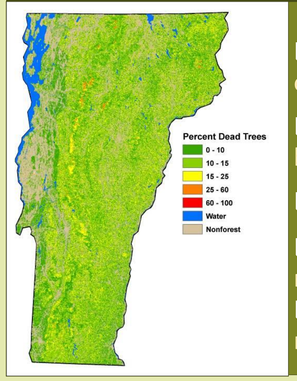
FIA Plots, Aerial Survey, and Health Plots Integrated to Understand Tree Mortality in Vermont

Sandy Wilmot and Robert DeGeus, VT Forestry; Randall Morin, US Forest Service; Lindsay Watkins, Univ. of VT

The 2008 inventory for Vermont (Forest Inventory and Analysis) showed high numbers of dead trees per acre for paper birch, red spruce, American beech, balsam fir and red maple. An investigation of causes is underway using existing FIA, aerial survey, health plot data, spatial models, and field verifications. Completion date is September 2012.

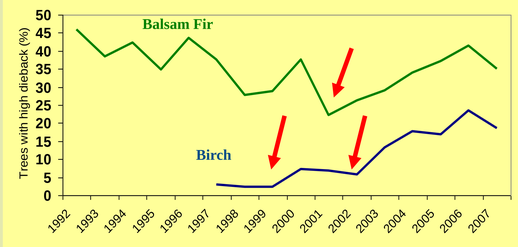
Pattern of Mortality From FIA Data



FIA Analyses

- ❑Timberland affected (not just high elevation forests)
- ❑ Northern and southern Vermont both affected
- ❑ Not due to stocking level
- ❑ Smaller diameter trees may be more susceptible
- ❑Red maple particularly high mortality

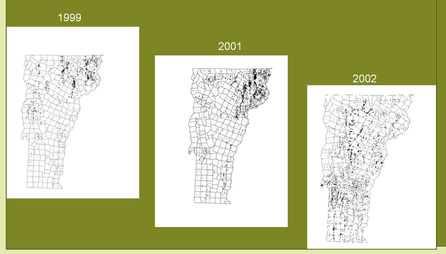
Timing of Decline From Health Plots



Heath plots on Mt. Mansfield in the Vermont Monitoring Cooperative indicate different initiation periods for balsam fir decline vs birch decline.

Probable Causes From Aerial Survey

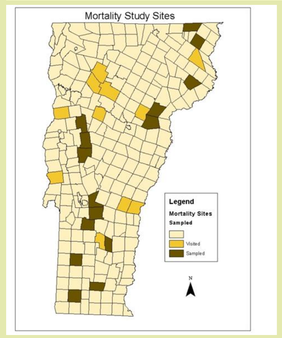
Drought Symptoms Mapped



Aerial Survey Mapped These Problems

- Ice Storm
- Wind Storms
- Birch Decline
- Balsam Woolly Adelgid
- Beech Bark Disease
- Winter Injury
- Drought
- Forest Tent Caterpillar
- Anthracnose

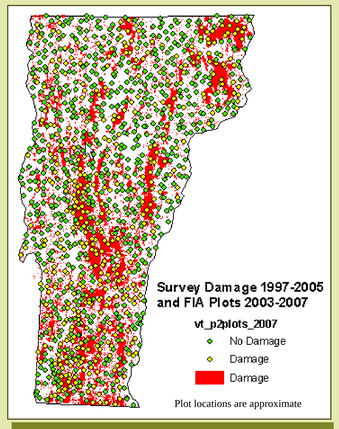
Site evaluations in 2011 included sampling of tree cores to determine the timing of decline, and soil sampling to assess contribution of soil nutrient deficiency.



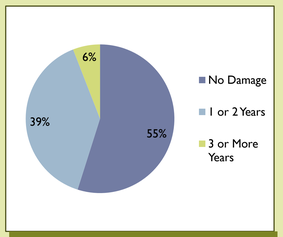
Additional research conducted by local scientists has determined probable causes for red spruce and paper birch:
Schaberg, Paul G.; Lazarus, Brynne E.; Hawley, Gary J.; Halman, Joshua M.; Borer, Catherine H.; Hansen, Christopher F. 2011. Assessment of weather-associated causes of red spruce winter injury and consequences to aboveground carbon sequestration. Journal of Forest Research. 41: 359-369.
Halman, Joshua M.; Schaberg, Paul G.; Hawley, Gary J.; Hansen, Christopher F. 2011. Potential role of soil calcium in recovery of paper birch following ice storm injury in Vermont, USA. Forest Ecology and Management. 261: 1539-1545.

Spatial Analyses

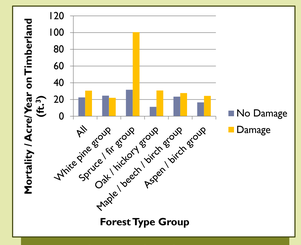
FIA Mortality Compared To Damage Survey, Soil Depth, and Soil Dryness Index



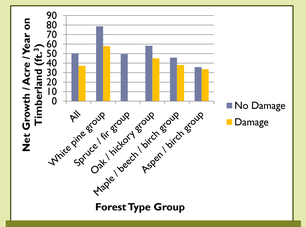
Aerial survey mapping of forest damages (red) and 962 forested FIA plots (circles), where 419 plots intersected damage polygons.



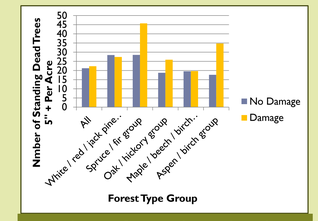
Approximately 45% of VT's forest land received 'damage' between 1997-2005.



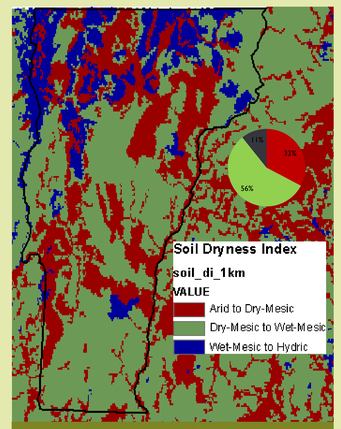
Mortality is higher on plots that intersected damage polygons for most forest type groups.



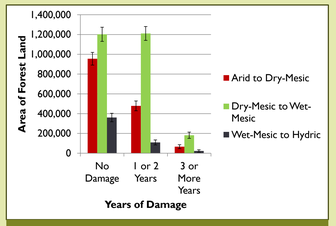
Net growth is lower on plots that intersected damage polygons for every forest type group and all forest land.



Number of standing dead trees was higher on plots that were 'damaged' in the spruce/fir, oak/hickory, and aspen/birch groups.

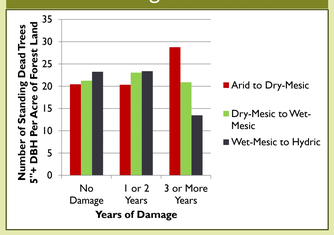


56% of Vermont's forest area grows on moderately wet soils.



Damage and Soil DI do not appear to be correlated. The relationship is similar across damage categories.

Number of standing dead trees was higher on forest land with 3 or more damages on drier soils.



Vermont Department of Forests, Parks & Recreation

USDA Forest Service