



Steven Kuzma

Forest Health Monitoring Program Overview



Borys M. Tkacz
National Program Manager





Forest Health Monitoring Program

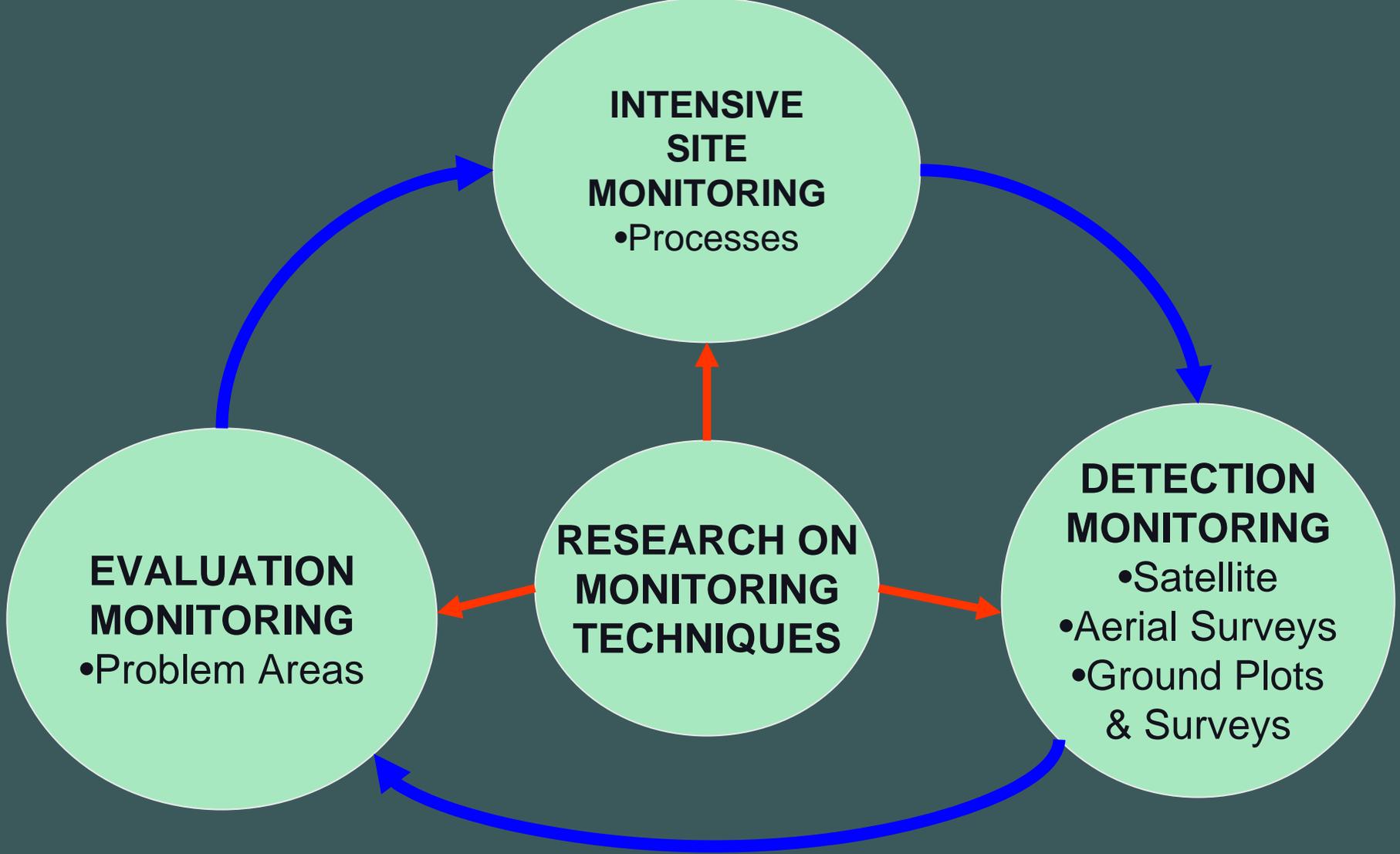
- Initiated in 1990 to provide information on the status, changes, and trends in forest health and sustainability.
- The FHM program provides information on all forested lands to land-managers and policy makers that affects, directly or indirectly, all Americans.



Forest Health Monitoring(FHM)

Objectives:

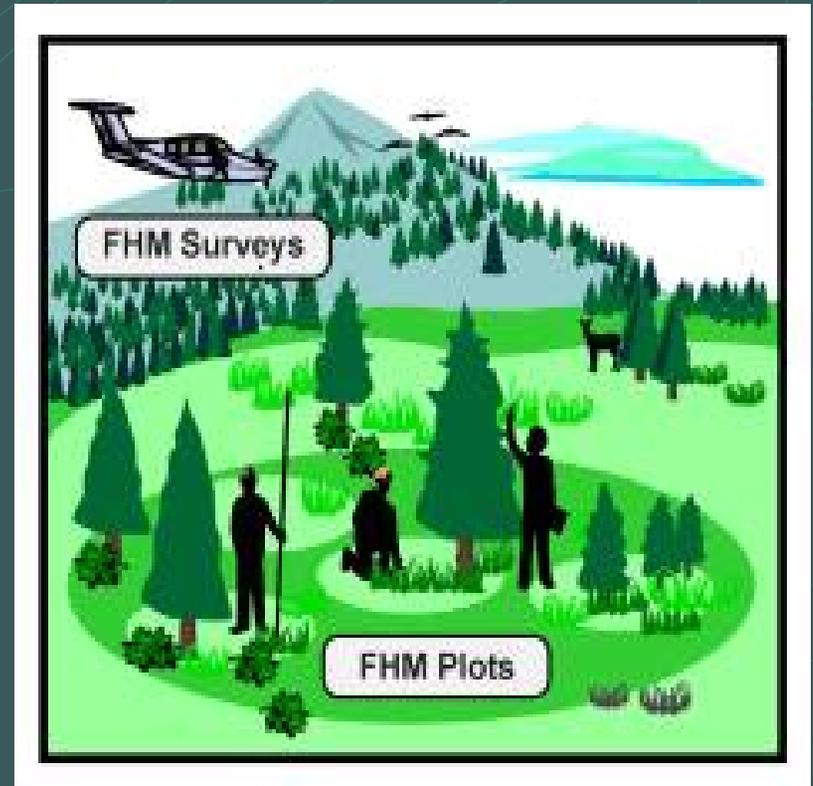
- Establish a monitoring system throughout the forests of the United States to determine detrimental changes or improvements that occur over time.
- Provide baseline and health trend information that is statistically precise and accurate.
- Report annually on status and changes to forest health.



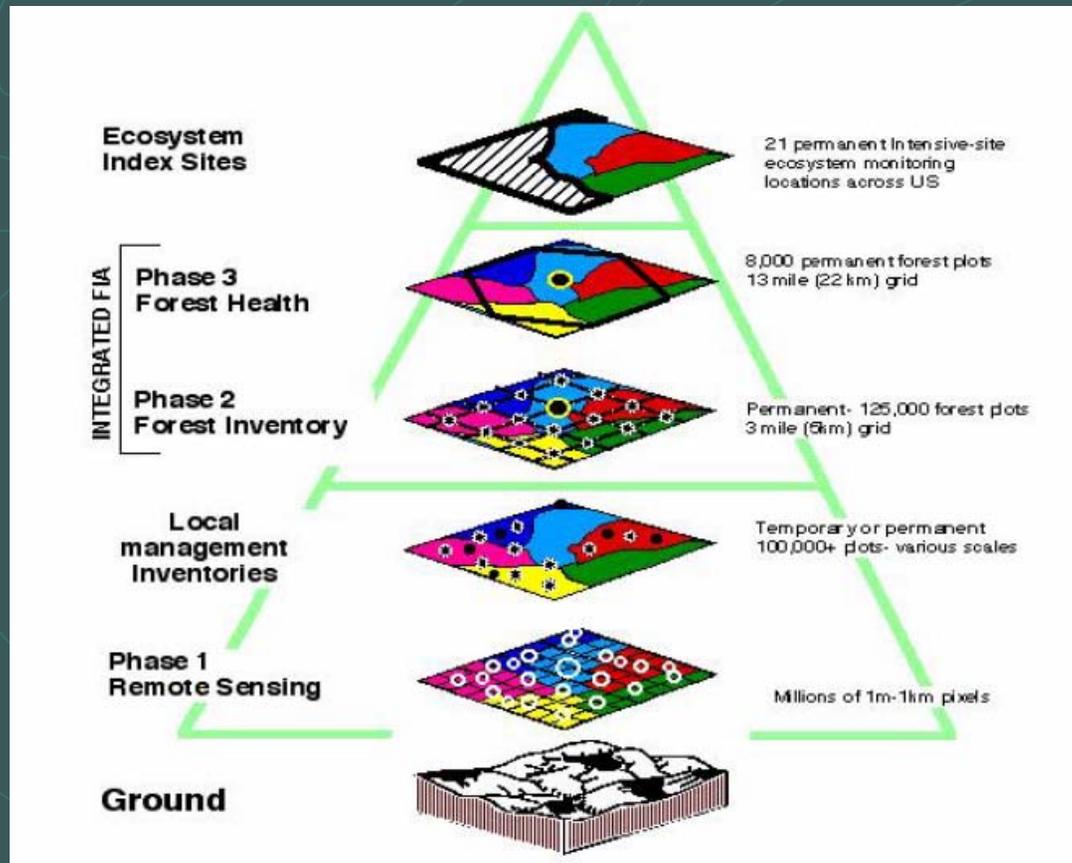
Forest Health Monitoring Program

Detection Monitoring

- Nationwide grid of permanent sample points
 - Integrated w/ FIA since 1999
- Aerial damage detection surveys
- Special ground surveys



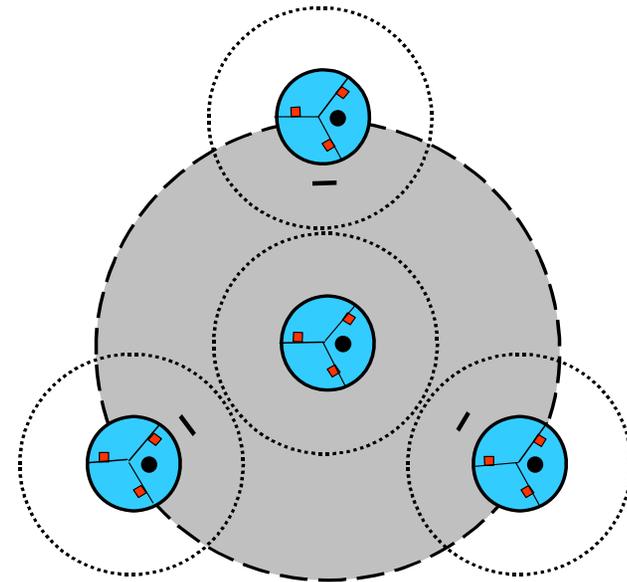
Integrated Monitoring Framework



FHM/FIA Plot Integration

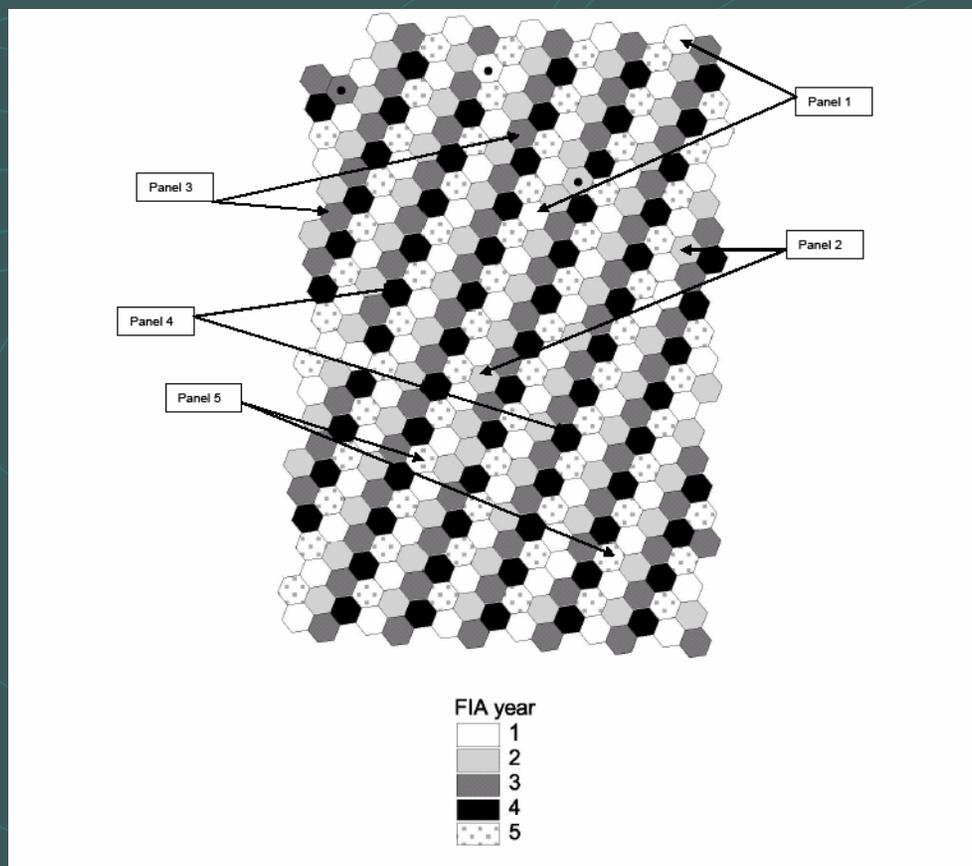
- Since 1999 FHM ground plots have been integrated with Forest Inventory and Analysis (FIA) plots
- Phase 2 – Tree Measurements (~125,000 plots, each representing ~6,000 ac.)
- Phase 3 – Health Indicators (~8,000 plots, each representing ~96,000 ac.)
- Each plot measured once every 5 to 10 years

Phase 2/Phase 3 Plot Design



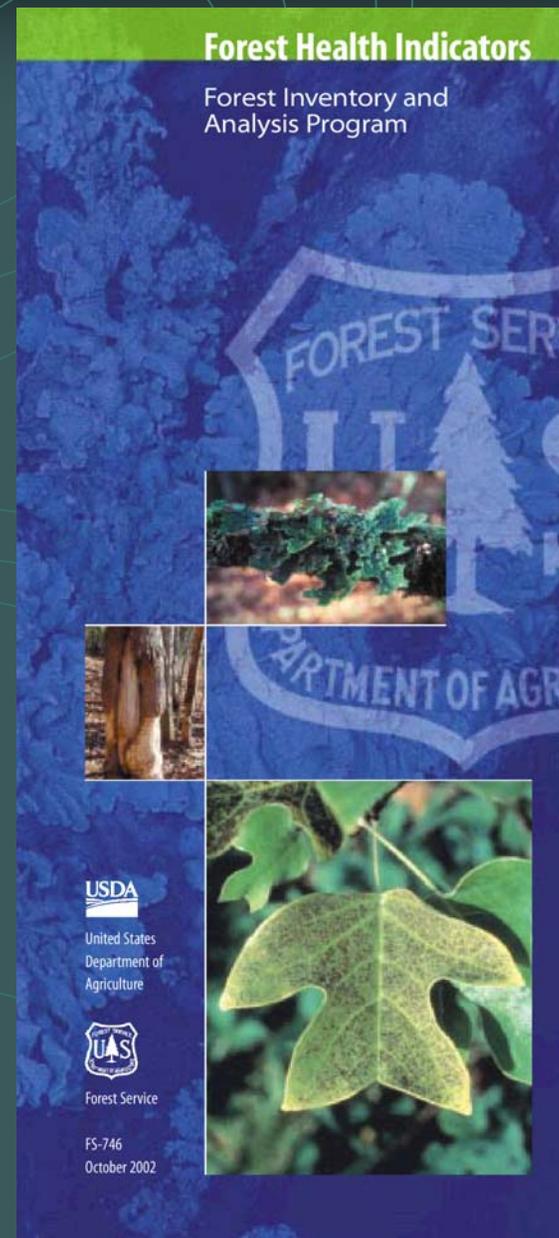
| | |
|---------------------|---------------------------|
| ● Subplot | 24.0 ft (7.32 m) radius |
| ● Microplot | 6.8 ft (2.07 m) radius |
| ○ Annular plot | 58.9 ft (17.95 m) radius |
| ● Lichens plot | 120.0 ft (36.60 m) radius |
| ■ Vegetation plot | 1.0 m ² area |
| — Soil Sampling | (point sample) |
| — Down Woody Debris | 24 ft (7.32 m) transects |

Rotating Panel Design



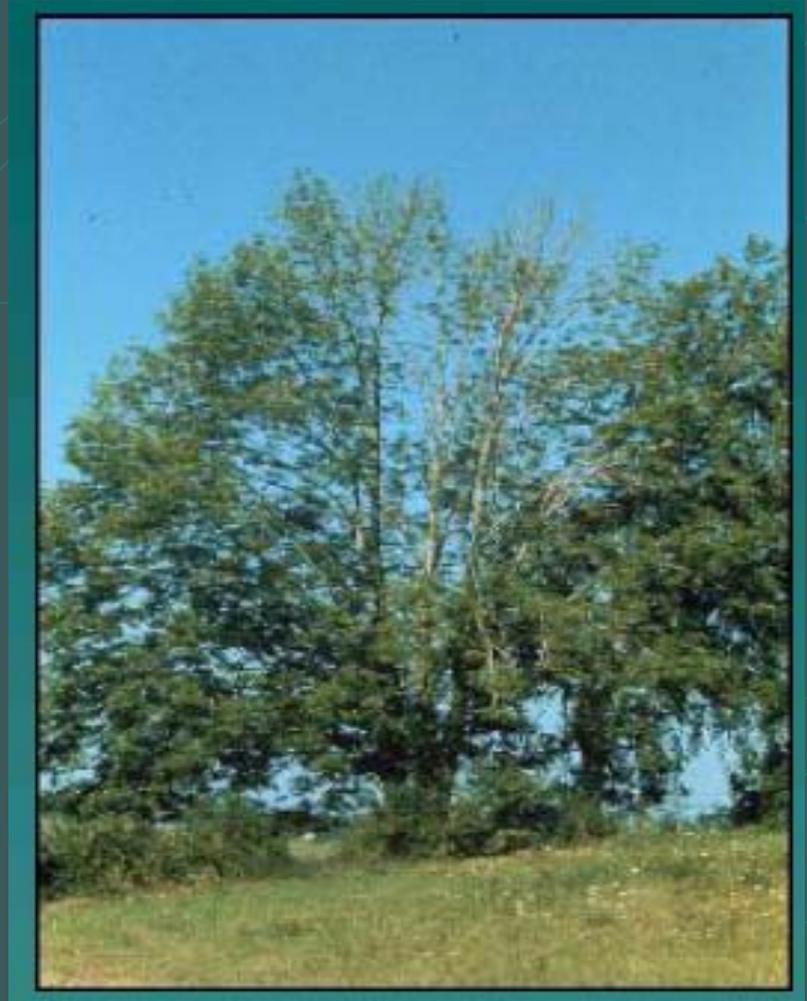
Forest Health Indicators

- Tree Growth
- Tree Regeneration
- Tree Crown Condition
- Tree Damage
- Tree Mortality
- Lichen Communities
- Ozone Bioindicator Plants
- Soil Morphology and Chemistry
- Vegetation Structure
- Plant Diversity



Crown Condition

- Live crown ratio
- Density
- Foliage transparency
- Dieback
- Diameter



Lichen Communities

- Fungi that live in association with algae
- Sensitive to environmental stresses such as air pollution or climate change
- Indicators of forest biodiversity
- Biotic indexes are developed based on pollution and climate gradients



Photo by Stephen Sharnoff

Ozone Injury

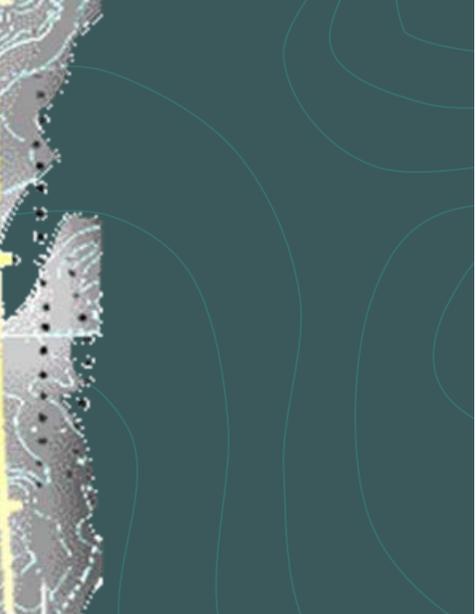
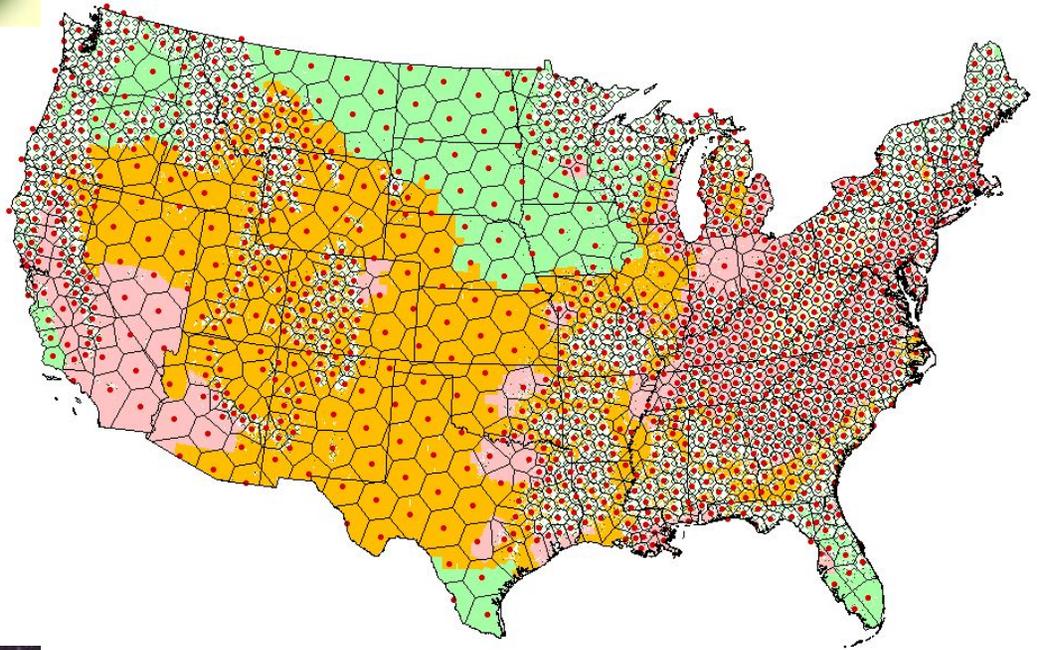
- Ozone causes direct foliar injury to many species
- Bio-indicator plants are evaluated for severity of foliar injury
- Sampled on separate plots



Photo by Gretchen Smith

Ozone

Biomonitoring



Down Woody Material

- Measurement of fallen trees, dead branches along transects
 - Diameter
 - Length
 - Stage of decay
 - Species
 - Cavities
- Assess fire risk, wildlife habitat, carbon



Photo by Chris Woodall

Vegetation Diversity and Structure

- Type, abundance, and arrangement of plants on plots
- Allows reporting on diversity of native and introduced species
- Monitoring for change over time will be possible by re-measurement



Photo by Will McWilliams

Soil Condition

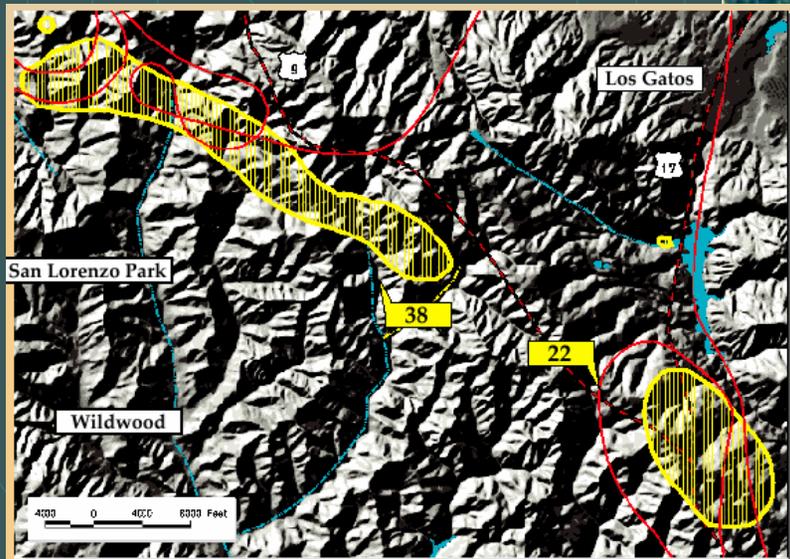
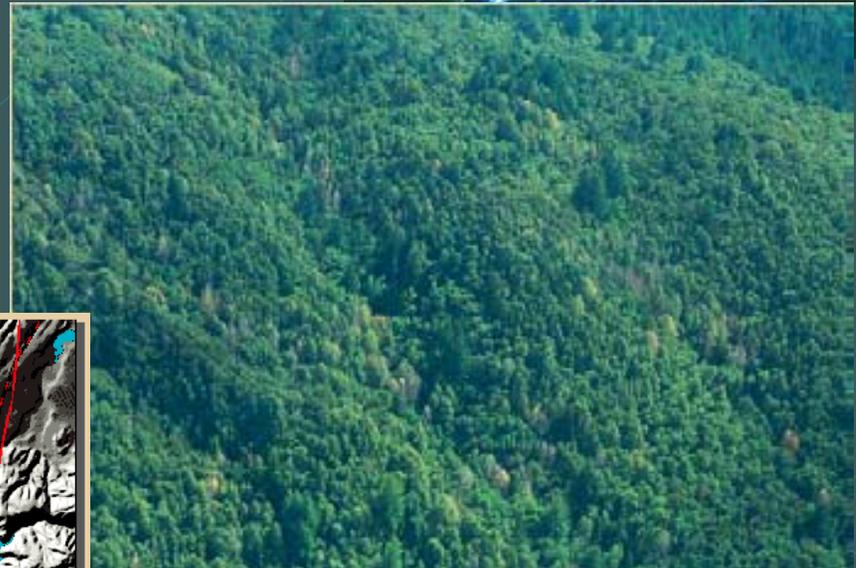
- Measurement of soil physical properties, compaction, erosion potential
- Soil samples collected for chemical analyses
 - Acidity
 - Exchangeable cations
 - Nitrogen and carbon
 - Toxics
 - Bulk density

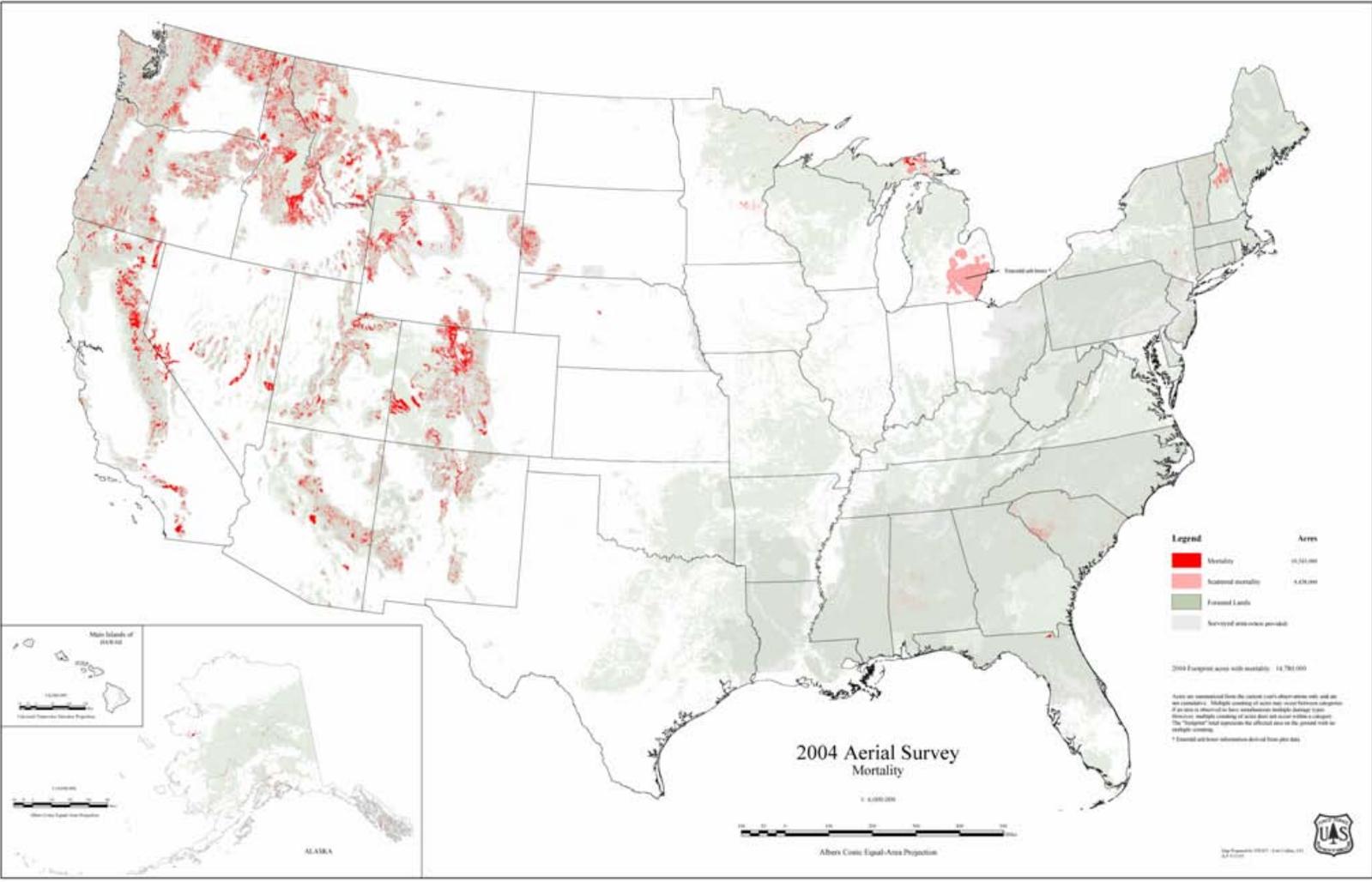


Detection Monitoring

Aerial Detection Surveys

- Observers in aircraft at 1,000 to 2,000 ft. elevation
- Create maps visible damage





Special Detection Surveys

Pine mortality in the Southwest



Piñon pine in New Mexico - 2003

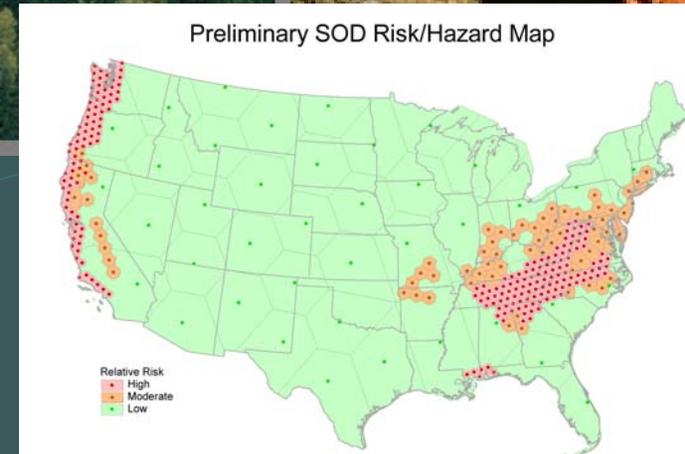


Ponderosa pine in Arizona - 2003

Special aerial and ground surveys conducted in 2003 covering 15 million acres in AZ, NM, CO, UT, NV

Sudden Oak Death Detection and Monitoring

- Objectives:
 - Multi-scale approach to distribution, incidence, and impact of SOD in CA
 - Detection, effectiveness of eradication in OR
 - Detection outside infested areas in CA and OR



Maps and photos
Courtesy R5, ODF, SRS

Evaluation Monitoring

- Determine the extent, severity, and causes of undesirable forest health changes.
- Address likely cause-and-effect relationships, identify associations between forest health and forest stress indicators.
- Identify management consequences and alternatives for reducing the effects of forest stress.
- Identify research needs.



Research on Monitoring Techniques

- Urban Monitoring – design sampling strategies for urban forests and street trees
- Riparian Monitoring – design sampling strategies for riparian forests



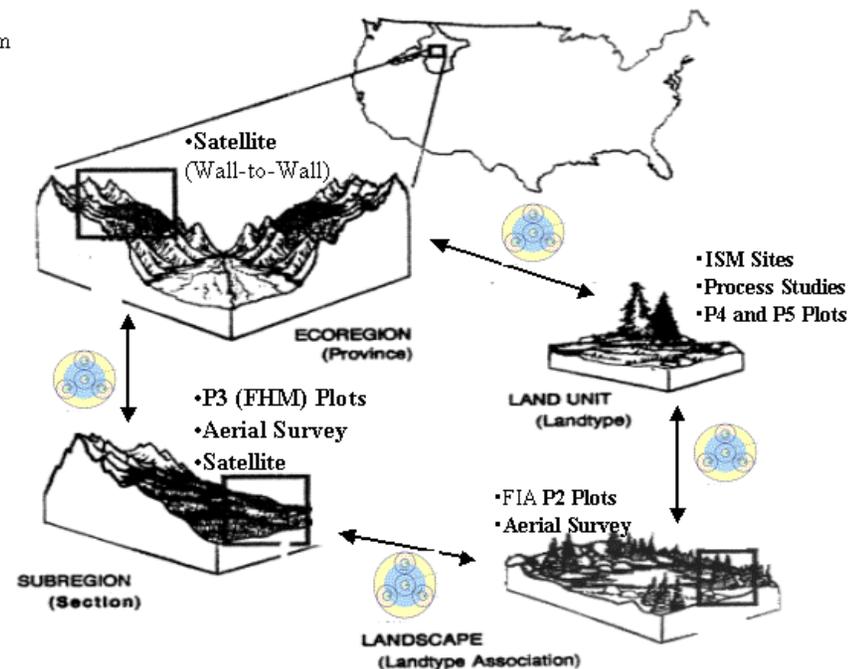
Intensive Site Monitoring

– Linking Multiple Scales

- In depth monitoring of indicators to determine detailed information on key components and processes of selected forest ecosystems



Monitoring Forest Ecosystems at Multiple-Spatial Scales

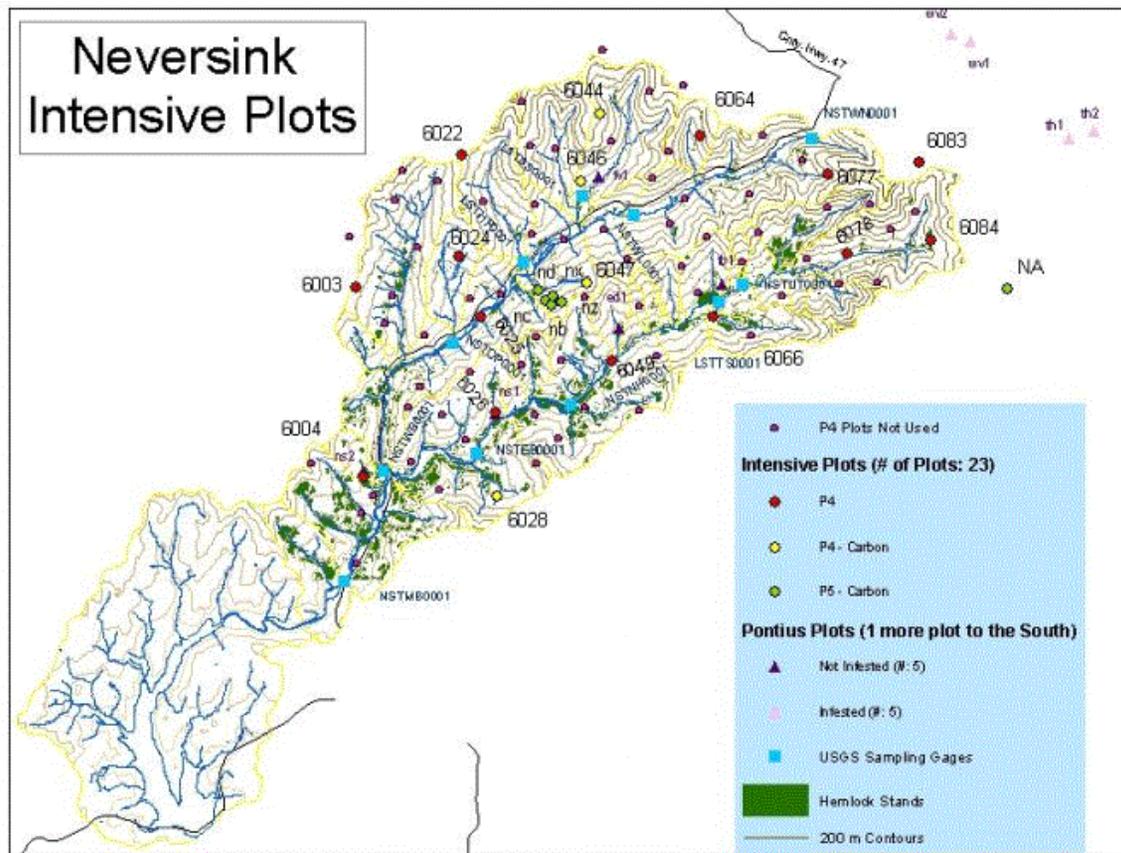


Delaware River Basin

Collaborative Environmental Monitoring & Research Initiative

CEMRI

- Water quality
- Total Carbon
- Calcium Depletion
- Invasive Species



Reporting Highlights

National Reports

- FHM National Technical Reports
- 2003 Sustainability Report – Montreal Process Criteria and Indicators for Sustainable Forests
- Heinz Center – The State of the Nation's Ecosystems
- EPA – US/Canada Air Quality Agreement Progress Reports

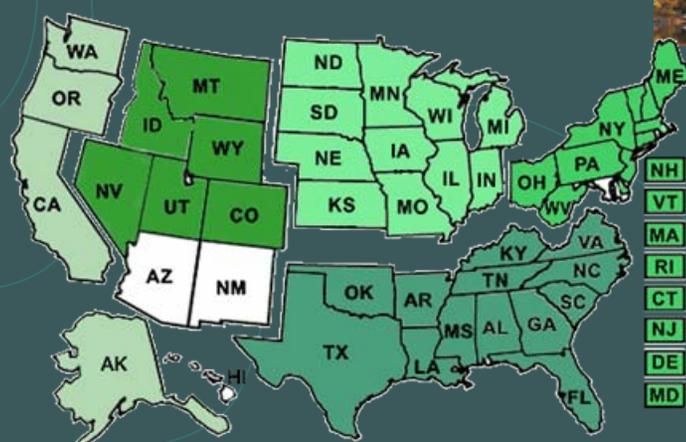
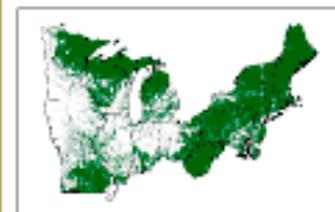
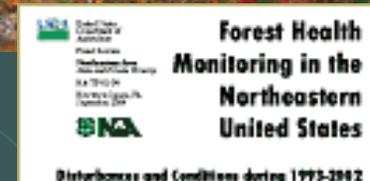
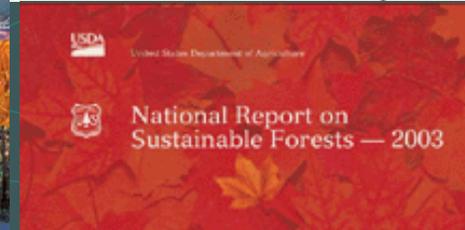
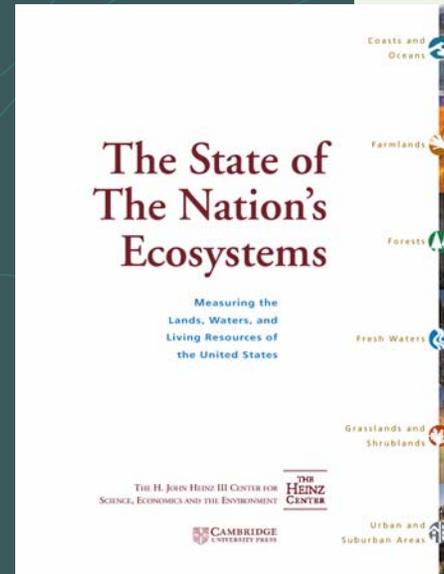
Regional Reports

- Northeast Forest Stressor Report
- Aspen Forest Cover Change in Rockies

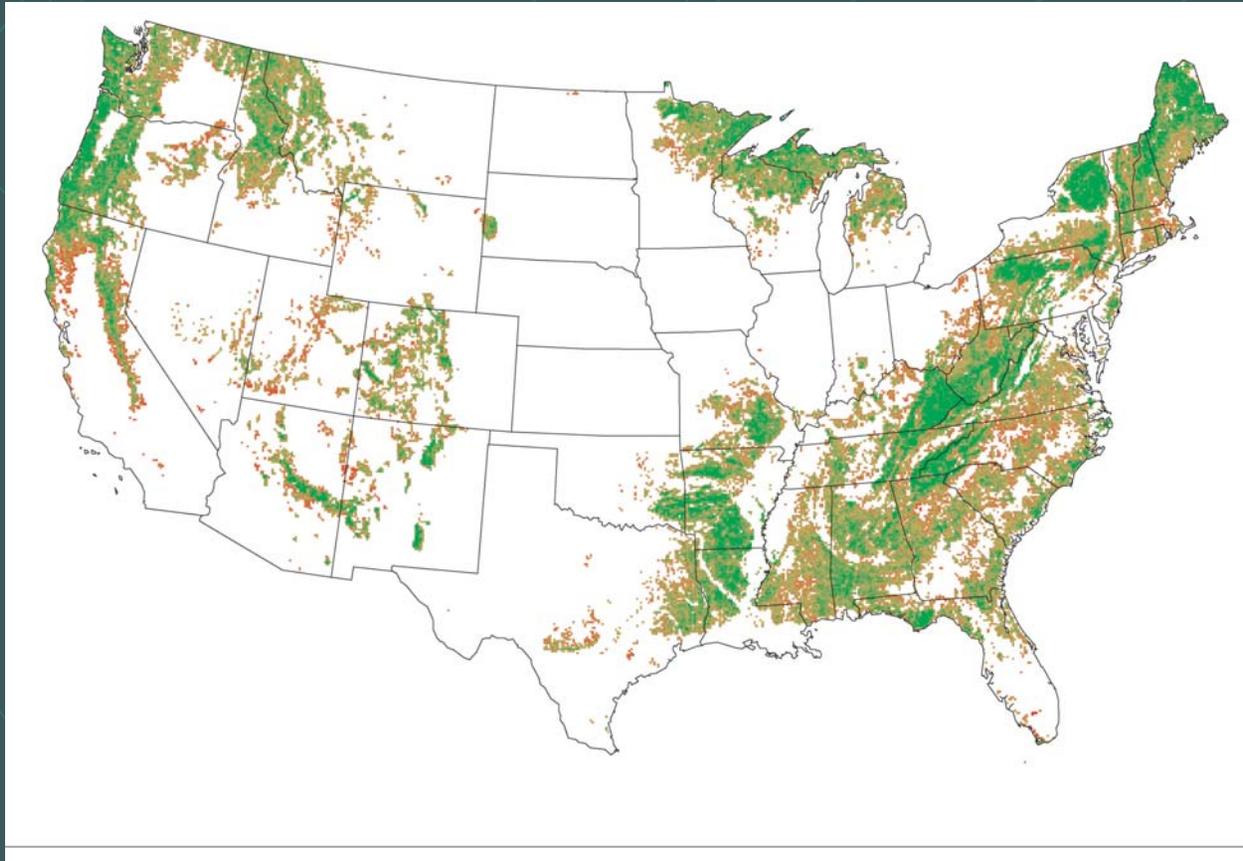
State Reports

- Utah Baseline Report
- Forest Health Highlights

<http://fhm.fs.fed.us>



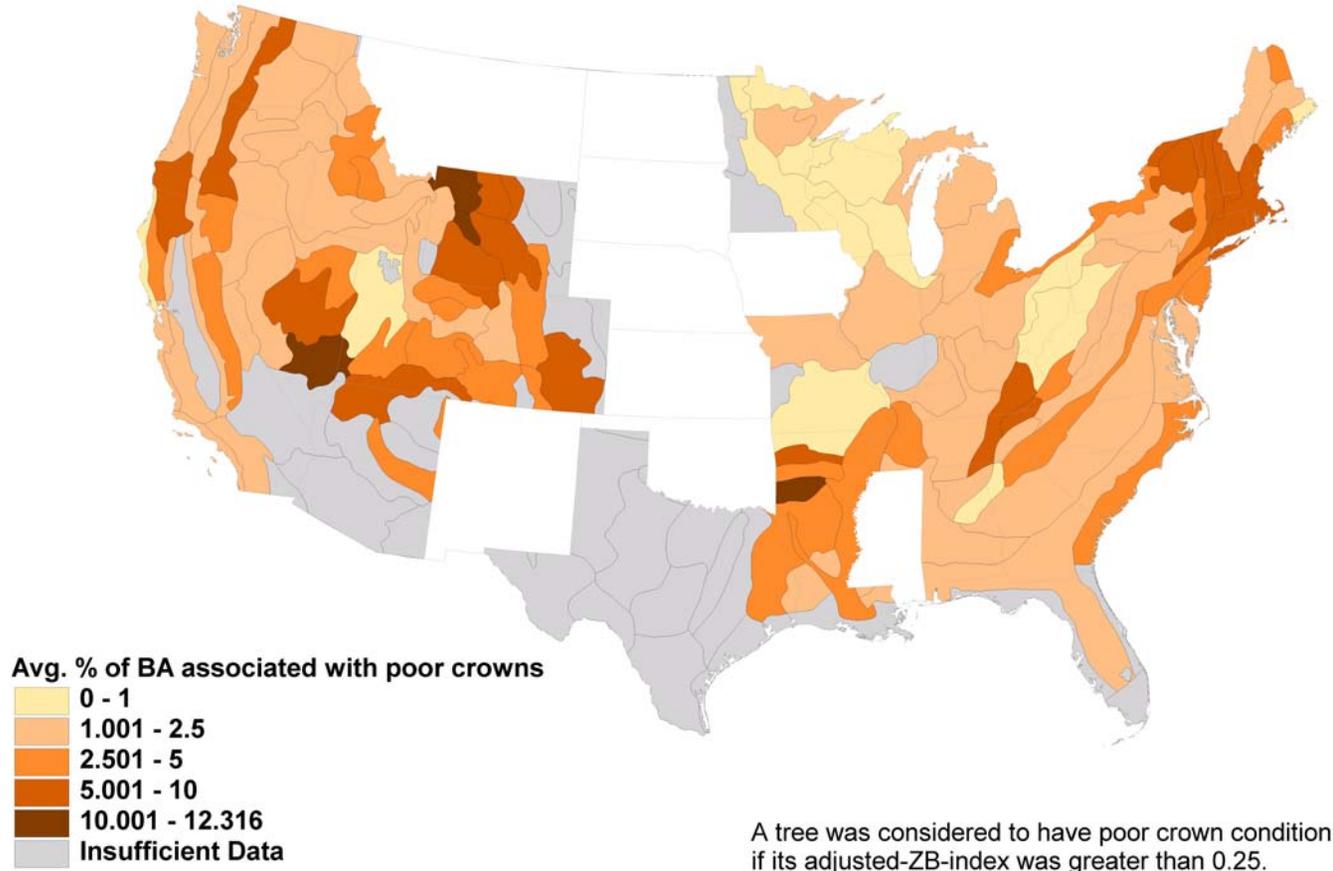
Fragmentation



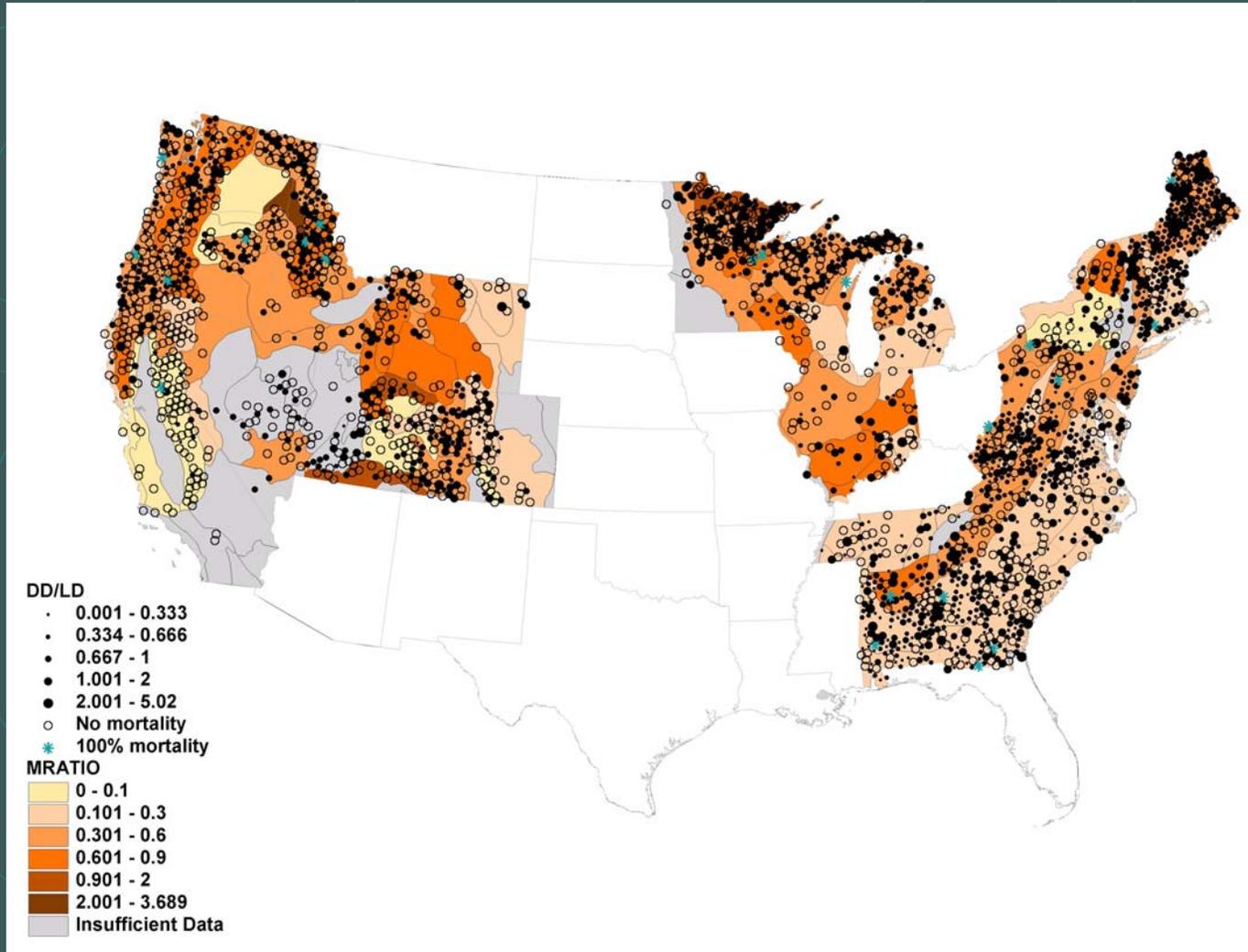
This map shows the relative amount of “interior” forest at 7-ha scale shaded from low (red) to high (green) for areas containing >60% forest overall.

Crown Condition

Crowns: 1999-2002

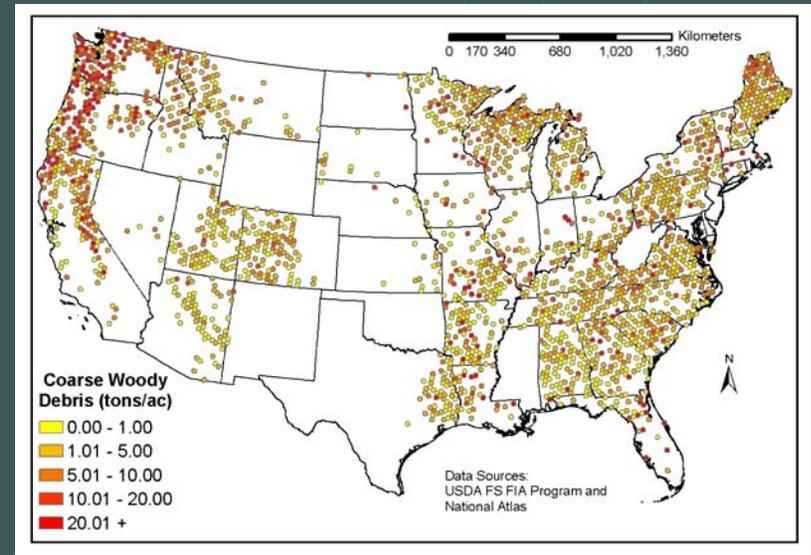
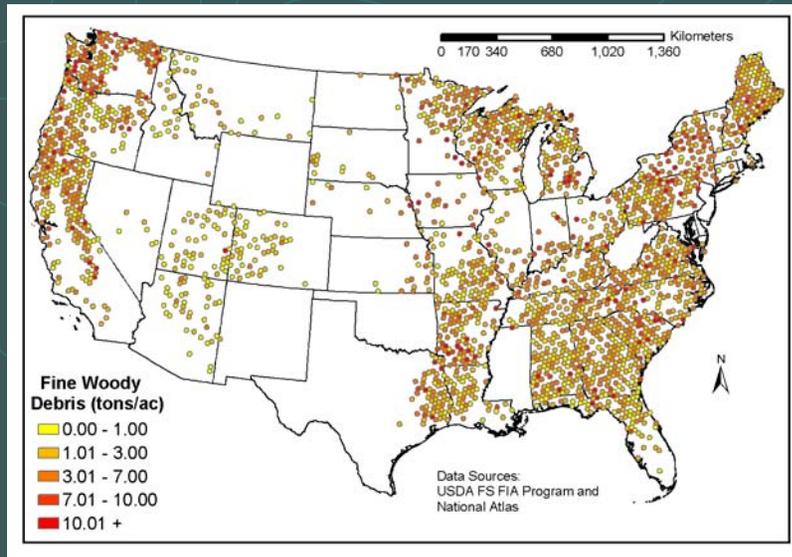


Mortality

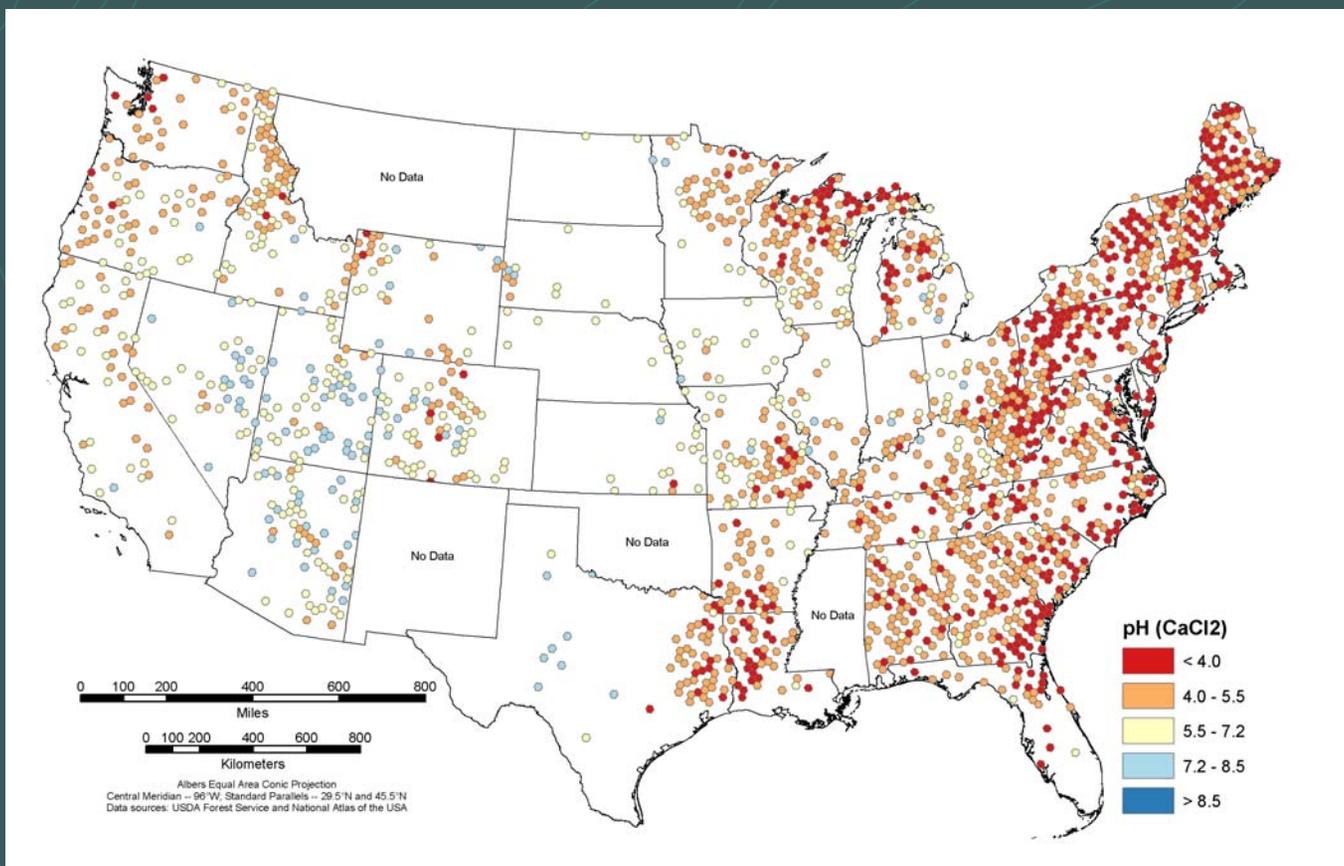


Tree mortality expressed as the ratio of annual mortality volume to annual gross growth volume (colored polygons).

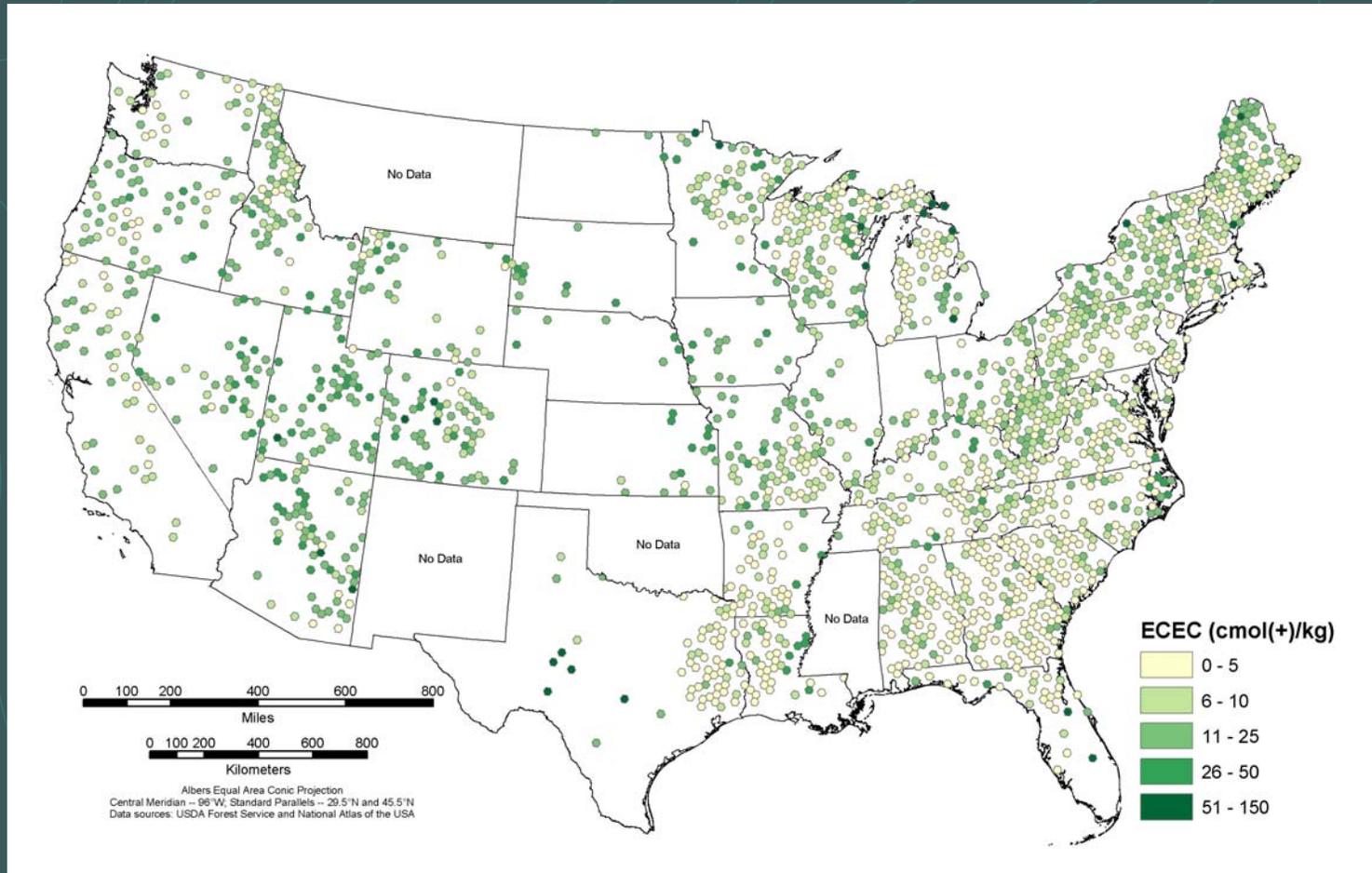
Down Woody Material



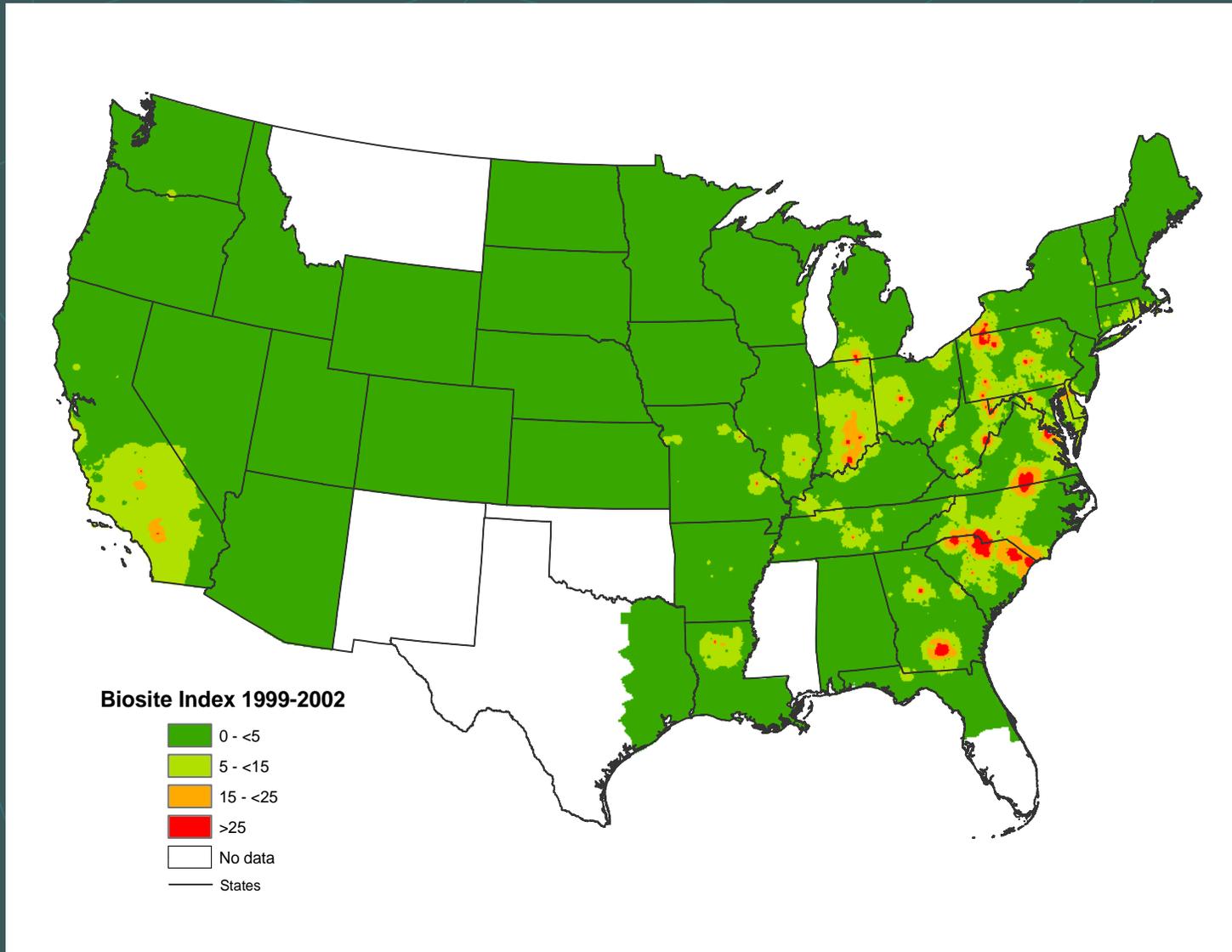
National map of observations of soil pH in the top 10 cm of soil (2001-2003)



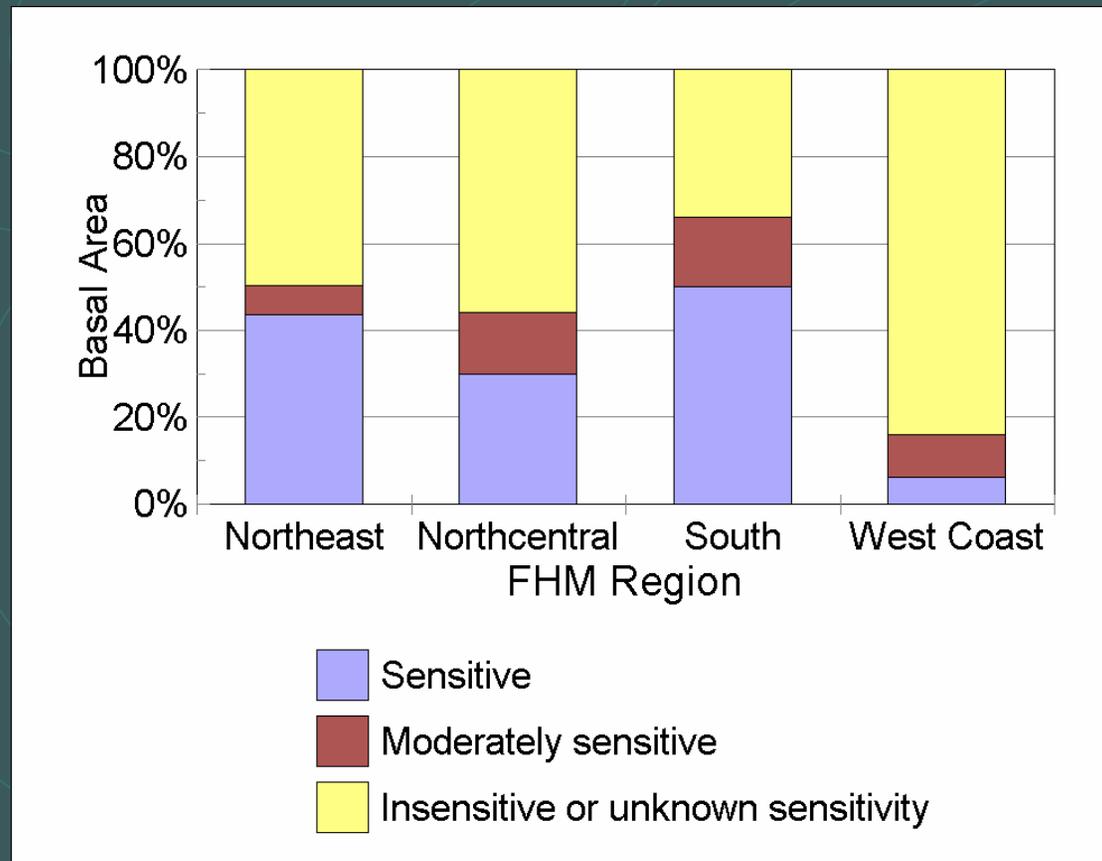
National map of effective cation exchange capacity in the top 10 cm of soil (2001-2003)



Interpolated ozone biosite index value (1999-2002).



Sensitivity of tree species in the high and moderate ozone risk areas of the conterminous United States



Future Challenges



- Stress key strengths of FHM
 - Partnership-based
 - Innovative
 - Comprehensive
 - Science-based
- Be “Real Time”
 - Timely detection, analysis, and reporting of adverse changes in forest health to facilitate effective management response
- Look Beyond the Grid
 - Look back – analyze trends, integrate diverse data sources
 - Look forward – forecast future conditions, analyze risks
 - Design new approaches for detection of invasives