# Evaluating Black Ash (*Fraxinus nigra*) Decline in the Upper Midwest

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## The Problem:

Black ash (*Fraxinus nigra*) decline has been noted with increasing frequency. Over 27,000 acres were affected in Minnesota in 2004.

## Importance:

Black ash is an important component of wetland forests throughout the Upper Midwest and northeastern USA, and is highly valued for paneling, veneer, furniture, and Native American basketmaking.

## Decline Hypotheses Tested:

- Hydrography
- Adjacency to roads
- Tree age
- Temperature and precipitation
- Soil characteristics

## Objectives:

- Use Forest Inventory & Analysis (FIA) and Forest Health Monitoring (FHM) data to assess the distribution of decline in Minnesota.
- Relate decline occurrence and variation to mapped landscape-scale climatic, physiographic, and edaphic data.
- Conduct field evaluations of decline and mortality within selected ecosystems.
- Quantify relationships between field observations and cultural features.

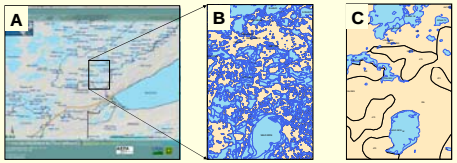
## Data Sources:

- FHM aerial sketchmapping data, Minnesota, 2004.
- FIA public data (1977 to 2005) and FIA true-coordinate data (1990 and 2003).
- National Hydrography Dataset, National Wetlands Inventory, STATSGO soils (Fig. 1), PRISM climate, and roads data.
- Field observations of 2,116 trees – mortality, condition, DBH, age, soil moisture, and regeneration.

### Analyses:

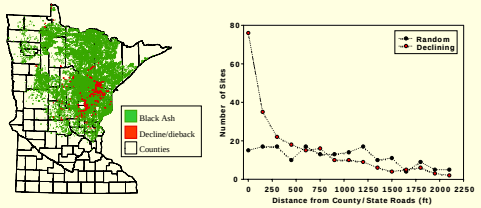
- Linear regression and categorical data analyses.

**Figure 1.** (A) Hydrography, (B) wetlands, and (C) soils data.




## Results: FHM sketchmapping

- Decline was concentrated spatially.
- Declining stands were significantly closer to city, county, and state roads.




## Results: FIA public data

- Survival and mean DBH decreased over time.
- Survival differed greatly among counties (44% to 94%).
- Mean DBH and survival were greater on moist slopes than on flat, wet sites.
- Most declining and non-declining trees (~80%) and the oldest trees were growing on sites with the poorest productivity.
- Dead terminals and conks or decay were the most common damage types.

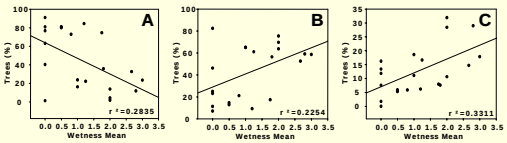
## Results: FIA true coordinate data

- Change in DBH was greater on drier than on wetter sites.
- Levels of mortality differed among counties, climate divisions, and ecological subsections.
- Soils, temperature, and precipitation data were associated with mortality and change in DBH, but explained little of the variation.

## Results: Field evaluations

- Trees growing on wetter plots had greater decline symptoms than trees growing on drier plots (Fig. 2).
- Severity of decline was greater in older trees than in younger trees.
- Black ash regeneration (seedling and sapling size classes) varied widely across sites but was generally greater on better drained plots (Fig. 3).
- Trees growing closer to roads had more decline symptoms than those farther from roads.
- No biotic agent was found to be responsible for the decline.

**Figure 2.** Relationship between (A) healthy, (B) dying, and (C) dead trees and field plot wetness.




## Discussion:

Roads contribute to decline of black ash, potentially due to changes in hydrology or accumulation of de-icing agents. Trees were often old (>100 years) and older trees may be more vulnerable to biotic and abiotic stresses.

FIA growth and mortality data proved valuable for discriminating among several factors that could be associated with black ash decline but the data were limited in revealing factors that could have caused the decline, such as damage from biotic and abiotic agents.

**Figure 3.** Vigorously growing black ash trees (left) and thriving regeneration (right) on a rich mesic site.

**For additional details see:**

**Ward, K., M. Ostry, R. Venette, B. Palik, M. Hansen, and M. Hatfield. 2007**. Assessment of black ash (*Fraxinus nigra*) decline in Minnesota. In: Proceedings of the Eighth Annual Forest Inventory and Analysis Symposium. October 16-18, 2006. Monterey Bay, CA, USDA Forest Service, Northern Research Station (In Press).

## Continuing Research:

- Conduct additional field evaluations of black ash decline and mortality within selected sites varying in hydrology, stand age, and management history.
- Use dendrochronology to identify periods of reduced growth associated with drought, flooding, or changing land use.
- Relate regeneration to hydrology, stand history, and adjacency to roads.

## Acknowledgement:

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