

Ash Tree Health Index



“Sustaining Forests in a Changing Environment”

A research work unit of the USDA Forest Service Northern Research Station

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Calculating Ash Tree health Index (ATHI)

What you will need:

- A digital camera
- [Gap Light Analyzer Software](#)—Will require installation
- A 16” tape measure

What to Look For:

Signs of emerald ash borer (EAB) presence include:

- Canopy die back (top picture on page 2)
- Epicormic sprouts (center picture on page 2)
- D-shaped exit holes (bottom picture on page 2)
- Splitting bark
- Increased woodpecker damage

The ATHI incorporates the first 3 signs/ conditions to estimate tree health.

Concept:

Visual surveys currently do not indicate the health of the tree, thereby assuming each tree has the same degree of infestation and state of vigor. As destruction caused by EAB increases in a tree, the flow of nutrients throughout the tree becomes cut off. In response to the lack of nutrients, the tree displays signs of declining health. This declining state can be monitored to determine the best management options, including pesticide use or removal.

Forty-five green ash (*Fraxinus pennsylvanica*) trees from Toledo, Ohio were collected to develop the tree health classification. These street trees were of various stages of infestation.



Emerald ash borer larvae can be identified by the triangle shaped segments



Adult emerald ash borer insects emerge between mid-May and late July

How to Calculate ATHI

1. Determine the number of D-shaped exit holes
 - It is important to be accurate, since the number of exit holes will help to determine an estimate of the population size.
 - We suggest that you count all exit holes between 4’ and 8’.
2. Determine the number of epicormic sprouts to a height of 16’
3. Determine the percent of canopy light transmission
 - On a clear day, photograph the canopy of the tree so that most of the canopy is in the frame.
 - The photograph should be a representative image of the entire canopy conditions.

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4. Analyze the canopy photograph with the [Gap Light Analyzer Software](#)

- Open the image; File>Open Image
- Register the image; Configure>Register Image
 - You will do this for each analysis (may vary due to image size, ran on 3264 x 2448 pixels)
 - A: Initial point: 1677, 2202; Final point: 1626, 202 (Center*)
 - B: Initial point: 1, 1224; Final point: 2465, 1224 (Left†)
 - C: Initial point: 3264, 1224; Final point: 800, 1224 (Right‡)
- Process the image; Edit>Select Region>Free Hand
 - Use the mouse to trace around either vegetation or sky
 - Small contiguous areas will produce a more accurate analysis
- Apply a Threshold to the region; Image>Threshold
 - Slide the bar right (to darken) or to the left (to lighten) the region.
- Once the Threshold has been performed on the entire image, calculate the light transmission; Calculate>Run Calculations
 - Use the defaults, Calculate
 - Append the results to the output summary file
- Repeat for Registry B and C
- Save the output summary file

5. Average the results from the Canopy output file

- The value in the column named % Cnpy Open

* Determine the center point of the image and position a circle to encompass the top and bottom of the image.

† From the center of the left edge of the image position a circle to encompass the top and bottom of the image.

‡ From the center of the right edge of the image position a circle to encompass the top and bottom of the image.

These three circles will overlap, averaging the canopy light transmission.



Canopy dieback



Epicormic sprouts



D-shaped exit hole

6. Insert the values into the ATHI formula to classify your tree's health

$$\text{ATHI} = (\% \text{ Light transmission } (.50)) + (\# \text{ epicormics } (.30)) + (\# \text{ exit holes } (.20))$$

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Interpreting the Classification

ATHI is a weighted index of health, where the influence of the three symptoms relates to the condition of the tree. Healthy trees will have a low ATHI rating while severely unhealthy trees will have a high ATHI rating.

- Healthy trees had values <10
- Intermediate trees ranged from 10 to 20
- Poor trees had values >20

Examples:

(% Light Transmission (.50)) +
(# Epicormics(.30)) + (# Exit Holes (.20))

A. Healthy (7.72)

% Light Transmission =
13.0 (telephoto)
EpicormicShoots = 6
Exit Holes = 0

ATHI =
[(13.0 * 0.5) + (4 * 0.3) +
(0 * 0.2)]

B. Poor (36.43)

% Light Transmission = 47.5
(telephoto)
EpicormicShoots = 39
Exit Holes = 5

ATHI =
[(47.5 * 0.5) + (39 * 0.3) +
(5 * 0.2)]



Example A



Example B

ATHI classified the top tree (A) as healthy (7.72) and the bottom tree (B) as poor (36.43)