

Extent and Severity of Balsam Woolly Adelgid (*Adelges piceae* (Ratzeburg)) Damage to Eastside Washington and Oregon Forests



Year 1 of 2 Year Project Grant, WC-F-07-01

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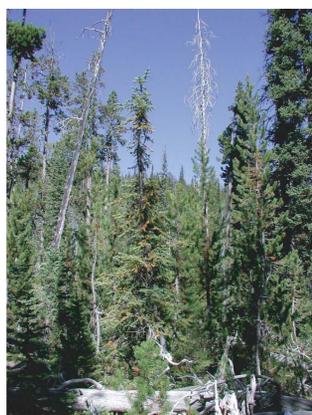
1. La Grande, Oregon
2. Bend, Oregon
3. Wenatchee, Washington

OBJECTIVES:

1. Determine the extent and severity of damage and mortality to subalpine fir (*Abies lasiocarpa* (Hook.) Nutt.) from balsam woolly adelgid.
2. Assess the management options available to promote resistance and/or regeneration that will ensure the long-term viability of subalpine fir on the landscape.

BACKGROUND:

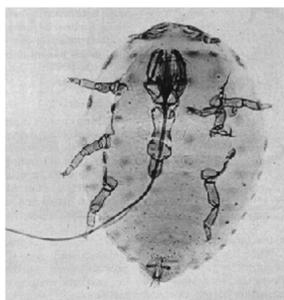
The balsam woolly adelgid (BWA) is a tiny sucking insect that was introduced into North America from Europe around 1900. It feeds on the stem, branches and twigs of true firs (*Abies* spp.). During feeding, the insect injects a salivary substance into the host tree which causes branch calluses and abnormal wood formation. Heavy bole infestations usually kill the tree. Branch and twig infestations cause gouting which progressively weakens the tree. Tops become curled or "fiddle-shaped," and portions of the crown may die.



BWA damage to subalpine fir: Tree in the center has typical "fiddle shaped" crown.

Photo by L. Spiegel, FHP LaGrande

Because the impact on the host is sometimes subtle and the insects are only visible for a short time, FIA and CVS plots probably underreport the incidence of balsam woolly adelgid. Plot remeasurements occurring between 1997-2004 in Region 6 documented little or no adelgid activity in many forests while aerial surveys documented thousands of acres of increasing damage in these same forests. While mortality in these areas is widely recognized, the impact on the landscape is not understood.



Balsam woolly adelgid adult.
 Photo from USDA FS archives



Branch gouting from BWA infestation. Impact is sometimes subtle.
 Photo by J. Hadfield, FHP Wenatchee

METHODS:

In the fall of 2007 we installed permanent fixed plots in 13 sub-alpine fir stands distributed throughout eastern Oregon and Washington. Each plot is 0.1 acre in size (37.2 feet in radius), with a smaller plot (0.02 acres, 16.7 feet in radius) nested at the same center. In order to characterize stands of interest, we have recorded the following information:



- Plant association
- Disturbance history
- Height, diameter and species of all trees or snags greater than or equal to five inches in diameter on the large plot
- Height, diameter and species of all trees greater than or equal to one foot tall but less than five inches in diameter on the small plot
- Tree status on the large plot (Standing/Blowdown/Live/Dead/Snag Condition)
- Live crown ratio
- Age from increment core (one fir in each five-inch diameter class)
- Radial growth for the last 10 years

The following data are used to characterize adelgid severity:

- Stem Infestation Density – an estimate of the number of adelgids found on the bole
- Crown Severity Rating – percentage of the crown damaged or killed by BWA
- Gouting Severity – number of nodes on a branch affected by BWA



Heavy stem infestation of BWA: Note the cottony appearance
 Photo by C. Mehmel, FHP, Wenatchee



Declining crown with pronounced lichens are a signature used by aerial survey to identify BWA

Photo by R. Flowers, OR Dept. of Forestry

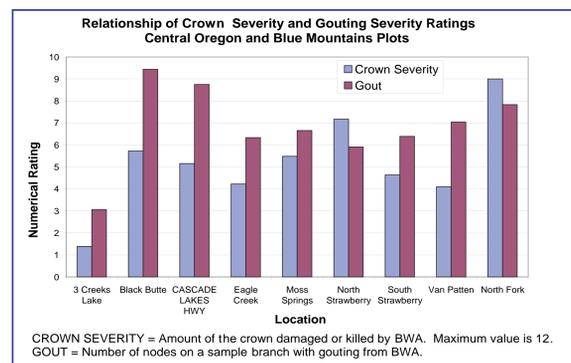
PRELIMINARY RESULTS:

All areas surveyed have yielded surprises.

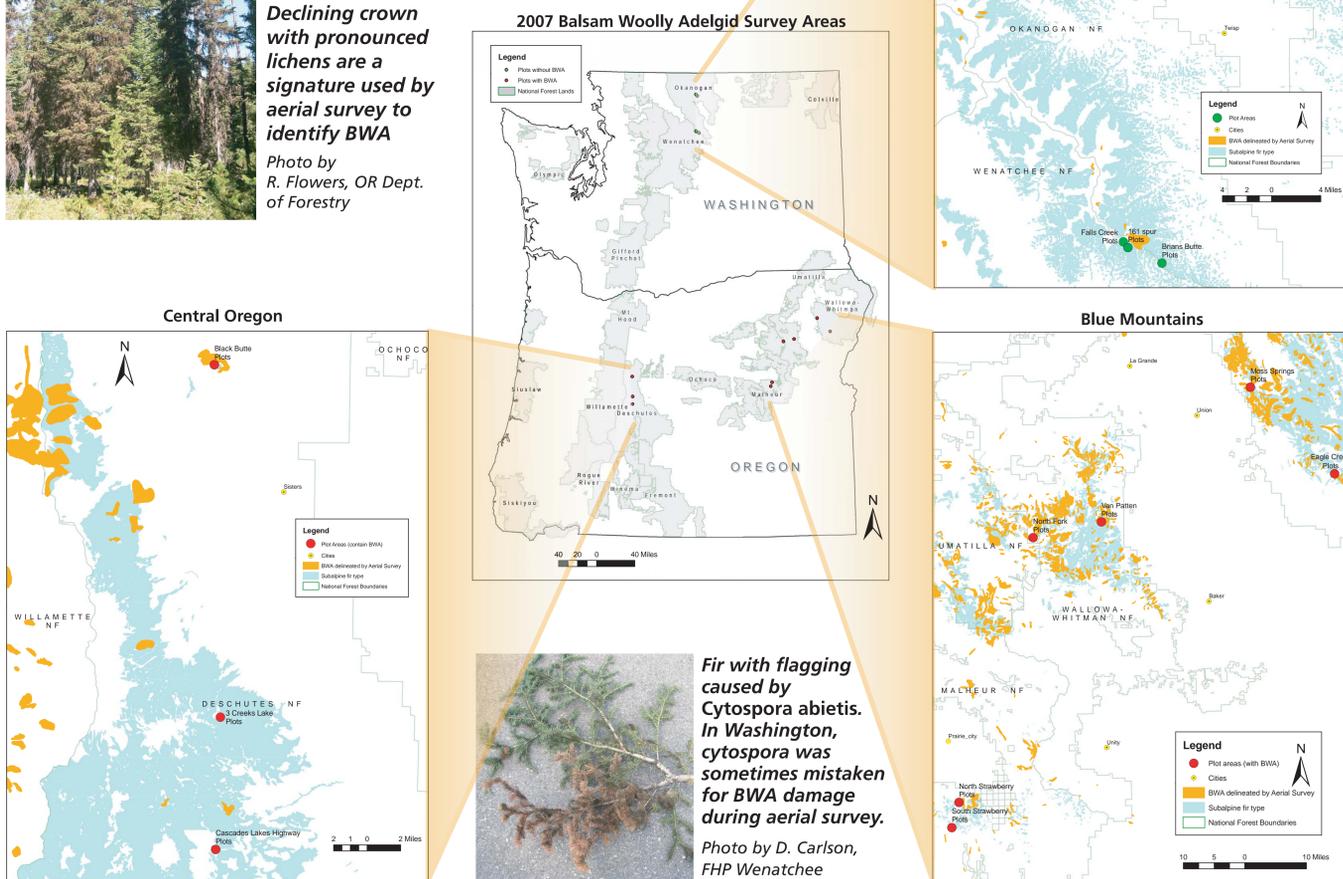
- In the eastern Cascades, adelgid infestations may not be as widespread as reported. Stands examined in northern Washington revealed no BWA infestations. Damage reported by aerial survey was apparently caused by other agents, most prominently *Cytospora* canker and *Pityokteines minutus*. *P. minutus*, while in the "twig beetle" group, appears to be acting as a tree killer in these drought-affected stands.
- Stands examined in northeastern Oregon are very severely infested. Areas recorded as free of BWA in 2000 now all have widespread infestations. Some stands had so few subalpine fir over 5" in diameter still alive that plot locations had to be adjusted.

FUTURE WORK:

- Double the number of plot installations in 2008.
- Continue long term monitoring of established plots.
- Evaluate management options for subalpine fir.
- Evaluate the relationship of crown severity and gouting severity as measures of BWA impact.



CROWN SEVERITY = Amount of the crown damaged or killed by BWA. Maximum value is 12. GOUT = Number of nodes on a sample branch with gouting from BWA.



Fir with flagging caused by Cytospora abietis. In Washington, cytospora was sometimes mistaken for BWA damage during aerial survey.
 Photo by D. Carlson, FHP Wenatchee