

Abstract

Balsam woolly adelgid (BWA) infests fir throughout the southern half of Maine but damage has become increasingly severe in a band within 10 miles of the coast in eastern Maine.

During 2003, Maine Forest Service (MFS) crews developed a field assessment protocol to quantify BWA impacts on candidate stands. Assessed conditions and data categories were challenged for practical utility by testing for use in corporate landowner decision making processes. Crew assessments of damage symptoms and classes were repeatable by both MFS crews and industry crews, and were felt to be relevant to both tree survivability and commodity utility. Vetted data fields and categories were adapted to FIA plot data protocols and are being collected at a tree level basis to allow analysis for correlated site and tree health conditions. These analysis will facilitate development of weighted and expandable risk associations.

Balsam Woolly Adelgid Impact Studies in Maine

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Balsam Woolly Adelgid Evaluation Monitoring

Prior to preparation of the Maine balsam woolly adelgid (BWA) evaluation monitoring proposal, an aerial survey was conducted in 2002. This aerial evaluation revealed a patchy pattern of adelgid damage, ranging in severity from scattered fir mortality to stands where more than 75% of the stems had died. Adelgid damage was most severe within 10 miles of the coast in eastern Maine, but areas of significant damage were found more than 30 miles from the coast. In addition to the aerial evaluation, ground reconnaissance revealed that the severity of adelgid attack had risen sharply in recent years. The rate of new mortality had increased significantly since the 2000 season.

Determining Study Parameters

Following approval of the first year of this proposal, additional ground assessment of damage patterns and severity of adelgid damage was conducted in coastal and eastern sections of Maine. This information was used to develop the initial design for an evaluation method that would result in a workable hazard rating system. Variables thought useful in the development of a hazard rating system were selected. Observations of tree damage and decline were used to establish the initial damage ranges that would be evaluated as predictors of tree and stand risk. This work was completed in the spring of 2003.

Development of Survey and Training Material

Early in 2003, numerous photographs of balsam fir woolly adelgid damage and insects were taken to aid in training of crews and to document study variables. Photos included all levels of adelgid damage on all sizes of host trees. Damage ranged from trees with gouted twigs resulting in a reduced bud (foliage) compliment to dead trees. Adelgid symptoms were documented on mature fir, seedlings, and all sizes in between. A range of trunk phase adelgid populations was also photographed.

A draft photo guide was prepared in June 2003 to be used for crew training. The guide had photographs of four levels of trunk phase population, four levels of gout damage, seven variations of top damage, nine levels of whole tree damage, and pictures of adelgid damage on regeneration.

This assessment tool was adapted for stand level assessment and, through a cooperative project with International Paper Company, was tested for use as a management decision tool (see panels below). Based on the success of BWA assessment at the stand level, a rating system was added to the plot and tree level data collected on FIA phase 2 plots in eastern Maine. Five FIA field crew members were trained to use the photo guide. After a half day training, they were able to reliably and repeatedly classify adelgid conditions.

Because this evaluation monitoring project was initiated after the start of the FIA field season, there is only partial plot coverage for 2003. While enough data was collected to serve as proof of concept, the 2003 FIA data are not a definitively usable regional dataset. A complete set of data for the sample region is planned for 2004.

Concurrently, the University of Maine is establishing a series of off-frame FIA-style plots to assess the impact of climatic zone on population and impact relationships (right panel).



3 - Trace Branch Mortality



5 - 26% - 50% Branch Mortality



6 - 51% - 75% Branch Mortality

BWA Stand Evaluation Form

Observer: _____ GPS Coordinates: LAT: _____ LONG: _____

Location: _____

Description of Location: _____

STOPS (17)

1 - Normal	% trees with	% trees with
2 - Low/Defunct/None		
3 - Low/Defunct		
4 - None/None		
5 - Dead/Defunct		
6 - Dead/Defunct		
7 - Dead/Defunct		

DAMAGE (Tree Crown)

1 - No Damage	
2 - Bud Loss	
3 - Trace	
4 - 1-25%	
5 - 26-50%	
6 - 51-75%	
7 - 76-99%	
8 - Branch Gout	
9 - Old Dead	

TRUNK PHASE

1 - Absent	
2 - Trace	
3 - Light	
4 - Heavy	

REGULINGS

% Gout	
Use	

RECOVERY: _____

COMMENTS: (quantity of stand, etc, % fir in stand, etc.) _____

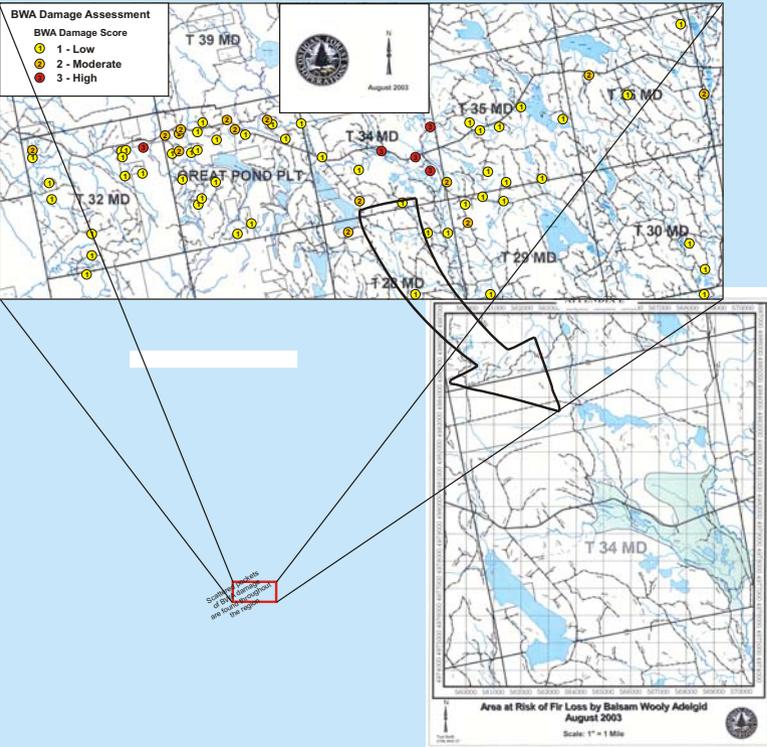
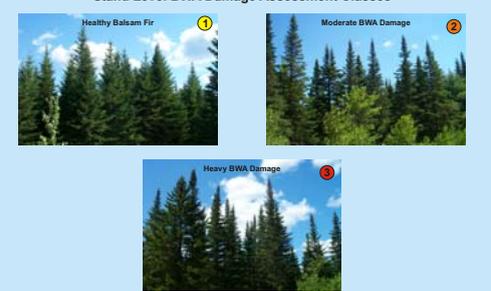
PLOT NUMBER: _____

Damage Score 4 to 9

Top Score 1 to 7

Note: area in blue box (above) was used by International Paper Company to evaluate BWA stand risk

Stand Level BWA Damage Assessment Classes



Industry Pilot Project

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Goals of the Study

- 1) Understand the dynamics of the BWA outbreak.
- 2) Define the geographic extent of the outbreak.
- 3) Rate stand damage.
- 4) Determine the appropriate management response.

Assessment Methodology

Assessment was based upon estimating the percentage of fir canopy of a stand in the various damage categories ranging from 1 (no damage) to 9 (dead). The total for all classes equaled 100%. Gout, regeneration condition, and trunk phase data were also recorded.

Stands selected for assessment were chosen based on the percentage of fir in the stand, proximity to the Studmill Road, and precommercial thinning (PCT) investment. Over 75 stands were assessed using this criteria.

Stand Damage Rating

Assumptions

- Fir component has to be > 33% of the stand BA and only the fir component of the stand is rated.
- 10% or less fir damage is acceptable.
- >33% moderate to severe fir damage is unacceptable.
- Trees with >25% branch mortality do not recover.

Rating System

- Stands were rated for damage on a numerical scale of 1 to 9.
- A cumulative damage score was determined for each plot.
- Plots were rated low, moderate, or high and assigned corresponding management choices (see below).

Summary of Results

- BWA damage is present in the older fir in nearly all stands in the Studmill Road and Route 9 corridor.
- Vigorous, young PCT stands show little damage.
- Heavy damage is present in the area between the forks of the Narraguagus River in T34MD and the Myra Area in T32MD.
- Subsequent anecdotal evidence suggests that BWA damage, that would be classified as light stand damage, is present on Company lands 30 miles north of the current study area.

Balsam Woolly Adelgid Forest Management Guidelines

Rating	Damage Description	Management Choice
1 - Low	0% to 10% cumulative tree score 2 to 9	Let grow
2 - Moderate	11% - 33% cumulative tree score 2 to 9	Monitor within next 2 years
3 - Heavy	34% - 66% cumulative tree score 4 to 9	Salvage

Balsam Woolly Adelgid Study Area



FIA Study Area

University of Maine Study Area

UMO BWA Research Project

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Background

Balsam woolly adelgid (BWA), *Adelges piceae*, was introduced on nursery stock to Maine in the early 1900's. By 1947 BWA had been found across the lower half of Maine. The most severe infestations occurred east of the Penobscot River in Hancock and Washington Counties and in the Kennebec Valley from Augusta to Bingham. Since then coastal areas of Maine have had chronic infestations, while damage on trees further inland has not been apparent until the past decade. Our study will address the following questions: Has the pattern of balsam woolly adelgid infestation changed in interior Maine in recent years resulting in more areas being affected with growth loss? If so, has the change corresponded with uncharacteristic weather patterns?

Study Plan

- Establish 10 plots in each of the 4 eastern climate zones in Maine following Forest Inventory and Analysis plot design
 - Collect site and tree information (e.g. soil drainage class, dbh, height, crown class, adelgid damage).
 - Collect increment cores from all co-dominant and dominant trees.
- Analyze increment cores
 - Compare chronologies from balsam fir (*Abies balsamea*) and a non-host species to remove stand-wide effects on growth patterns of climate and competition in an attempt to single out effects from BWA.
 - Attempt to develop a history of infestation to determine if recent infestations have occurred in areas not previously impacted by adelgid damage.
- Examine weather records to determine if potential periods of BWA infestation were associated with distinct weather patterns

Accomplishments:

Delivered

- Development and testing of BWA damage classification system
- Training of in-house and external foresters in damage classification system
- Evolution of damage rating system into operational forest management decision tool
- Development of a color brochure/photo guide for BWA recognition

In Progress

- Publication of full damage rating system/training manual (web based accessibility)
- BWA photo guide accessibility on web site
- Generation of FIA-linked plot/tree level BWA data set for eastern Maine
- University research project on relationship between BWA infestation/impact trends and recent weather patterns

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