	*	*
4017	Skunk Creek	56.6	53.4	15.8	11	4	0.4	*	*	*	*	*
4018	Cow Creek	17.4	20	17	29.2	15.2	2.3 ⁴	*	*	*	*	*
4019	Howell Canyon	0.6	2.4	0	0.2	0.74	*	*	*	*	*	*
4020	Porphyry Ck.	5.2	1.2	1.2	4.8 ⁴	*	*	*	*	*	*	*

*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**

Egg mass surveys were conducted separately from EWS adult trapping in 2019 in R4, see [figure 13](#).

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Appendix 3. (continued) 2009 to 2019 Douglas-fir tussock moth trap results for USFS-R4 monitored sites

Plot #	Site Name	Mean Number of Moths per Trap										
		2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
4021	Lick Ck.	27.6	1	15.4	8	*	*	*	*	*	*	*
4022	Adams Ck.	17	1.4	0	0.2	*	*	*	*	*	*	*
4023	Antelope Flat	15.8	*	22.4	*	*	*	*	*	*	*	*
4024	Bear Basin	24.8	12.4	1.8	*	*	*	*	*	*	*	*
4025	Barrinaga Co	1.2	*	0	*	*	*	*	*	*	*	*
4026	Ant Basin	15.2	5	11.6	*	*	*	*	*	*	*	*
4027	Bear Saddle	0	*	31.2	*	*	*	*	*	*	*	*
4028	Mann Creek	3.4	9.4	10	*	*	*	*	*	*	*	*
4030	Cottonwood Spring	0	10.4	*	*	*	*	*	*	*	*	*
4031	Craters of the Moon	22.4	67.2	*	*	*	*	*	*	*	*	*
4032	Deer Point	20.4	22.2	*	*	*	*	*	*	*	*	*

Number of Sites Trapped:	28	21	24	19	16	16	3	9	12	7	7
Mean # of Moths per Trap:	18.31	19.73	12.92	20.48	10.71	3.04	1.80	0.79	1.75	0.11	2.95

*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**

Egg mass surveys were conducted separately from EWS adult trapping in 2019 in R4, see [figure 13](#).