2005 DOUGLAS-FIR TUSSOCK MOTH EARLY WARNING SYSTEM TRAPPING SUMMARY FOR OREGON AND WASHINGTON

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Summary
Douglas-fir tussock moth (DFTM) pheromone traps were located on approximately 518 Early Warning System (EWS) plots scattered throughout Washington and Oregon in 2005. In 2005, DFTM trap catches remained at endemic levels throughout most of Washington and Oregon. Traps in the south central Oregon area had a slight decrease in population levels. However, the slight increases in the 2005 trap catches on the Okanogan/Wenatchee, Wallowa-Whitman, and Malheur NF's are comparable to early trends prior to the outbreaks in 1989-1991 and the more recent outbreak of 1999-2001, and coincide with the cyclic outbreak of DFTM. If DFTM follows its cycle, we should see continued increases in trap catches in these areas over the next several years. Trapping in 2006 will be very important for continuing to monitor the insect trends on these Forests.

Background
Douglas-fir tussock moth, *Orgyia pseudotsugata* (McCunnough) (Lepidoptera: Lymantriidae), outbreaks in the western United States and Canada tend to be cyclic, occurring about every 9 years (Shepard et al., 1988). In the Pacific Northwest, a Douglas-fir tussock moth population increase consists of four phases or years. During the first phase, the population begins to increase, but remains at suboutbreak levels. In phase II the population begins to increase to above the outbreak level threshold and some defoliation is apparent. In phase III, populations are extremely high and result in complete tree defoliation. Populations remain very high during phase VI; however, population pressure and insect pathogens cause the population to collapse during this phase. Additional defoliation will be incurred during this phase, subsequent to the collapse of the population.

Generally land managers do not recognize the significance of the severity of a DFTM outbreak until phase III when the first year of complete defoliation occurs. Once significant defoliation occurs, it is too late to implement any management options.

From 1971-1974, a widespread outbreak of Douglas-fir tussock moth occurred in eastern and central Washington, northeastern Oregon, and in adjacent Idaho. Since that time, populations have fluctuated three times which resulted in defoliation. The first two fluctuations resulted in outbreaks in more localized areas near Burns, OR in the early

1980's and near Halfway, in northeastern Oregon in the early 1990's. In 1991, about 116,000 acres of that outbreak were treated with the biological insecticide, *Bacillus thuringiensis* var. *kurstaki*. A more extensive outbreak occurred from 1999 to 2002. Approximately 220,000 acres of defoliation were detected in northeastern Oregon in 2000, and 39,000 acres were treated with TM-BioControl-1, the natural virus of the DFTM. In 2001, an additional 16,690 acres were treated on the Okanogan National Forest in Washington. By the fall of 2002, populations had returned to near endemic levels.

The DFTM Early Warning System

DFTM population level trends are monitored annually throughout Oregon and Washington using pheromone traps. This on-going DFTM EWS is a cooperative effort by the USDA Forest Service, the Oregon Department of Forestry, the Washington Department of Natural Resources, the USDI Bureau of Indian Affairs, and the USDI Bureau of Land Management. Other western Regions and States also participate in this West wide survey. The objective of the EWS is to detect incipient DFTM outbreaks. When trap catches increase to predetermined levels, additional sampling activities are initiated to further quantify population levels (Sheehan, et al., 1993). The DFTM EWS is intended to provide an advance warning of population changes that would indicate a potential outbreak one to two years prior to the outbreak occurring. This would allow land managers an opportunity to evaluate, analyze, and implement management options before high levels of defoliation occur. Daterman, et. al. (2004) summarizes the results and the effectiveness of the System on over 20 years of DFTM population monitoring sampling in the West.

The pheromone traps are deployed according to standardized procedures (Daterman, et al., 1979) in specified trap sites in July and retrieved following moth flight in the fall. The pheromone lures contain a very low pheromone dose and are calibrated specifically to detect low populations. There are five traps per plot. The average number of moths per trap is calculated for each plot. Male DFTM are sampled annually on these permanent locations throughout eastern Oregon and Washington. This report summarizes the sampling results for 2005.

Population Monitoring Process

Plot trap catch averages, trends in trap catches on plots from year to year, and trap catch density patterns over larger geographic areas are the factors considered when determining future sampling intensity and methodology. When plot averages exceed predetermined threshold levels and the trend of trap catches is increasing in areas where defoliation would concern land managers, ground sampling is initiated.

Cocoon, egg mass, and/or larval surveys, using methods described by Fettig et al. (2001), are conducted in the fall of the same year, or spring and summer of the following year, in the vicinity of plots with trap catch averages exceeding 40 moths per trap within areas of concern. Cocoon and larval survey data provide estimates of population densities and give more accurate indications of outbreak potential and population trends than the pheromone trap data, which indicate population changes over large geographic areas.

The DFTM Early Warning System is **not designed or intended** to predict exactly where the defoliation will occur; areas to be sampled on the ground should be selected on the basis of the impact of potential DFTM defoliation on management objectives. DFTM EWS traps are not calibrated for use during an actual DFTM outbreak. As populations increase, a decline in trap catches will typically be noted. Once the traps have signaled a population increase, larval and cocoon/egg mass surveys are used to determine what the populations are doing in that particular area.

Results and General Trend

Figure 1 shows the average number of moths caught in DFTM pheromone traps distributed throughout the host range in eastern Oregon and Washington. Throughout the Region, trap catches remained at endemic levels. Although there were some scattered individual traps with 25 – 40 moths trapped, there was an overall decrease in the number of moths per trap on the Fremont and Winema NF's from 2003 and 2004. This would be indicative of normal fluctuations in suboutbreak populations that occur, especially in that area. Figure 2 shows the trend of traps with trap catches by categories of moths per trap. Figures 3&4 and 5&6 show the trap catch trends on the Wallowoa-Whitman and Malheur NF's in Oregon, and the Okanogan-Wenatchee NF and the Colville Indian Reservation in Washington, respectively. These are the areas where trap catches show an increase in the sub-outbreak populations. If the cyclic trend of this insect is followed, there could be additional trap catch increases in 2006 and 2007 on these Forests.

Table 1 lists the plots where traps with an average of 10 or more moths/trap were caught.

Figures 7&8 and 9&10 are maps showing the distribution and location of the DFTM traps and numbers of moths trapped in Oregon and Washington for 2004 and 2005, respectively.

DFTM Early Warning System data and summaries for Oregon and Washington can be found on the R6 website: http://www.fs.fed.us/r6/nr/fid/data.shtml#dftm. Additional information on the DFTM Early Warning System, previous years' reports and maps of trap locations, and an animated map series showing the changes in trap catches from 1995-2004 can also be found on this site.

References Cited

Daterman, G.E.; R.L. Livingston; J.M. Wenz; and L.L. Sower. 1979. How to use pheromone traps to determine outbreak potential. US Dept. of Agric. Hdbk 546. 11p.

Daterman, Gary E.; J.M. Wenz; and Katharine A. Sheehan. 2004. Early warning system for Douglas-fir tussock moth outbreaks in the Western United States. Western J. of Applied For. 19(4): 232-241.

Fettig, Christopher J.: Jeffrey Fidgen; Quintin C. McClellan; Scott M. Salom. 2001. Sampling methods for forest and shade tree insects of North America. US Dept. of Agric., Forest Service, Forest Health Technology Enterprise Team, FHTET 2001-01. 273p.

Sheehan, K.A.; E.A. Willhite; A.Eglitis; P.T. Flanagan; T.F. Gregg; and B.B. Hostetler. 1993. Regional guidelines for sampling Douglas-fir tussock moth and western spruce budworm. US Dept. of Agric., Forest Service, Pacific Northwest Region, For. Pest Mgmt. R6-93-03. 18p.

Shepherd, R.F.; D.D. Bennett; J.W. Dale: S. Tunnock; R.E. Dolph; and R.W. Their. 1988. Evidence of synchronized cycles of outbreak patterns of Douglas-fir tussock moth, *Orgyia pseudotsugata,* (McCunnough) (Lepidoptera:Lymantriidae). Ipaths From a Viewpoint: The Wellington Festschrift on Insect Ecology. Mem. Ent. Soc. Can. 146:107-121.

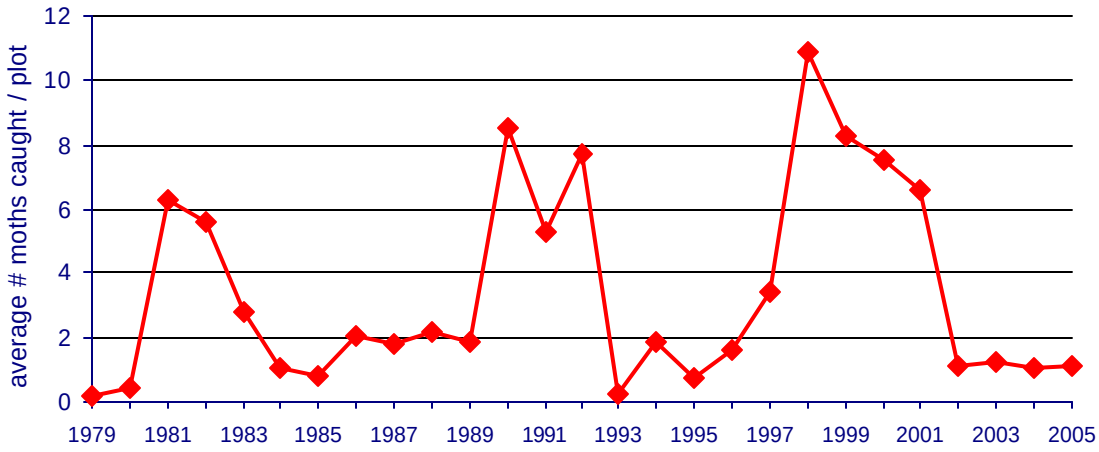

Figure 1: Average number of Douglas-fir tussock moths caught in DFTM pheromone traps distributed throughout eastern Washington and Oregon.

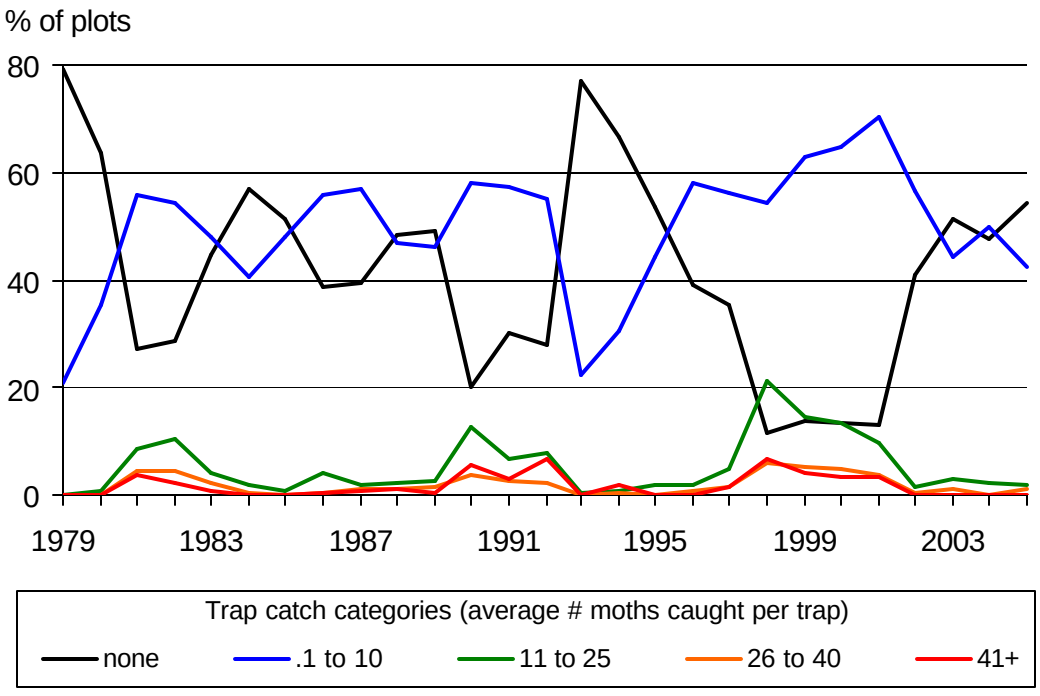

Figure 2: Trend of the average moth catches for the Region by number of moths per trap.

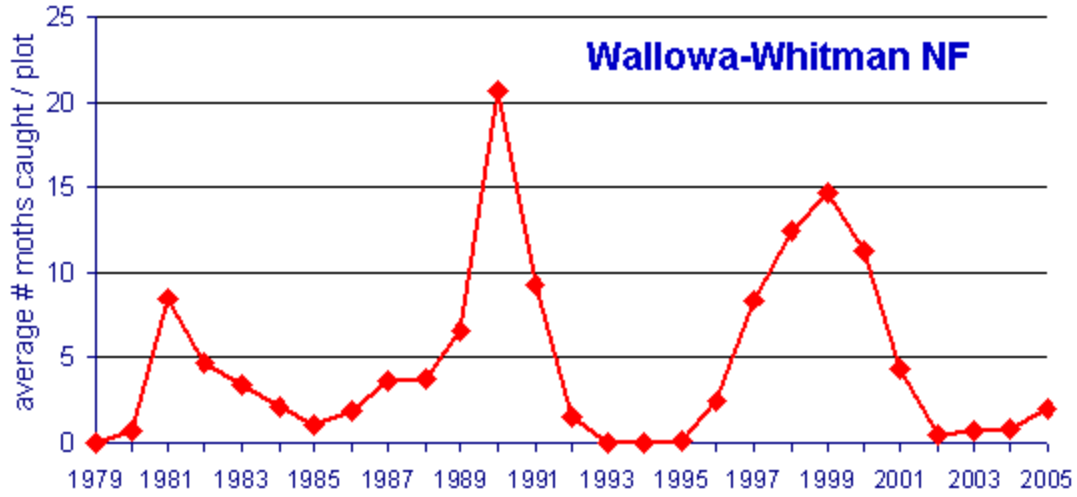

Figure 3: Average DFTM trap catches and trends for the Wallowa-Whitman NF.

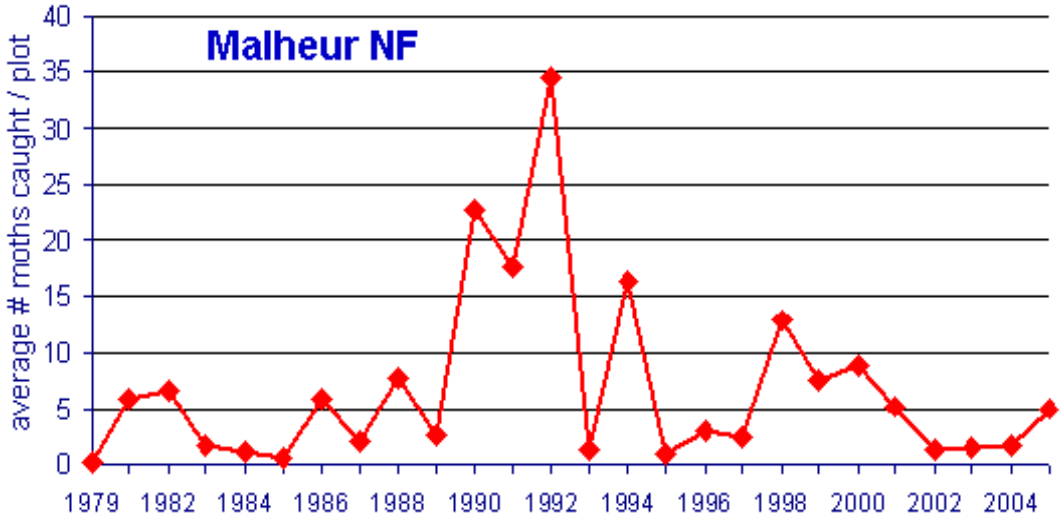

Figure 4: Average DFTM trap catches and trends for the Malheur NF

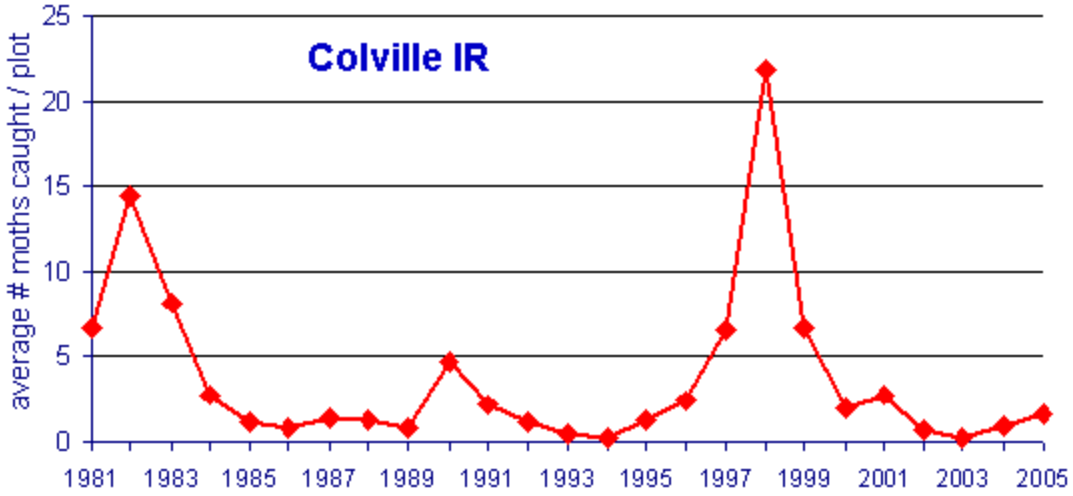

Figure 5: Average DFTM trap catches and trends for the Colville Indian Reservation

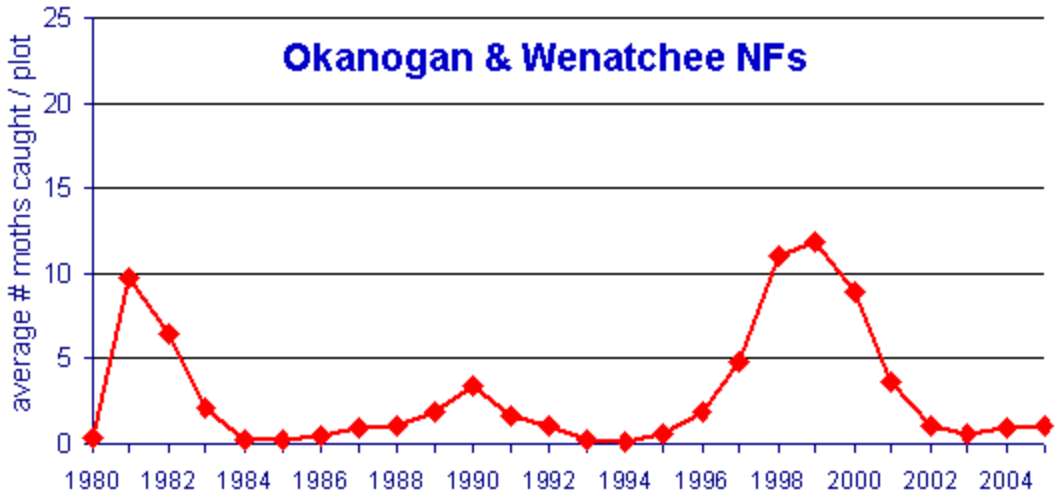

Figure 6: Average DFTM trap catches and trends for the Okanogan-Wenatchee NF

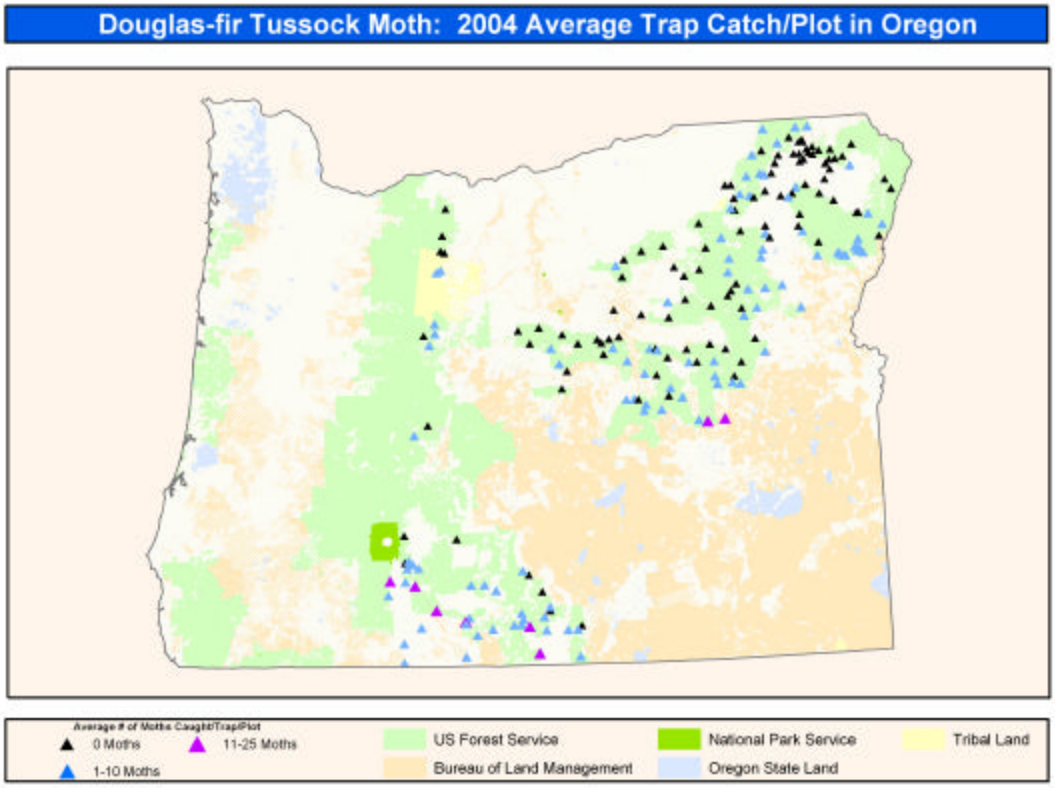

Figure 7: DFTM EWS trap locations and moth catches for Oregon, 2004.

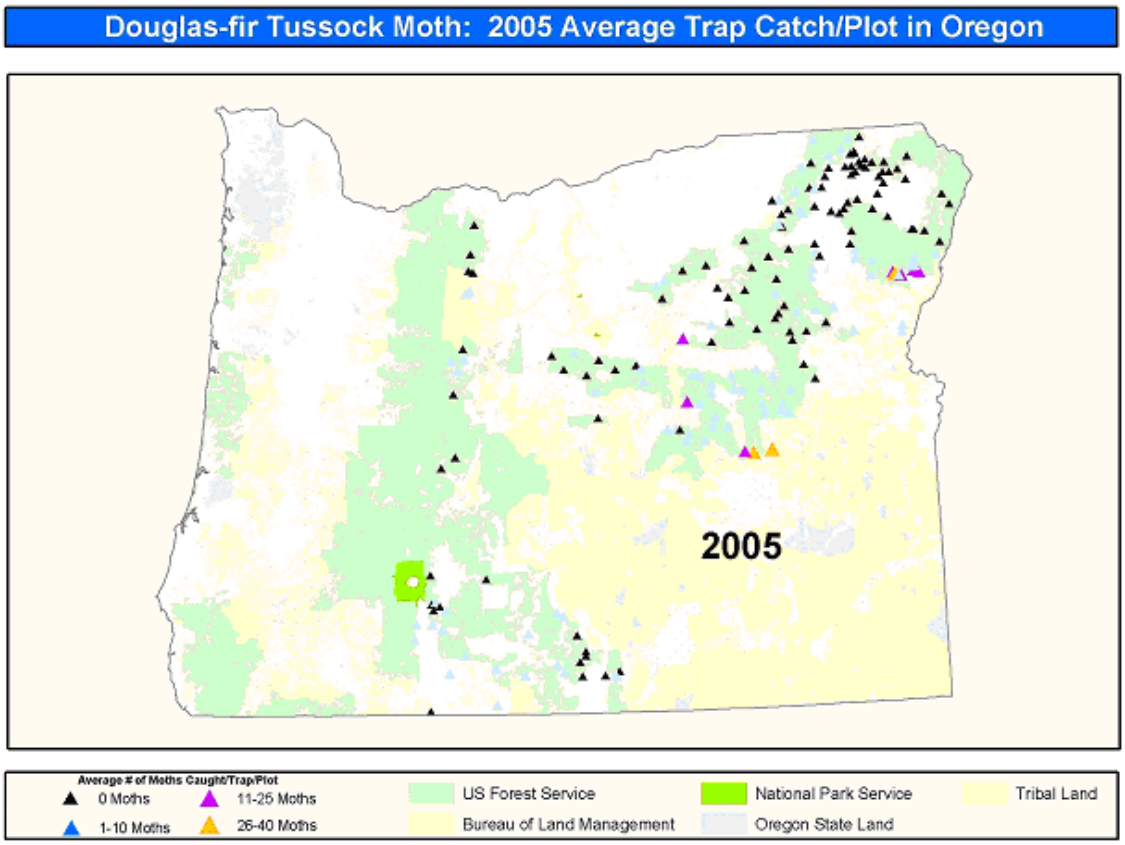

Figure 8: DFTM EWS trap locations and moth catches in Oregon for 2005. Note the decrease in the number of traps with higher moth catches in South Central Oregon and the increase in the number of traps with higher trap catches in Northeastern Oregon.

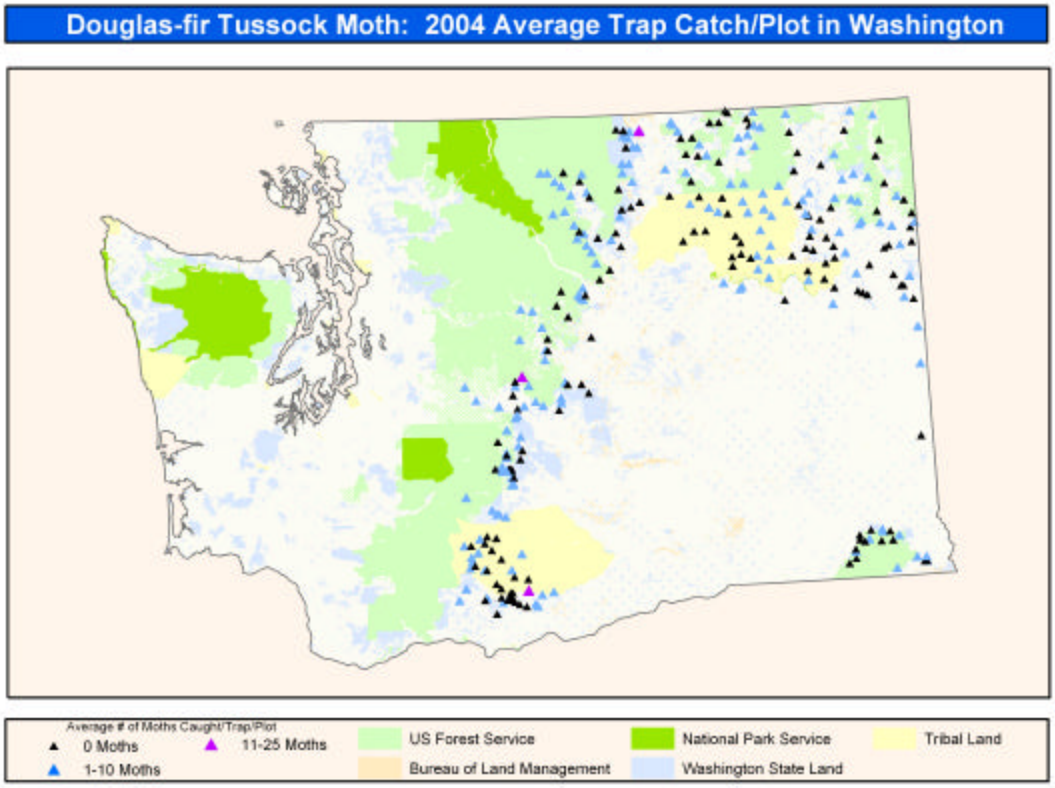

Figure 9: DFTM EWS trap locations and moth catches for Washington, 2004.

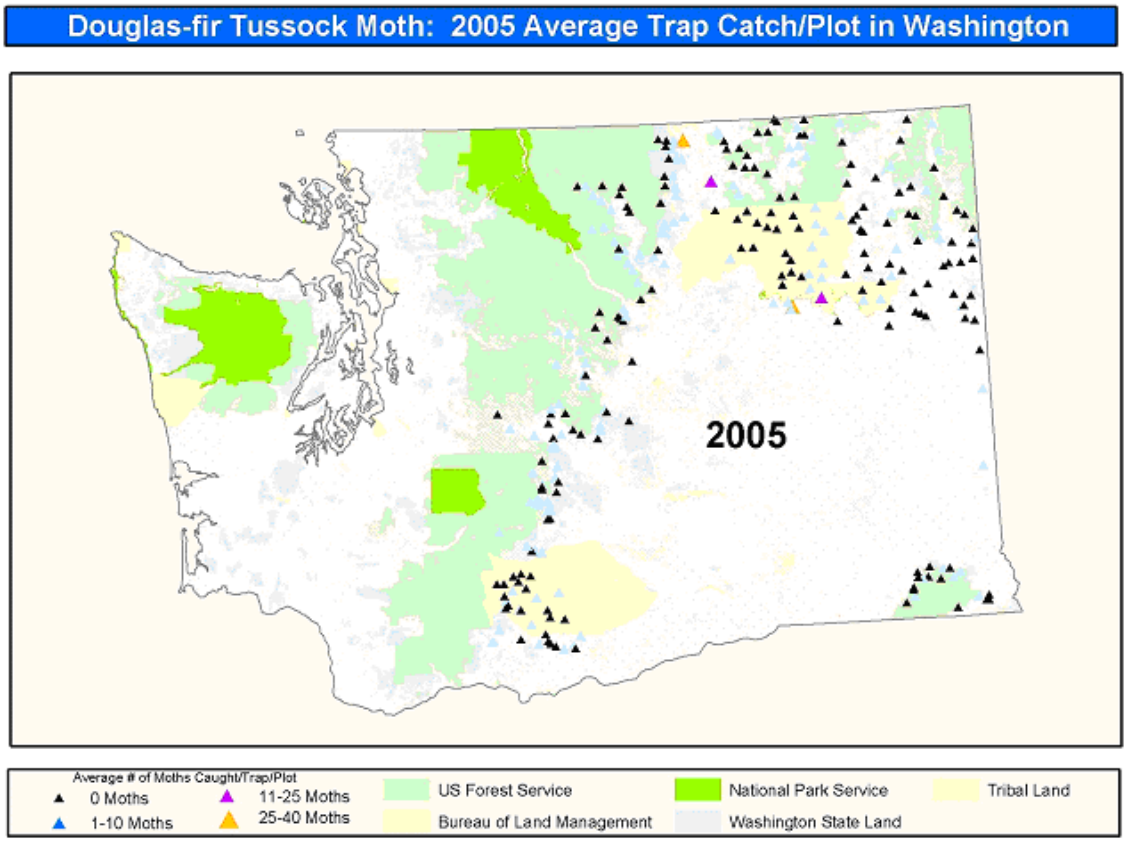

Figure 10: DFTM EWS trap locations and moth catches for Washington, 2005.

Nearest Forest	Nearest District	Plot No.	Plot Name	Agency*	1998	1999	2000	2001	2002	2003	2004	2005
Colville IR	Inchelium	10	Johnny_George	bia	17.7	6.0	4.0	12.6	1.4	0.0	1.8	11.2
Colville IR	South	111	Keller_Ferry	dnr	46.4	50.4	15.8	21.4	1.6	0.6	6.4	26.0
Malheur NF	Blue_Mtn	7	Buck_Cr	usfs	21.8	10.8	25.6	1.2	0.4	3.0	2.0	15.0
Malheur NF	Emigrant_Cr	201	2850_Road	usfs	14.6	15.8	8.2	9.2	9.8	11.8	13.6	34.8
Malheur NF	Emigrant_Cr	202	King_Mountain	usfs	4.6	2.6	5.0	0.8	1.8	1.6	0.6	11.0
Malheur NF	Emigrant_Cr	211	Thompson_Spring	usfs	5.0	11.4	3.8	7.4	10.0	8.4	14.8	33.2
Malheur NF	Blue_Mtn	ECO-32	Prairie_City_Timber	odf		7.8	8.8	22.3	0.0		0.0	12.8
Okanogan&Wen. NF	Tonasket	8	Palmer_Lake	dnr	43.2	58.6	34.4	9.4	13.0	4.6	18.6	28.4
Okanogan&Wen. NF	Tonasket	173	Dusty_Mtn_Meadow	dnr		55.0	52.6	40.0	26.6	7.8	3.0	17.8
Wallowa-Whitman NF	Pine	71	Paddy_Seed_Orch	usfs	52.2	63.6	59.2	9.4	2.0	9.6	5.6	33.8
Wallowa-Whitman NF	Pine	74	Summit_Pt_Rd	usfs	42.0	87.8	56.2	23.6	3.2	1.6	3.2	12.8
Wallowa-Whitman NF	Pine	75	Rd_050_Dry_Cr.	usfs	59.4	88.8	54.0	56.0	7.0	3.8	6.6	19.0
Wallowa-Whitman NF	Pine	76	Clr_Cr._Beecher	usfs	63.0	94.4	71.6	23.4	4.2	6.0	3.8	13.0
Wallowa-Whitman NF	Pine	78	Gold_Eagle_Pack	usfs	66.6	26.6	12.2	6.0	1.8	2.0	2.0	11.6
Wallowa-Whitman NF	Pine	79	Fish_Lake	usfs	31.8	59.8	50.6	3.4	2.6	4.0	5.8	10.0

* bia = USDI Bureau of Indian Affairs,
dnr = WA Dept. of Natural Resources,
usfs = USDA Forest Service,
odf = Oregon Department of Forestry

blue = trap catches >= 25 and < 40 moths per trap
red = trap catches >= 40 moths per trap

Table 1: DFTM plots with average trap catches of 10 or more moths per trap, primarily on the Wallowa-Whitman and Malheur NF's.