

White Pine Decline Risk Assessment in Maine

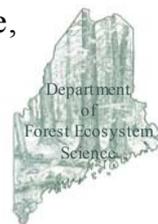


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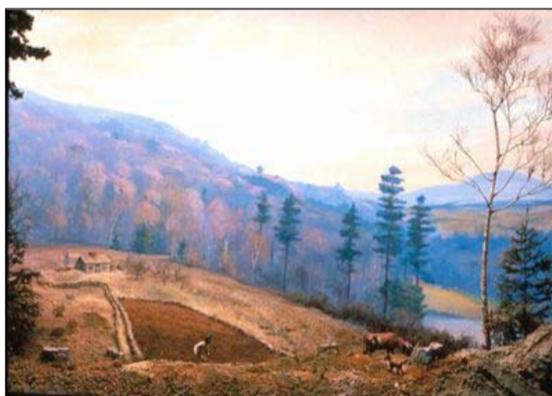


Tree mortality 1997-2000

- Thinning crowns
- Southern Maine
 - ✓ Scattered locations
 - ✓ Simultaneous appearance
- Dense, pole-size stands

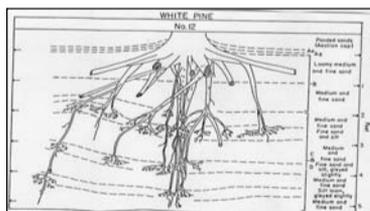
Past Agricultural Uses and Pine Forests

- Field abandonment
 - ✓ By 1940 total number of farms in Maine declined by 80 %
 - ✓ From 1872-1995 over 7 million acres converted back to forest
- Consequences
 - ✓ Plow pans
 - ✓ Soil compaction
 - ✓ Favored white pine establishment on many diverse sites



Harvard Forest Diorama

Rooting Habits of White Pine



Brown and Lacate,
1961



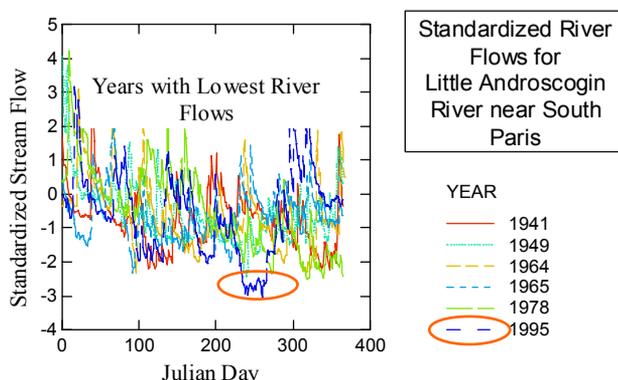
Steve Howell, 2000

- Normal Rooting
 - ✓ Grows best in deep, well drained soils
 - ✓ Lacks a taproot.
- Restricted Rooting
 - ✓ Soil barriers inhibit root penetration
 - ✓ Barriers include plow pans, high water tables, bedrock, and texture changes (lithological discontinuity)
 - ✓ Lack of roots deeper in the soil keeps trees from getting water during droughts

White Pine Decline is Incited by Drought

- Most (64%) dead trees had last year of growth in 1996-1997
- Severe drought in 1995

Record low stream flow in late summer 1995



White Pine is Predisposed to Mortality Incited by Drought in Stands with:

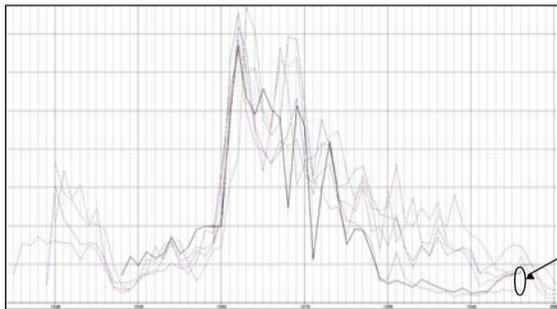
1. Shallow rooting depths

- 12 inches or less to rooting restriction
- Causes of restrictions
 - ✓ Lithological discontinuity
 - ✓ Plow layer
 - ✓ Water table
 - ✓ Bedrock



2. Dense Stands

Cross-dating of cores from killed & living trees



- About 30% of trees killed in affected stands
- 495 stems/ha, 23 cm dia in high mortality plots
- 273 stems/ha, 37 cm dia in low mortality plots
- Killed trees were slower growing (see graph)
- Insects and fungi secondary

Risk Assessment for White Pine Decline

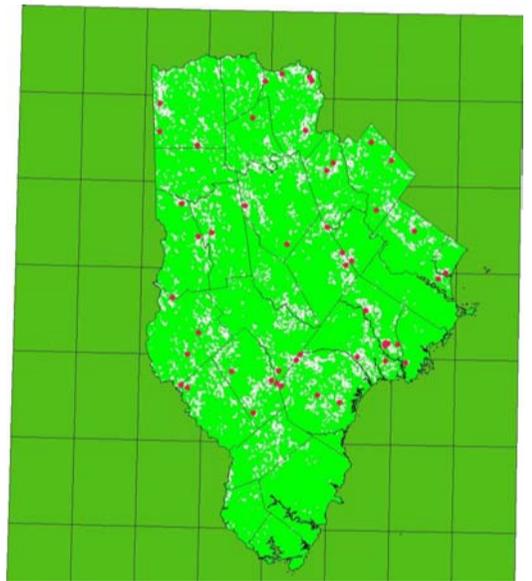
Estimate amount of white pine stands growing on soils with rooting restrictions:

- Complete for York, Cumberland, and southern Oxford Counties
- Select stands randomly
 - ✓ Overlay satellite image of cover types with soil map
 - ✓ Randomly select sites where conifer type overlays soil type where rooting restrictions are possible
 - ✓ Sample sites where owners are willing to cooperate



Satellite Image with Cover Types

Conifer type in green



York County, Maine

White areas indicate where conifer type overlays soils with possible rooting restrictions

Symbols indicate random locations for sample sites



Measure:

- Four subplots per site
- Depth to soil restriction
- Basal area of stand and white pine
- Site index for white pine
- Regression between site index and depth to rooting restriction
- Complete 40-60 sites in 2003

FIA Plots and Potential Risk to Decline

- 56 FIA plots in York County
- Locations identified on soil maps
- 31 plots on soils with possible rooting restrictions

Expected Outcomes

- Estimate amount of area at risk to white pine decline
- Quantify relationship between white pine site index and depth to rooting restrictions
- Develop management guidelines for identifying stands that should:
 - ✓ Be maintained at low densities
 - ✓ Have rooting restrictions removed (subsoiler) to improve white pine survival and growth