Climate Adaptation Issues for MD Forests and Stream Buffers

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Improving Forest-related BMPs

- Riparian Forest Buffers
  - Consider drainage flow context and Farm Plan
  - Address concentrated flows with companion practices
  - Use cover crops and control invasive species
- Tree Planting
  - Plan species diversity
  - Expand agroforestry/income
- Forest Harvesting BMPs
  - Focus on stream crossings and stabilizing soils

Why Forests and Forest Buffers

- Forest is natural cover along most MD streams
- Multiple ecological benefits
  - Nutrient reduction
    - filter, infiltrate, denitrify
  - Bank stabilization-
    - Deep rooting
    - Less mobile channel long-term
  - Aquatic habitat
    - Food sources, LWD, shade
  - Wildlife habitat
  - Air quality, Carbon sequestration

Forests, infiltration, & adaptation

- **Deep rooting** develops macropores for rapid infiltration
- **Forest floor**/ litter layer acts as sponge and supports insects/microbial community
- **Canopy intercepts** water and atmospheric pollutants
- **Evapotranspiration** uses water and creates more soil storage capacity

- Function related to biomass
- BMPs can infiltrate runoff but do not replace ET, so more water in streams

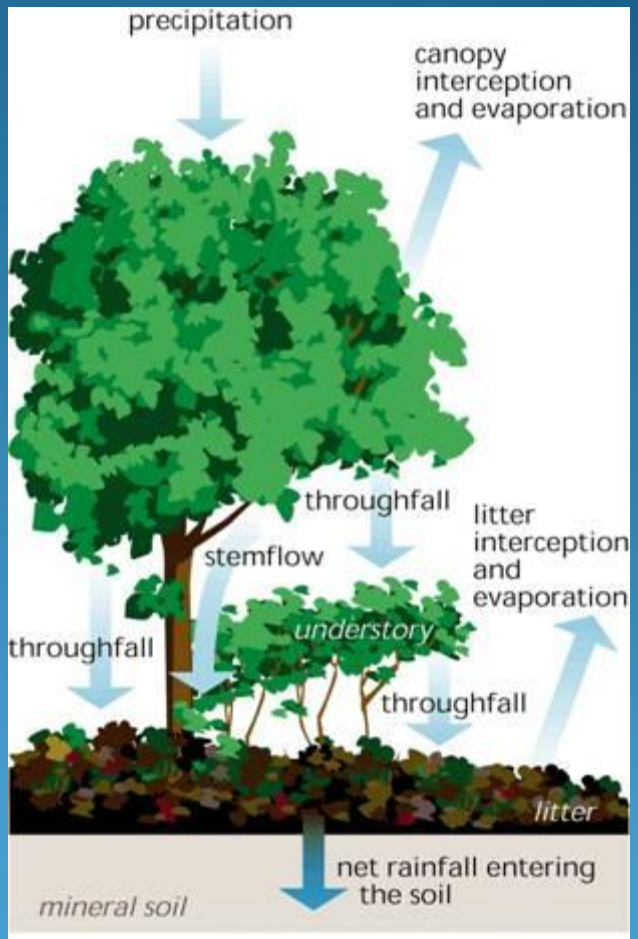
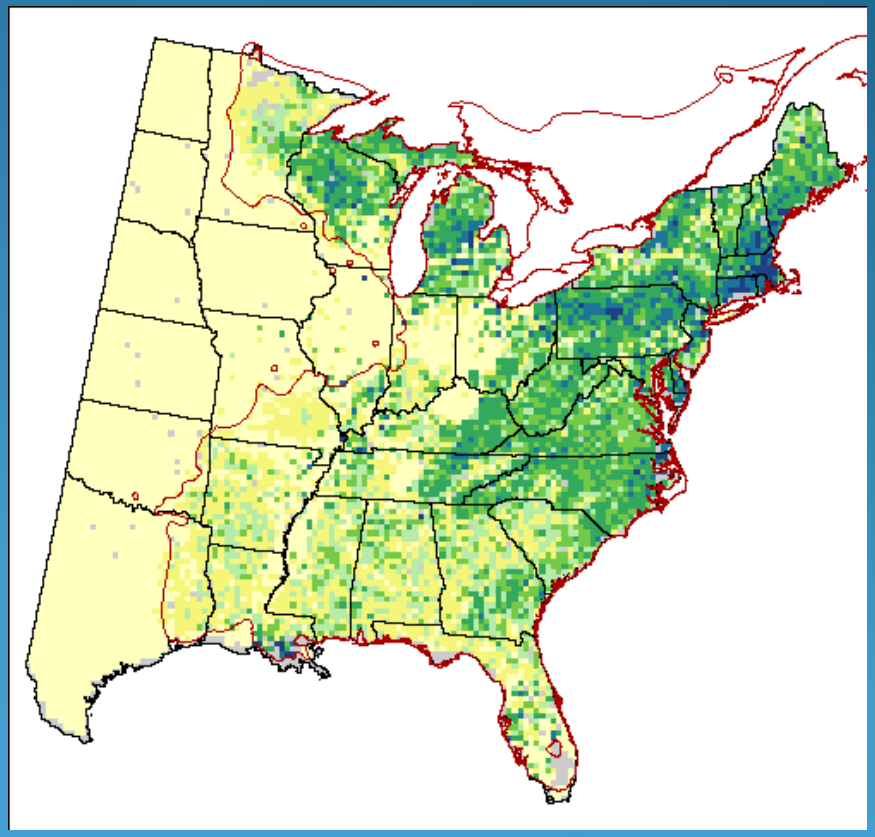


Fig. 2.3 -- Typical pathways for forest rainfall. A portion of precipitation never reaches the ground because it is intercepted by vegetation and other surfaces.
In Stream Corridor Restoration: Principles, Processes, and Practices (10/98).
Interagency Stream Restoration Working Group (15 federal agencies)(FESRWG).

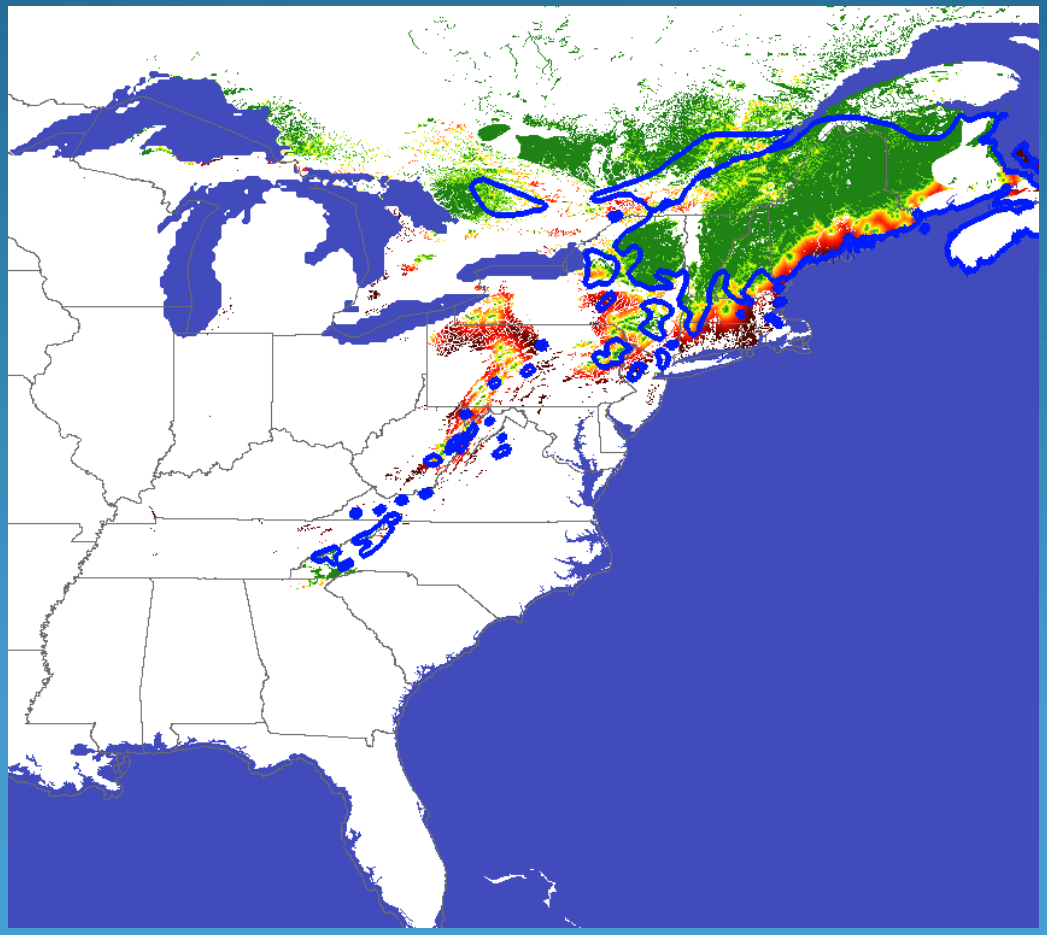
MD Forests and Climate Change

- USFS Northern Research Station has extensive research on predicted suitability under multiple climate scenarios
- USFS Climate Change Atlas- 134 tree species
- Prasad et al. 2007-ongoing. http://www.nrs.fs.fed.us/atlas/tree

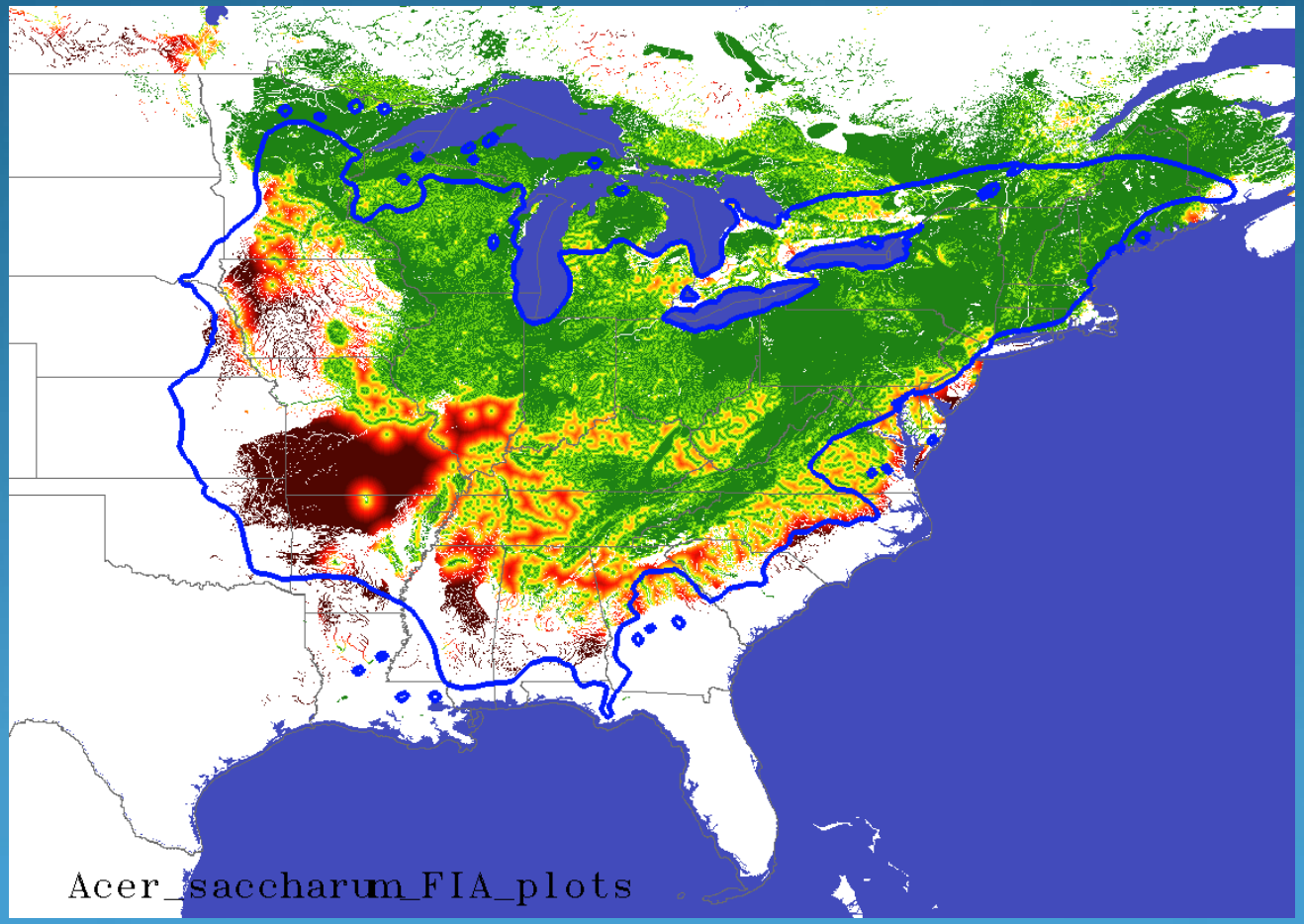


USDA U.S. FOREST SERVICE
Caring for the land and serving people
United States Department of Agriculture

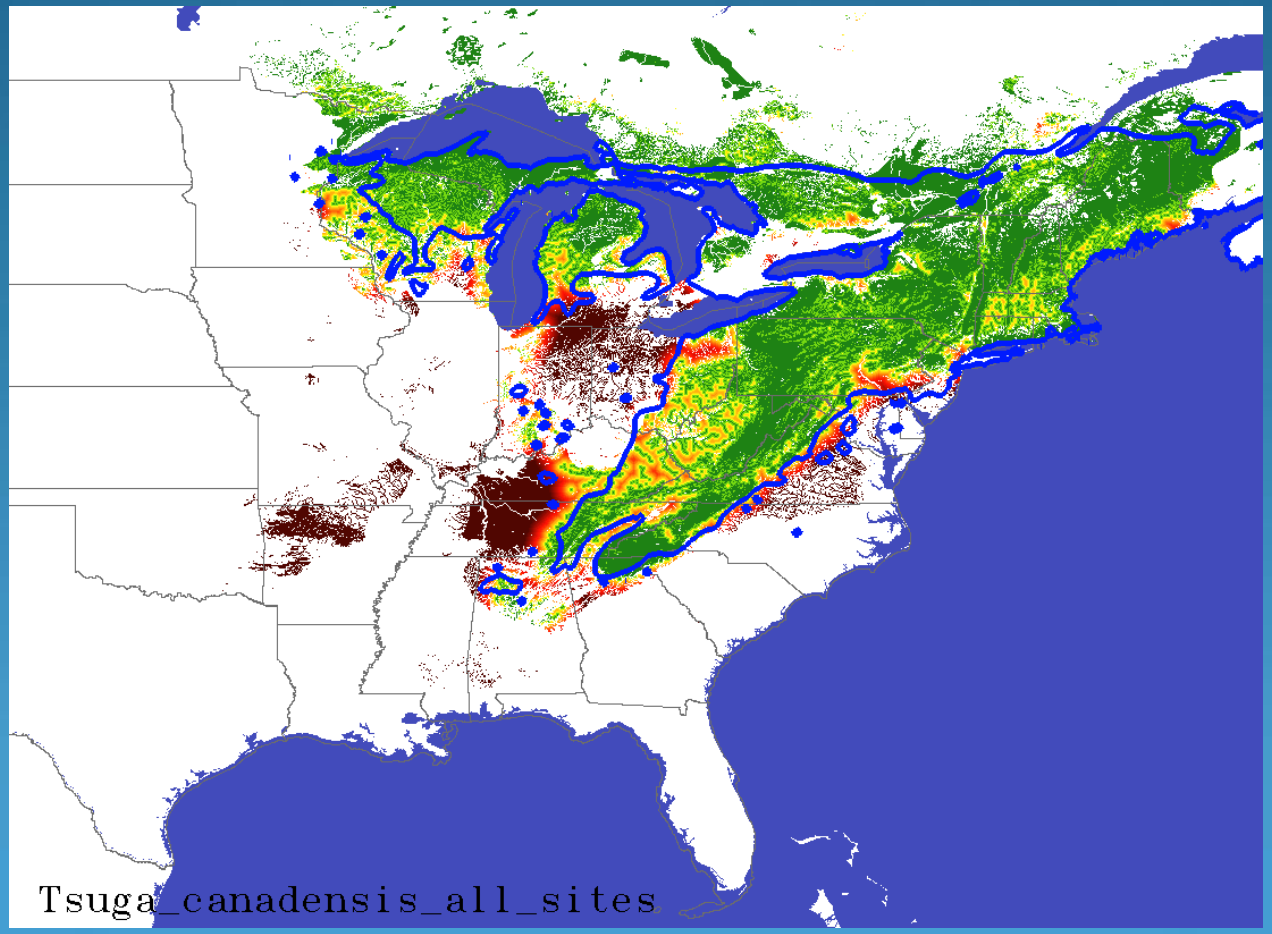
Species at the southern end of their range declines- red spruce



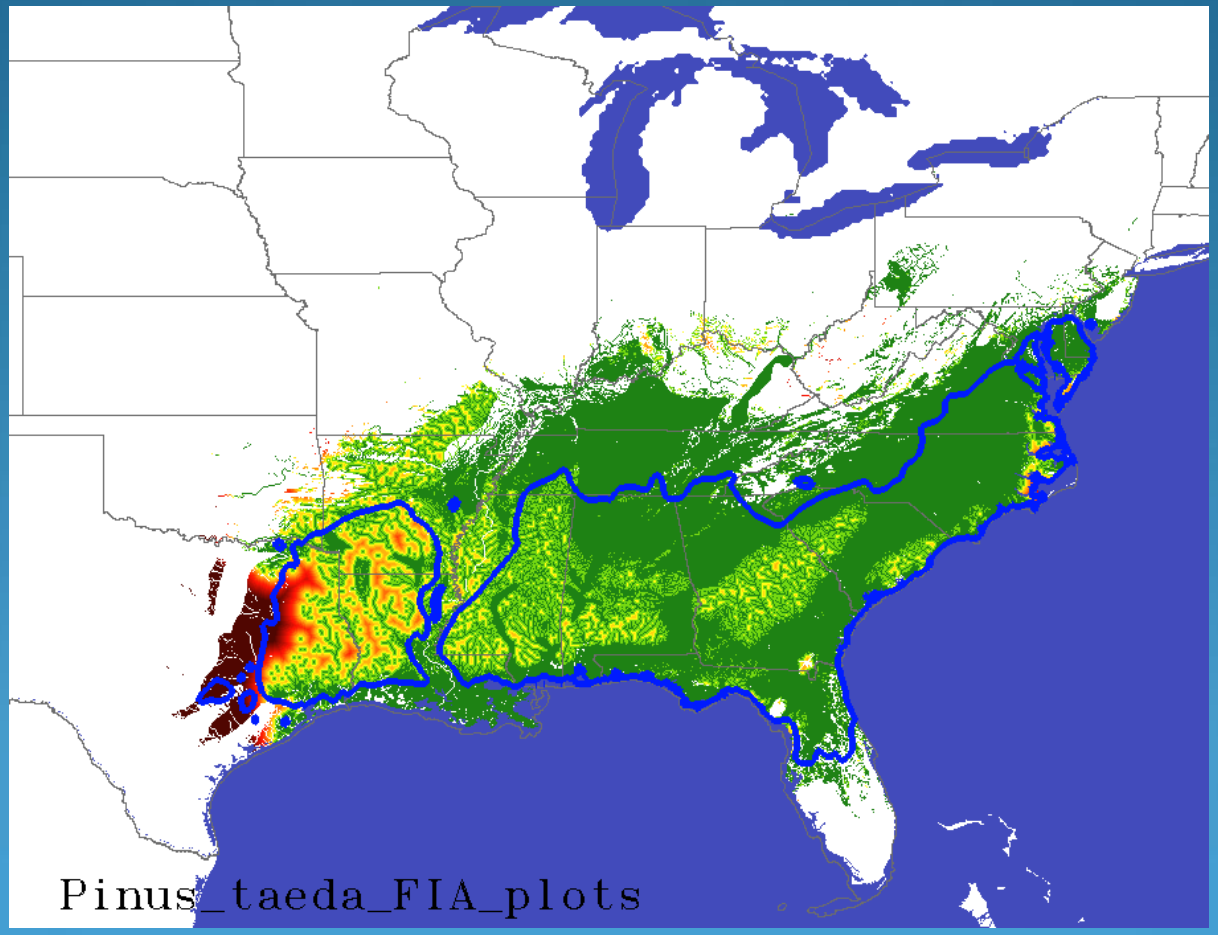
Sugar maple less abundant in eastern MD



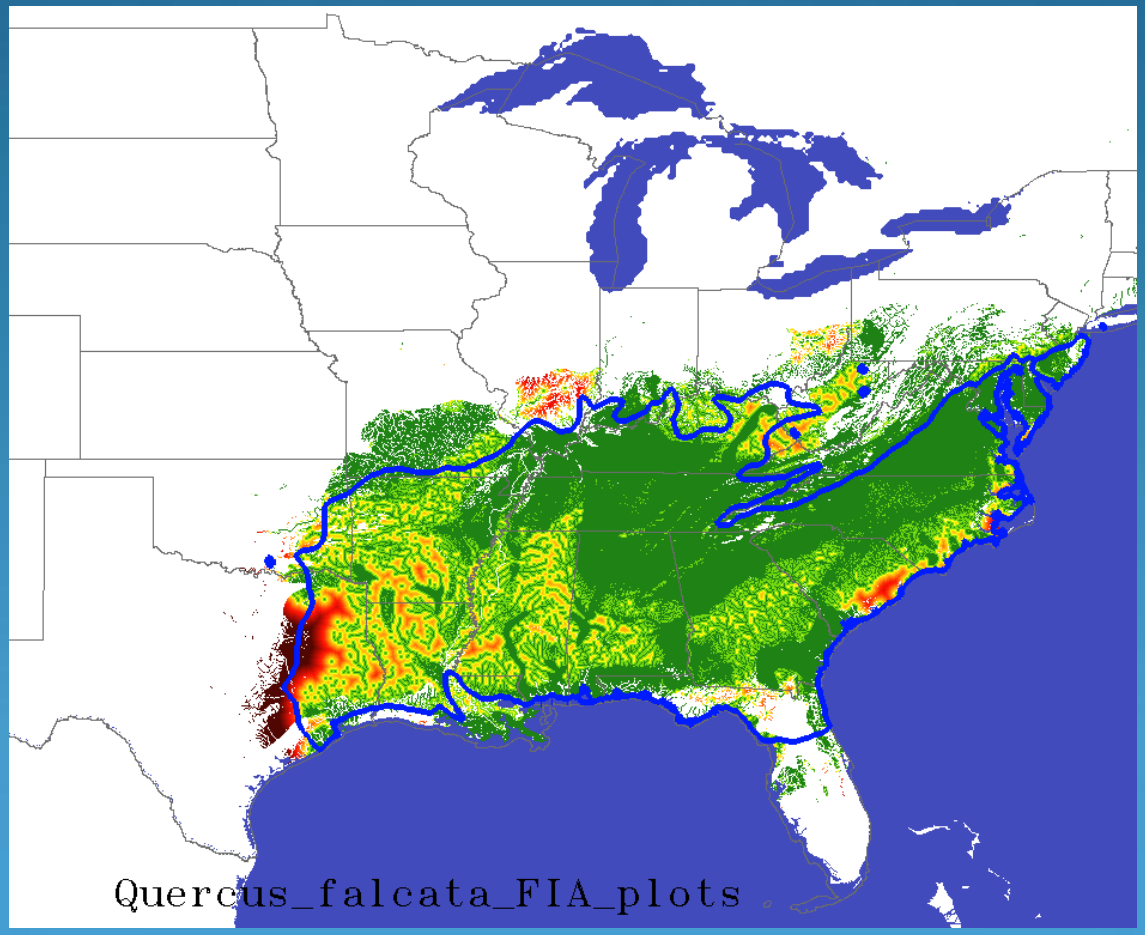
Fewer hemlock in E. MD



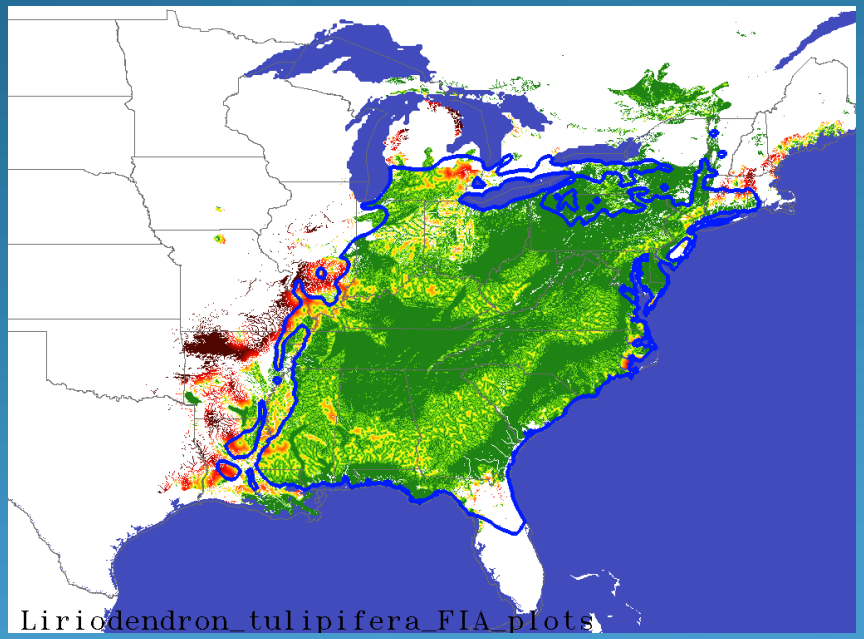
Some species expand range and importance, like loblolly pine

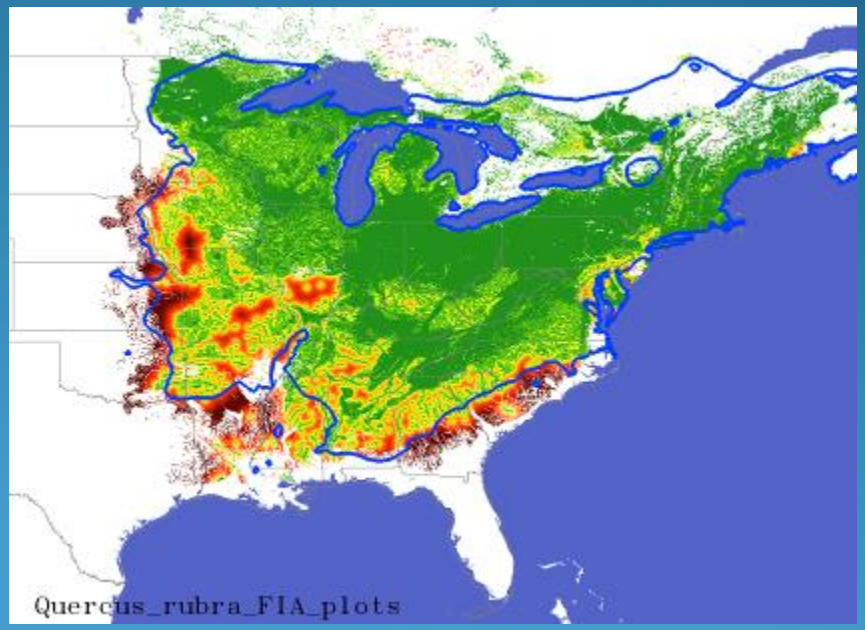


Increases in southern red oak



Some common species remain, but become less dominant- yellow-poplar, red maple, N red oak





Moderating Factors for Species Change

- Trees are long-lived, decades to centuries
- Mature trees and root systems can withstand changes where seedlings cannot
- Topographic variability will keep some areas suitable (e.g., NE aspect, cove position, seeps, higher elevation)

Watershed Forest Management

- Evaluating forest condition for watershed protection
  - *Resistant* to disturbances
    - Diverse species
    - Diverse ages
    - Complex structure
  - *Resilient* following disturbances
    - Multiple layers
    - Actively regenerating for future healthy forest

The Modern Ecological Context: Changed Disturbance Regimes

- Deer population rise
  - Problems with seedling survival
- Fire Suppression
  - Species shifts with loss of fire
- Invasive species
  - Plants
  - Pests
  - Diseases

Rapid changes in forest health

- Invasive exotic species expanding with globalization
- Several riparian species at risk from pests
  - Ash- Emerald Ash Borer
  - Hemlock- Hemlock Wooly Adelgid
  - Walnut- Thousand Cankers Disease
- Effects can be exacerbated by climate change
  - Warmer winters, greater pest survival
  - Longer growing seasons, multiple pest generations

Invasive Plants

- Pervasive presence
  - Oriental bittersweet
  - Porcelainberry
  - Japanese honeysuckle
  - Japanese stiltgrass
  - Multiflora rose
- Problematic for tree seedling survival
- Vines reaching tree canopies increase damage and death from ice and wind storms

No Regrets Climate Adaptation

- Take advantage of natural assets- native trees, wetlands, geologic diversity and work with landscape context/soils
- Leave room for the streams, buffer with native vegetation
- Design tree plantings for multiple benefits
  - Water quality, habitat, and shade for cold water streams
  - Air quality and community livability (reduce heat island)
- Conserve forests
  - Target priority forest blocks and watersheds/headwaters
  - More cost-effective to conserve than restore, and some functions are not readily replaced (e.g., rare species habitats)
- Manage for healthy forests
  - Control invasive species, esp. pests, vines
  - Encourage diversity in species, ages, structure
  - Select for regional native trees, considering site and range shifts