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Subject: Spruce Budworm Defoliation and Mortality on Flesher Pass (MFO-TR-06-10)

To: Forest Supervisor Beaverhead-Deerlodge National Forest, Forest Supervisor Helena National Forest

During June 2006, Nancy Sturdevant and Sandy Kegley conducted a survey near Flesher Pass to measure defoliation and mortality from heavy western spruce budworm feeding on Douglas-fir. Out of 50 trees in a unthinned forested stand, 29 trees were rated as alive during this sampling period. Of the remaining 21 trees, nine died as a direct result of budworm feeding and 12 were attacked by Douglas-fir beetle. They did not record any mortality from budworm or Douglas-fir beetle in an adjacent unthinned stand.

Although these results may portray what we can expect on Flesher Pass, they can not be extrapolated to the Helena National Forest in general or other National Forests in the Northern Region. More surveys are needed to assess conditions for specific projects or areas.

Attached is a summary of their observations and findings from this evaluation. Please call us if you have additional questions or needs regarding budworm defoliation and mortality on Flesher Pass.

/s/ Sharon M DeHart (for)
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Trip Report MFO-TR-01-10
Spruce Budworm Defoliation and Mortality on Flesher Pass-June 2006
Flesher Pass, Helena National Forest
July 25, 2006

On June 13, 2006, Nancy Sturdevant and Sandy Kegley measured spruce budworm defoliation and mortality on Flesher Pass near Lincoln, Montana. Western spruce budworm, *Choristoneura occidentalis* Freeman, is a native defoliator that occurs across the range of Douglas-fir and true firs throughout the west. It reaches outbreak conditions in Montana usually following consecutive years of warm and dry weather conditions. The current outbreak on Flesher Pass began in 2003 and has increased in intensity since then. The last outbreak in the Northern Region began in the early 1980s and lasted through 1993. The collapse of the budworm outbreak in 1993 was probably due to the very wet and cool weather conditions during the spring and summer of that year. On the Helena National Forest (NF) defoliation from budworm increased through the 1980s peaking in 1988.

In 2005, we established plots near the top of Flesher Pass in both thinned and unthinned Douglas-fir stands. Both stands are primarily multi-storied Douglas-fir stands. In 2005, average defoliation for trees in the unthinned area was 83.5% compared to 41.9% for trees in the thinned area. Forty-two trees in the unthinned area had greater than 90% defoliation compared to 11 trees in the thinned area. Thirty-five trees in the unthinned area were 100% defoliated. Of these, 18, or 50% had dry phloem and were presumed dead. Seven trees, or seven percent, in the thinned unit were 100% defoliated by budworm and therefore have the highest probability of dying within the next few years. In general, trees in the thinned area appeared greener and to be more vigorous than trees in the unthinned area.

In June of 2006, we measured defoliation from budworm, tree diameter, and insect and disease damage on 50 trees in both the thinned and unthinned areas. Trees were measured in the same areas as in 2005 but were not necessarily the same trees. Basal area was also determined for both thinned and unthinned areas.

Results

In the unthinned area, tree diameters ranged between 2 and 23 inches with an average of 15 inches. The basal area of the stand ranged between 140 and 260 square feet. Most of the trees had moist or very wet cambium even if they had very few buds and were almost 100% defoliated in 2005. Defoliation ranged between 80 and 100% with an average of 96%. Thirty out of 50 trees were 100% defoliated in 2005. Many of the trees sampled had very few new buds in June. Out of 50 trees, 29 trees were rated as alive during this sampling period. Of the remaining 21 trees, nine died as a direct result of budworm feeding and 12 were attacked by Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopkins (Table 1). The trees attacked by Douglas-fir beetle had larger diameters ranging from 12 to 23 inches. The trees that were directly killed by budworm feeding were pole size trees.

In the adjacent thinned stand, tree diameters ranged between 3 and 23 inches with an average of 15 inches. Defoliation ranged between 10 and 100% with an average of 60%. All of the trees

measured in this stand had new buds in 2006. Basal area for this stand ranged from 60 to 100 square feet. There was no tree mortality in our plots in this stand either as a result of budworm feeding or Douglas-fir beetle (Table 1).

Table 1. Average tree diameter (DBH), range of stand basal area (BA), average defoliation for 2005 and 2006, and tree mortality due to western spruce budworm feeding or Douglas-fir beetle attack between unthinned and thinned stands.

Stand	Ave. Tree DBH (inches)	Stand BA (sq. ft./ac)	Ave. Defoliation 2005	Ave. Defoliation 2006	Tree Mortality budworm	Tree Mortality DFB
Unthinned	**15**	**140-260**	**84%**	**96%**	**18%**	**24%**
Thinned	**15**	**60-100**	**42%**	**60%**	**0**	**0**

Discussion

Western spruce budworm defoliation has more than doubled between 2004 and 2005 in the Region. In 2005, a total of 453,739 acres containing some level of budworm activity were recorded. To date in 2006, we have recorded significant defoliation from budworm in areas that were not reported defoliated in 2005, including some near Lincoln, Montana.

Budworm-caused impacts are often short-term and mature trees can recover quickly after populations subside. Studies have shown budworm-caused mortality is usually light but can vary greatly between stands. Mortality is usually limited to smaller suppressed regeneration and pole sized trees, which collect falling larvae from the upper canopy. This mass aggregation can overwhelm less vigorous trees, causing severe branch die-back or loss in height in the understory trees (Ferguson 1988). Tree mortality following several years of consecutive heavy defoliation ranged between 1 and 53 % at sites in Washington, Idaho, Oregon and British Columbia (Van Sickle et al. 1985). In our plots on Flesher Pass, mortality from direct and indirect effects of budworm is 42% percent. Our sample was taken at the beginning of the flight period of Douglas-fir beetle. Mortality estimates from Douglas-fir beetle on Flesher Pass for 2006 and 2007 is expected to be higher.

There have been many outbreaks of budworm on Flesher Pass in the past. However, this may be the first time that we recorded mortality from budworm feeding and subsequent Douglas-fir beetle attacks. Although Douglas-fir beetle attacks following heavy periods of budworm defoliation is not unprecedented, it is also not common in the Northern Region. Many areas that have repeated and heavy defoliation from budworm are not attacked by Douglas-fir beetle. We have recorded very little mortality from budworm on a series of permanent plots that were established across the region in the early 1990s (Bulaon and Sturdevant 2006). Most of the mortality has been confined to the smaller suppressed understory and to a very limited number of pole size trees. The recent mortality on Flesher Pass as a result of heavy budworm defoliation is probably a result of the ongoing below average precipitation and above average temperatures that we have been experiencing across western Montana over the past 8 years. These weather conditions along with an increase in the number of wildfires in Montana have stressed trees and

resulted in increased Douglas-fir beetle activity across some parts of the region. This is certainly true near Lincoln, Montana and Flesher Pass where pockets of Douglas-fir beetle mortality have been evident across the landscape over the past 7-10 years.

Brookes et al. (1987) suggests that budworm infestations persist in stands until the internal competitive stress between host trees and immigration of new larvae are both reduced. This allows for the re-establishment of natural enemy regulation which is essential in maintaining populations at endemic levels. He also suggests that epidemics will continue indefinitely in forests of advanced successional stage but may fluctuate periodically based on abnormal weather patterns. Our results indicate defoliation and tree mortality levels are much higher in the unthinned area than in the thinned area on Flesher Pass.

Based on this information, reducing stand vulnerability to budworm defoliation using silvicultural methods or prescribed burning can be accomplished. Reducing number of canopy layers and stand density would reduce stand susceptibility to budworm. Prescribed fire could also be used to reduce stand susceptibility by reducing the intermediate tree layer and stocking density. Prescribed fire, though, may cause additional stress on leave trees and increase Douglas-fir beetle activity. Reducing stand susceptibility to budworm will also reduce the stand susceptibility to Douglas-fir beetle. Trees show individual resistance to budworm feeding and damage. Therefore, trees with the heaviest damage and defoliation should be selected during a thinning operation to decrease damage and mortality from budworm. Many of the pole size trees in the Flesher Pass area with severe defoliation may die over the next few years. Additional mortality from Douglas-fir beetle will also probably occur in the larger diameter tree classes that have been heavily and repeatedly defoliated by budworm.

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