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# Tracking the Distribution and Severity of Balsam Woolly Adelgid (BWA) Impacts within Maine's Biophysical Regions, 2004 and 2005

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## Abstract

Maine is continuing to monitor the spatial distribution and severity of the current Balsam Woolly Adelgid (BWA) infestation within three biophysical tiers. This poster provides both new and comparative analyses of BWA damage and mortality impacts over the last six years within a 6+ million acre survey area, and it includes new assessments of BWA impacts on saplings. In 2005, the 238 FIA conditions, located within the eight biophysical regions, are collapsed into three tiers that better represent climatic transitions from Maine's coast to the interior. Also to better correspond to FHM Risk Analysis techniques, basal area is used to assess proportions of damage and mortality attributed to BWA. In 2004, the total BWA impact on merchantable trees was estimated as 81%, 50%, and 57% respectively for the Coastal, Interior, and Foothills tiers. The 2005 data provides similar estimates of 77%, 36%, and 23% with ever-increasing reductions as the respective tier moves away from the coast. In 2005, the Coastal tier estimates an overall BWA mortality increase from 16% to 24%, with its subsidiary Penobscot Bay Biophysical Region estimating a 38% mortality impact.

In 2005, a similar assessment of BWA impacts were collected on the microplot #1, co-located with subplot #1. The spatial association to the coast and its warmer climate is even stronger, with 85% of the sapling stems impacted by BWA compared to 11% and 9% respectively in the Interior and Foothills tiers.

The interaction of BWA impacts on both merchantable trees and saplings within each of the three biophysical tiers is insightful. 24% of the plots with fir in the Coastal tier have high BWA impacts on both merchantable and sapling stems. Conversely, 79% of the plots with fir in the Foothills biophysical tier have low impacts on both merchantable and sapling stems.

## Methods

Following the same protocols as outlined in the 2004 poster, a full suite of BWA impacts were collected on all sampled fir trees on the FIA plots within the survey area (Figure 1). For each merchantable fir tree (5.0" + dbh), the following data fields were recorded: BWA Tree Status; Trunk Phase (live trees only); Top Damage-BWA; and Overall BWA Damage. Also in 2005, additional data collection of BWA impacts on individual saplings on microplot #1 was conducted. Data fields on saplings include vigor, BWA damage (live saplings only), and trunk phase (live saplings only). Details on procedures, tally-sheets, and data manipulation tools are available upon request from the authors.

## Analysis

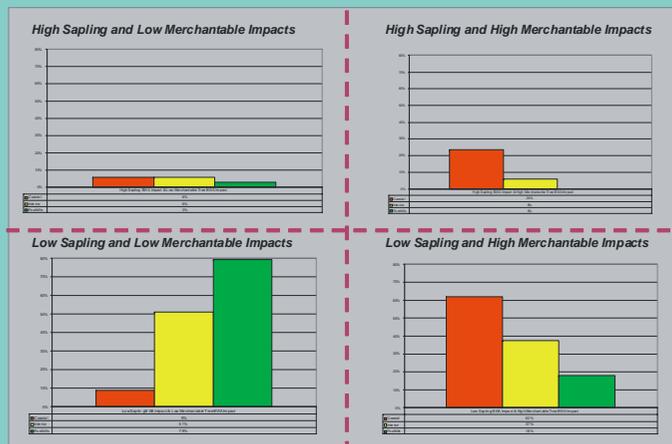
The process mimics, to a very large degree, the same as presented on the 2004 poster. BWA data was merged to the respective plot, point, and tree data collected in the 2000 FIA plot measurement. This resulted in the loss of new ingrowth trees and additional saplings and the ability to calculate impacts based on current dbh. With the continuing focus on risk analysis, MFS is presenting BWA impacts based upon basal area per acre at the condition level. The basal area calculations are based on the measured dbh in 2000, a common basis for trees that remained alive, were cut, or had subsequently died by the time of the 2005 remeasurement. MFS continued to aggregate plots into their respective biophysical region (Figure 1) and a spatial tier (Figure 2).

The arbitrary breakpoint of 35% basal area impacted by BWA (combined damage and mortality) was used to partition the data into four quadrants reflecting low (<35%) and high (>35%) BWA impacts on either saplings or merchantable trees within each of the three biophysical tiers (Table 3).

Table 1. Comparing BWA damage and mortality impacts for FIA conditions within BWA survey area by biophysical tier  
 Data collected in 2004 and 2005 on FIA plots  
 Percentage proportions represent changes in balsam fir trees from 1999/2000 measurements to the BWA assessment in 2004/2005 (Sears)

Tier	Biophysical Region	2004 FIA Conditions Sampled	2005 FIA Conditions Sampled	2004 BWA Damage Proportion		2005 BWA Damage Proportion		Merchantable (5.0" + dbh) Total BWA Impact		Saplings (1.0 - 4.9" dbh) Total BWA Impact	
				2004	2005	2004	2005	2004	2005		
Tier #1 - Coastal	Penobscot Bay	7	9	9%	9%	0%	1%	8%	7%	9%	9%
	Central Interior	71	15	8%	4%	0%	3%	25%	6%	2%	6%
	Tier #1 - Average	50	48	8%	4%	0%	3%	25%	6%	2%	6%
Tier #2 - Interior	Central Interior	80	58	41%	41%	7%	1%	46%	46%	46%	2%
	Eastern Lowlands	31	26	56%	57%	0%	1%	56%	56%	56%	0%
	Tier #2 - Average	91	84	44%	3%	0%	0%	50%	35%	50%	1%
Tier #3 - Foothills	Central Mountains	7	14	33%	3%	0%	0%	33%	24%	0%	0%
	Western Foothills	44	40	34%	6%	0%	0%	34%	13%	0%	0%
	Tier #3 - Average	89	108	33%	2%	0%	0%	37%	23%	0%	0%
Overall BWA Survey Area		231	238	30%	3%	0%	0%	37%	14%	0%	0%

Figure 3. Congruence of low versus high BWA impacts on either or both saplings and merchantable trees for 157 conditions that tallied a fir in 2000



Balsam Woolly Adelgid Survey Area Overlain Upon the Biophysical Regions of Maine

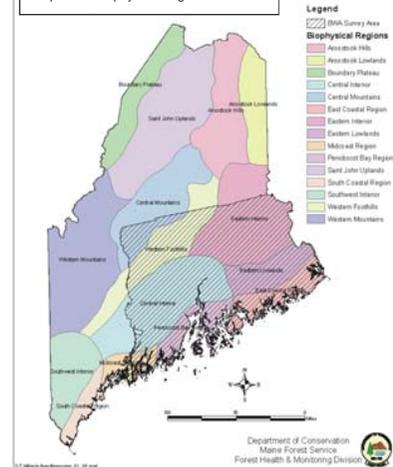


Figure 1

Biophysical Regions are Combined into Tiers for Assessing Balsam Woolly Adelgid Impacts

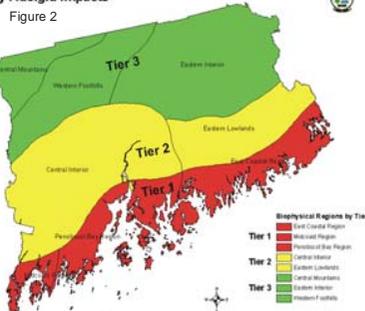


Figure 2

Department of Conservation  
 Maine Forest Service  
 Forest Health & Monitoring Division



## Discussion

The distinct biophysical trends noted in 2004 continued in 2005. The Coastal, Interior, and Foothills tiers had an estimated total BWA impact of 77%, 36%, and 23% respectively, maintaining the 2004 alignment (Table 1). Two notable differences with the 2005 data occur. First is the very high level of mortality (38%) estimated in the Penobscot Bay region, representing an increase of 14% from 2004. The second is the more rapid reduction as the data transitions from the coast to the interior and foothills, perhaps indicating a subtle BWA population dynamic related to average temperature and rain over the five-year period of 2000 - 2005 compared to the 1999 - 2004 period.

The sapling data estimates an even more extreme differentiation between the tiers in 2005. Combined BWA impacts of 77%, 16%, and 5% are estimated respectively, for the Coastal, Interior, and Foothills tiers (Table 1). The Eastern Coastal biophysical region was the most severely impacted by mortality over the period with 26% of the 2000 sapling basal area dying.

For both 2004 and 2005, BWA impacts on either merchantable trees or their basal area are almost identical on a percentage basis for all biophysical regions and tiers, indicating that the BWA impact is evenly spread across the entire fir merchantable diameter distribution. However, the 2005 BWA impacts on saplings do not match up very well between the two different bases. Some regions are losing larger proportions of trees (small dbh's, i.e. 1.0 - 1.9") relative to basal area, while other regions are losing fewer trees but they are a larger class (4" dbh), creating a larger percentage on a basal area basis.

Selecting 35% (combined BWA impact - basal area basis) as a breakpoint between low and high and then separately displaying tier averages for both saplings and merchantable trees provides for an interesting partition of the 157 conditions that had fir tallied in 2000. As expected, the Coastal tier is the runaway leader with high sapling and high merchantable BWA impacts occurring simultaneously on the same condition, with 24% of the conditions falling into this upper right quadrant (Figure 3). Add to this the 62% of the conditions with high merchantable BWA impacts (lower right quadrant) and this tier has 86% of its 2005 sample condition with a high BWA impact on merchantable stems. Conversely, 73% of the conditions in the Foothills tier have a low impact on both saplings and merchantable trees (lower left quadrant).

There is still the potential for additional tree level analysis of BWA growth impacts. MFS now has the complete Panel 1 - 2004 FIA dataset which can be merged to the 2004 BWA data for analyzing more tree specific, site specific, and management specific BWA impacts as noted on the 2004 poster.