

Predicting Forest Dieback Using Global Climate Indicators: Is it Possible?



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Current Focus

1. El Niño–Southern Oscillation (ENSO) and Forest Dieback Interactions

Forest Dieback:

Annual USDA-FS and State insect and disease surveys were used to reconstruct the severity of dieback in northern hardwood forests from 1950-1995.

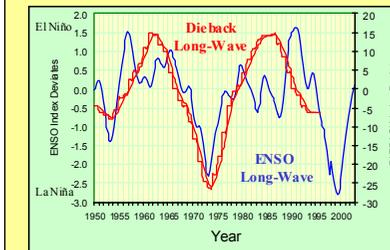
ENSO:

Seasonal ENSO values rated as El Niño (W-, W, W+), Neutral (N), or La Niña (C-, C, C+) were obtained from NOAA and quantified.

U.S. northern hardwoods underwent 2 periods of dieback, the first starting in 1954, and the second in 1976.

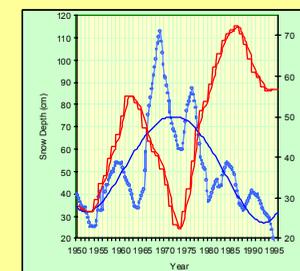
In both cases, major dieback periods were preceded by extreme La Niña conditions.

The recent La Niña event may foretell a third period of dieback over the 2003-2015 period.



2. Regional Climate Mechanisms

Depth of snow-pack was the only parameter of 10 regional climate stresses that showed a consistent link to forest dieback.



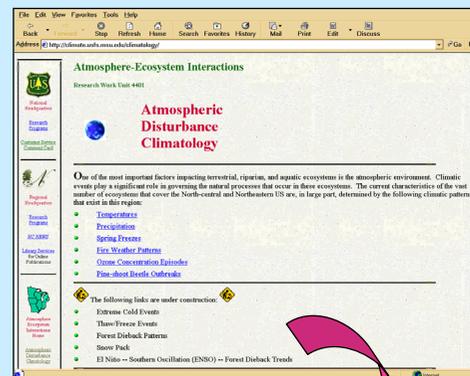
Paired, two-tailed *t*-tests for 23 dieback episodes showed snow depth was statistically significant for both onset and recovery of dieback.

Management Implications

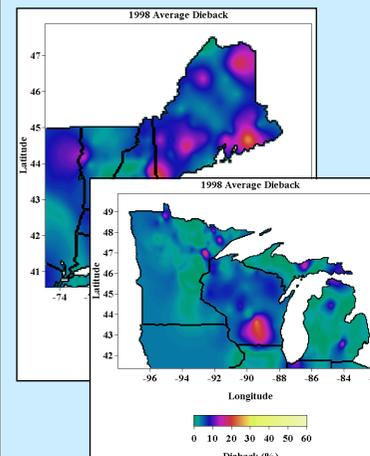
This is the first model projecting the incidence of future dieback in northern hardwoods. Knowledge of other factors such as stand age and site should enable managers to anticipate where and when forests are at risk to dieback

Web Archive: Forest Health – Climate Interactions

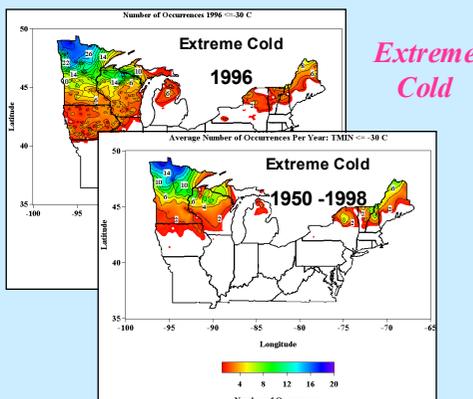
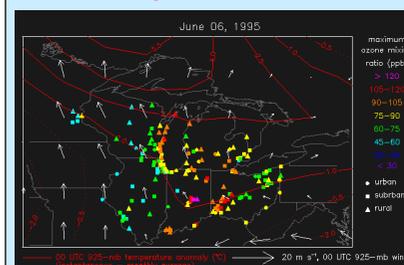
Patterns of extreme climate events, ozone, and forest health indicators over the north central and northeastern U.S. have been analyzed and archived. GIS maps of these patterns are being integrated into the North Central Research Station's web-based *Atmospheric Disturbance Climatology System* for forest health management support.



Forest Dieback

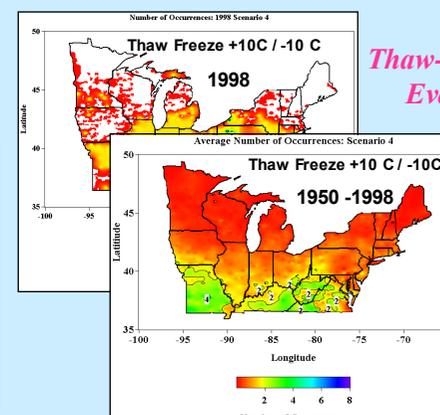


Ozone Pollution



Extreme Cold

Thaw-Freeze Events



Objective and Goals of Current Project

Objective:

To predict forest health outcomes using physical data on weather, climate, and air quality.

Goal 1:

Develop a series of climate indicators that evaluate changing risk to forest health.

Goal 2:

Develop formal decision support system to assist managers in making timely and accurate choices.

Project Approach

Develop archive of GIS maps of FHM, climate disturbance, and air quality data.

Focus initially on two symptoms: Crown dieback and Bioindicators.

Design and test a series of climate indices to correlate with FHM data.

Develop an early warning capability.



Concept:

- Determines status, changes, and trends in forest conditions annually.
- Uses ground plots and surveys, aerial surveys, and other biotic and abiotic data sources.
- Develops analytical approaches to address issues on sustainability of forest ecosystems.

Issue:

- Field results delayed 12-24 months; interpretation only after well-defined patterns emerge.
- Managers need advance warning of when and which injuries are likely.