

The Hunt for *Phytophthora ramorum* in the Eastern U.S.



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Eastern SOD Survey Efforts

- **APHIS Cooperative Pilot Survey of Nurseries**
 - VA, NC, TN, SC, GA
 - University Ornamental Pathologists & PCR Experts
- **“Other” Nursery Surveys**
- **USFS Cooperative Pilot Survey of Forests**
 - VA, NC, TN, SC, GA **Plus PA, WV**
 - Forested nursery perimeters
 - General forest areas
 - Field Survey by State Forestry Agencies
 - Diagnostics by University Ornamental Pathologists

2004- *Phytophthora* microflora in Eastern forests

Forest Survey Cooperators

- **PA- Tom Hall**
- **WV- Jill Hoff, Matt Taylor**
- **VA- Tim Tigner**
 - **VPI- Chuan Hong**
- **NC- Don Rogers, Brian Heath, David Grooms, Rob Trickel, Laura Lazarus**
 - **NCSU- Mike Benson, Colleen Warfield**
- **TN- Bruce Kauffman**
 - **UT- Alan Windham, Kurt Lamour**
- **SC- Andy Boone, Mike Remion**
 - **Clemson- Steve Jeffers**
- **GA- Terry Price, Jean Woodward**

Susan Diehl & Tom McElroy, Mississippi State University

West Coast Hosts of *P. ramorum*

- Coast Live Oak (*Quercus agrifolia*)
- Tanoak (*Lithocarpus densiflorus*)
- Black Oak (*Quercus kelloggii*)
- Shreve's Oak (*Quercus parvula* var. *shrevei*)
- Rhododendron (*Rhododendron* spp.)- including azaleas (USDA)
- Coast Redwood (*Sequoia sempervirens*)
- Douglas-fir (*Pseudotsuga menziesii*)
- Huckleberry (*Vaccinium ovatum*)
- Madrone (*Arbutus menziesii*)
- Manzanita (*Arctostaphylos manzanita*)
- Toyon (*Heteromeles arbutifolia*)
- California Bay Laurel (*Umbellularia californica*)
- Big Leaf Maple (*Acer macrophyllum*)
- California Buckeye (*Aesculus californica*)
- California Coffeeberry (*Rhamnus californica*)
- California Honeysuckle (*Lonicera hispidula*)



European Hosts for *P. ramorum*

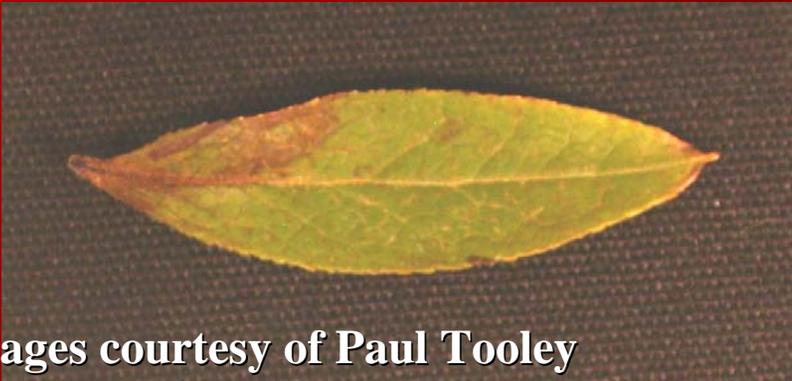
- Rhododendron
- Mountain laurel
- Viburnum
- Other nursery plants
- ***NO OAKS (or other trees) until fall 2003***
 - *southern red oak*
 - *northern red oak*
 - *holm oak*
 - *beech*
 - *horsechestnut*



Images courtesy of
DEFRA, UK

Putative Hosts for *P. ramorum*- Eastern U.S.

- *Inoculated*
- Oak species
- Rhododendron
- Mountain laurel
- Vaccinium



Pilot Survey for *Phytophthora ramorum* Diseases in the Eastern U.S.

- **Risk-Based**



Image courtesy
of Bob Anderson

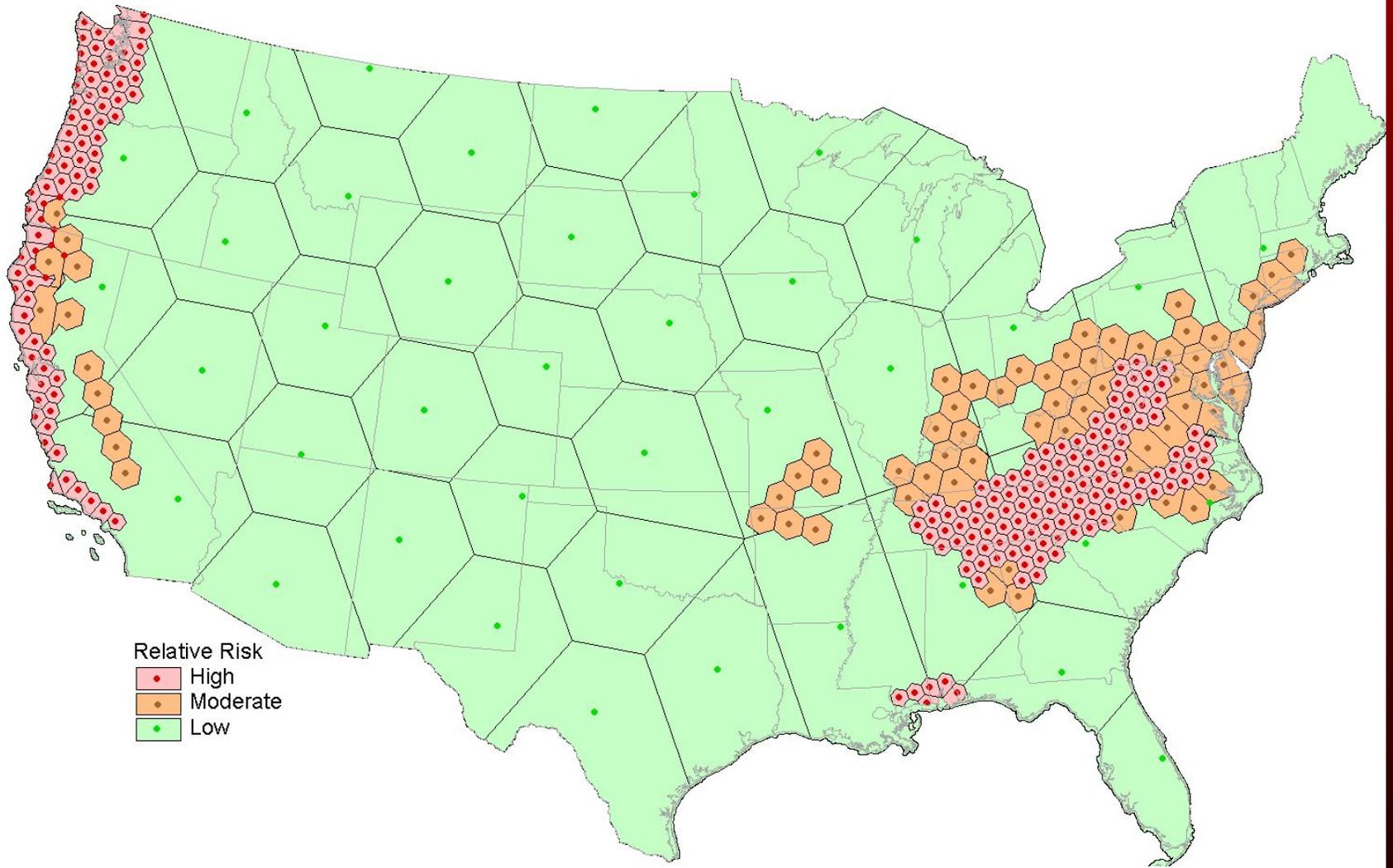
Components of *P. ramorum* Disease Risk Map

- **Favorable environment**
 - Presumed temperature and moisture optima
 - Presumed temperature and moisture limits
- **Host presence**
 - **Overstory**
 - Oak (esp. red oak group)
 - **Understory**
 - Rhododendron
 - Mountain laurel
- **Proximity to rhododendron nurseries**



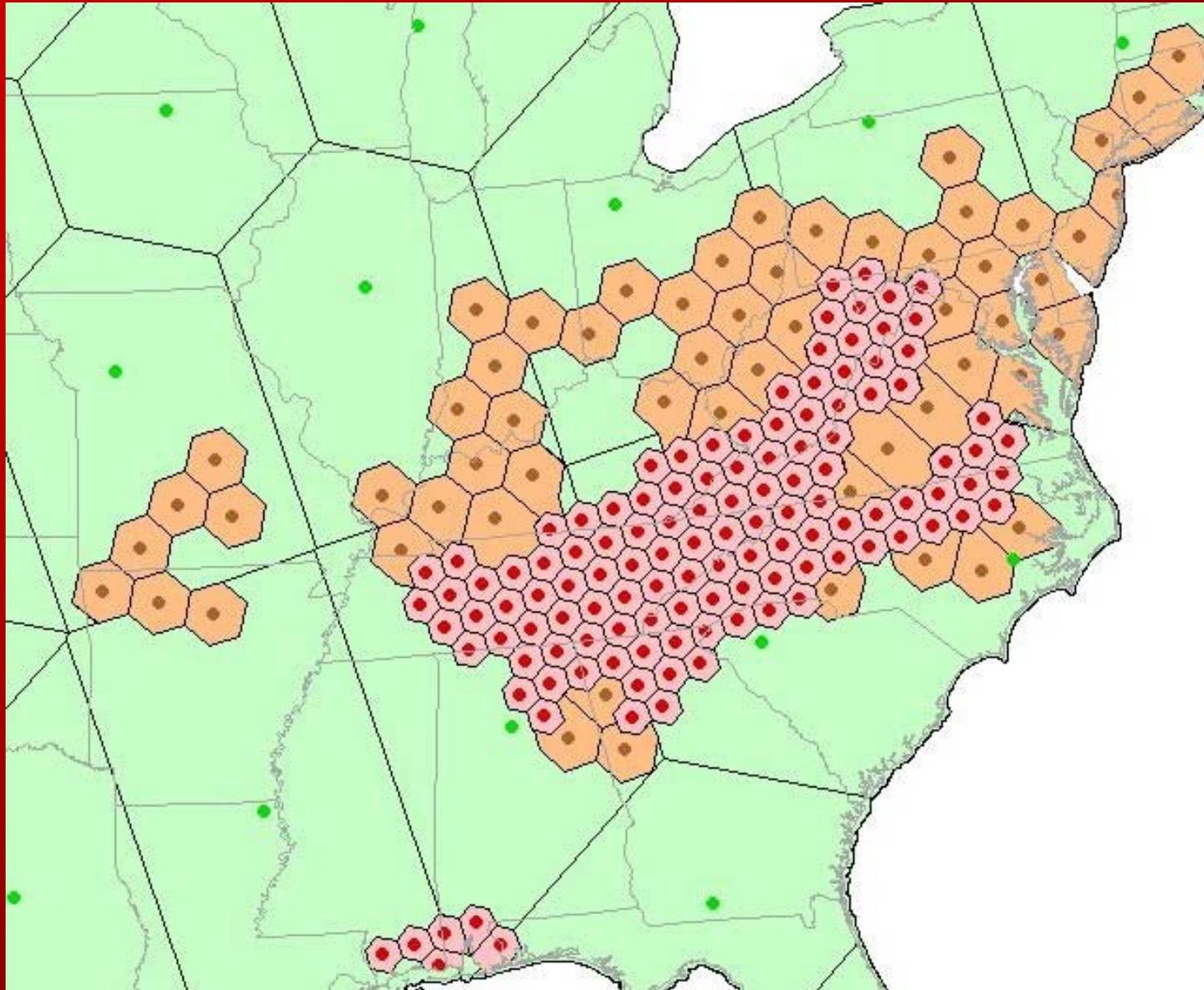
Image courtesy of Steve Jeffers

Preliminary SOD Risk/Hazard Map

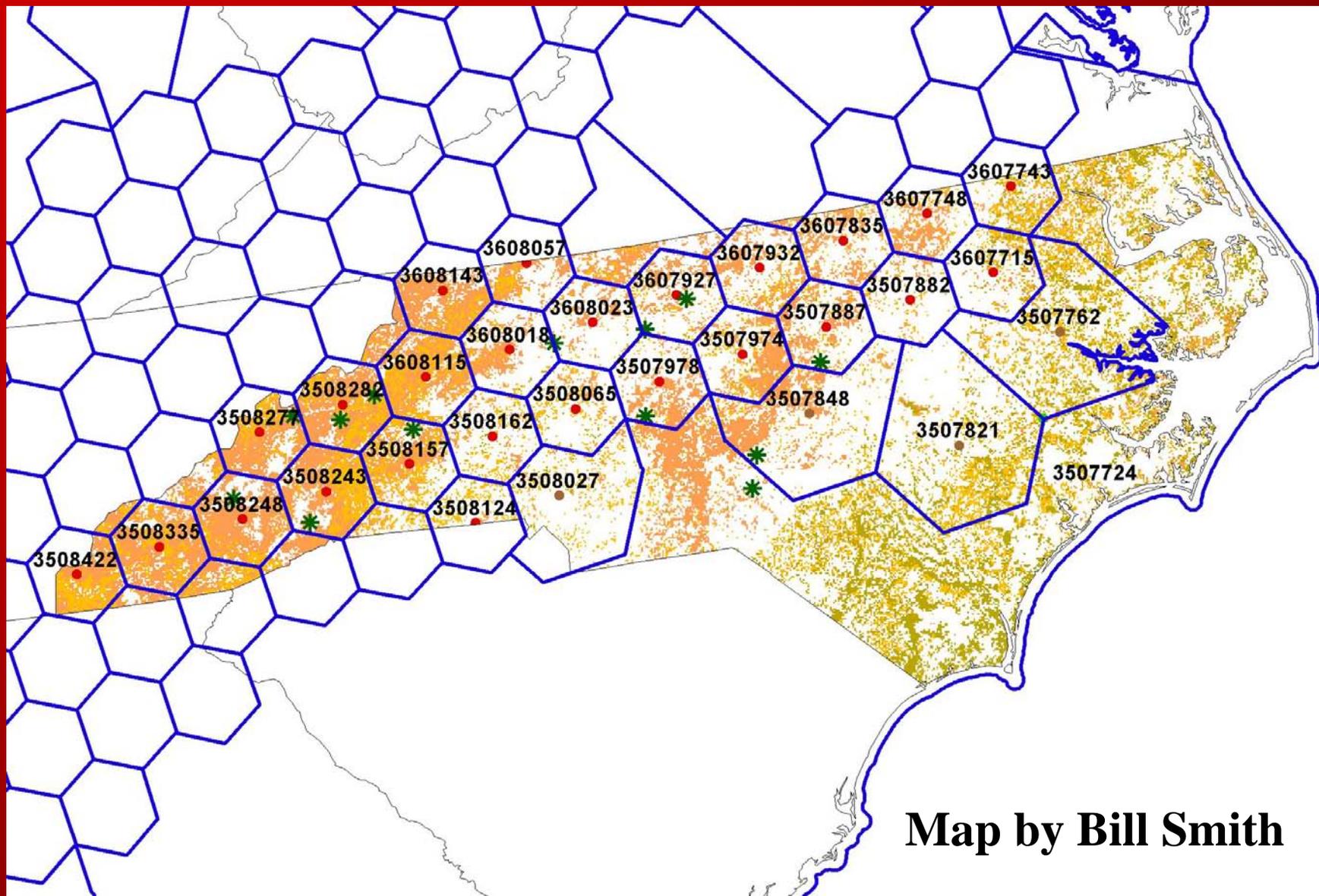


Map by Bill Smith

P. ramorum Disease Risk in the Eastern U.S.



SOD Forest Survey- NC Hex Numbers



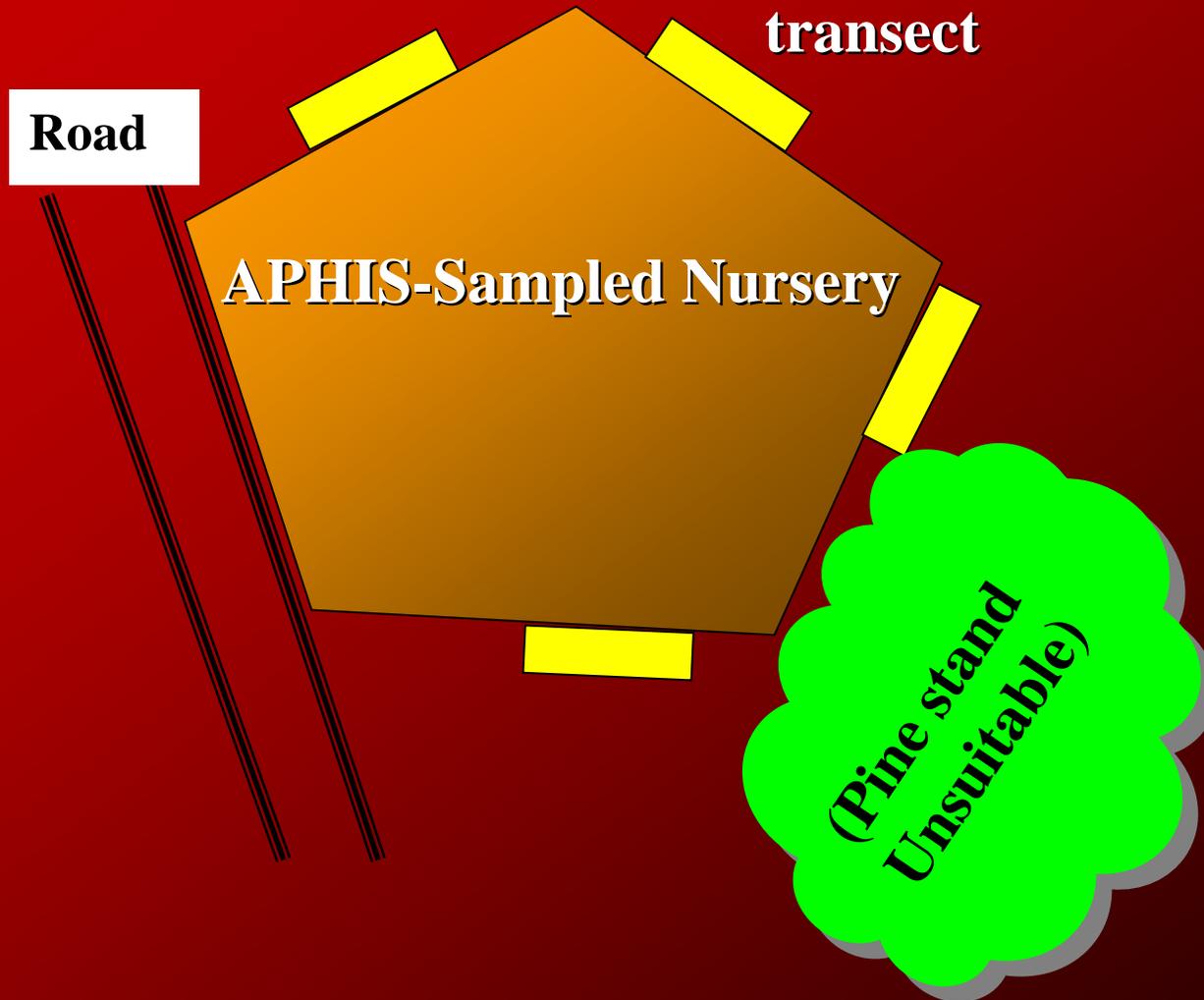
Map by Bill Smith

Pilot Surveys for *Phytophthora ramorum* Diseases in the Eastern U.S.

- Risk-Based
- Nurseries
 - APHIS funded
- Forest Environments
 - USFS funded
 - Nursery perimeter
 - General forest areas



Nursery Perimeter Survey



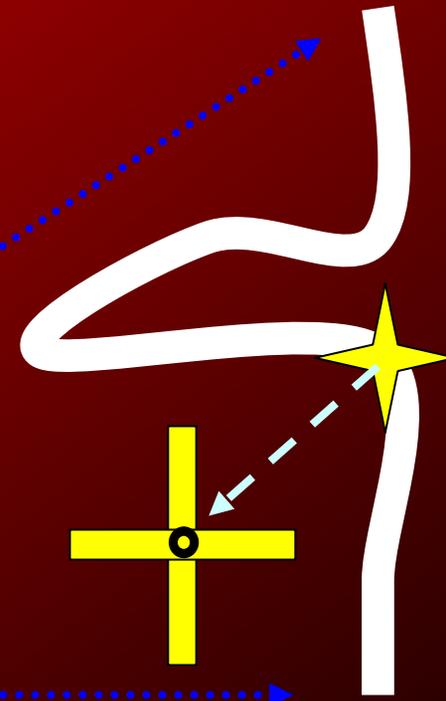
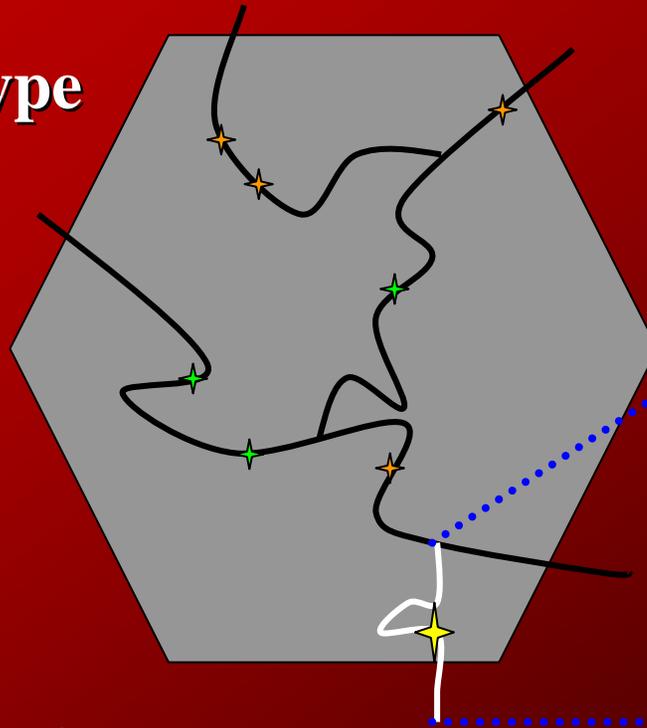
General Forest Area Survey

1. Intersect forest type with road network

2. Randomly select suitable locations

3. Scout and select

4. Four 100m transects



Ramorum Dieback & Leaf Blight



Images courtesy of Ellen Goheen

Symptom Profile- The perfect world



Image courtesy of Mike Benson

Potentially Confusing Conditions

**Leaf
Disease**



Borers

Bleeding Stem Canker (Oaks and Tanoak)



Bleeding Stem Canker



Dark colored bark
canker with black
zone line

Potentially Confusing Conditions

Cankers



Borers

Molecular Diagnostics with Isolation to Confirm

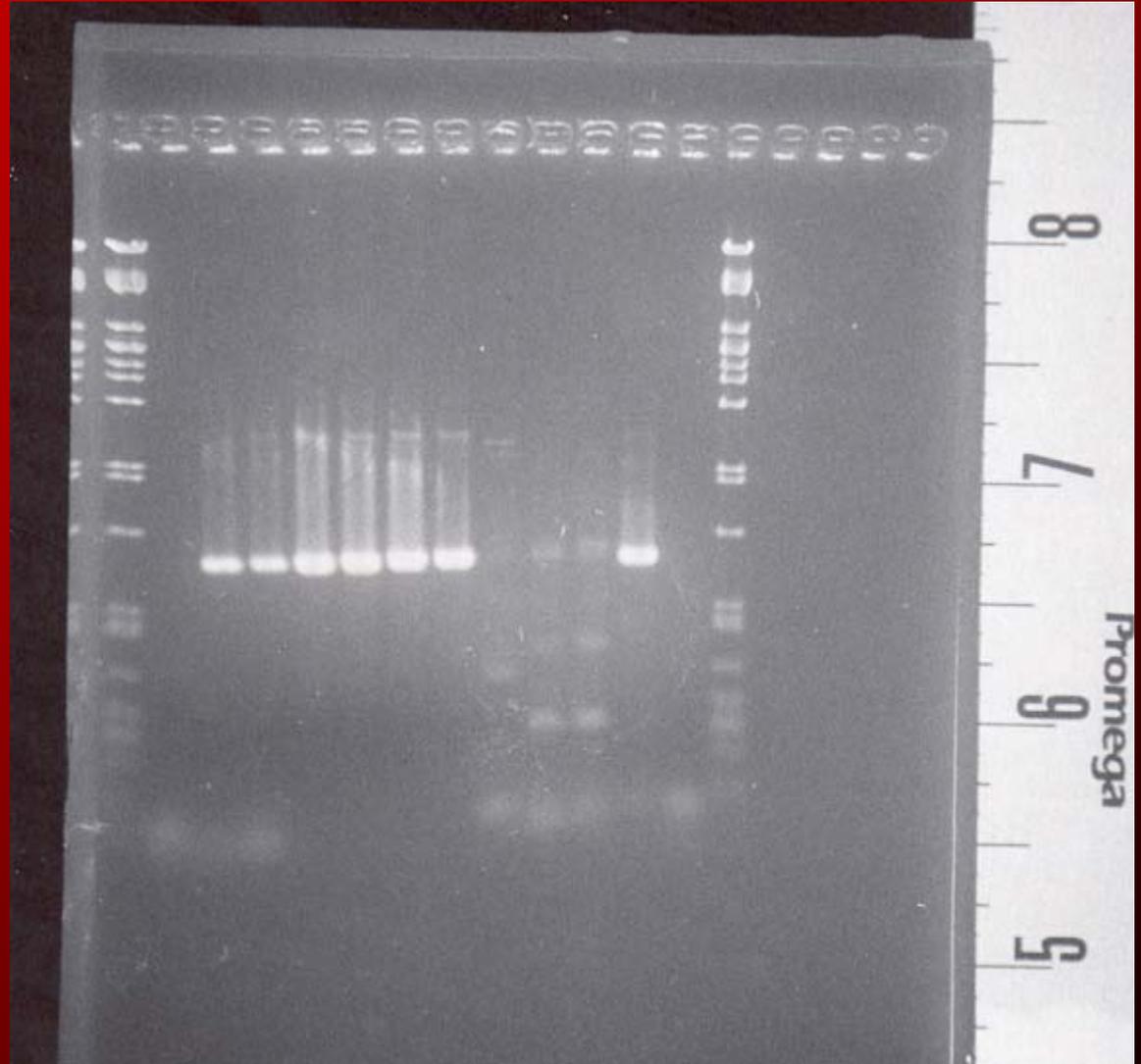
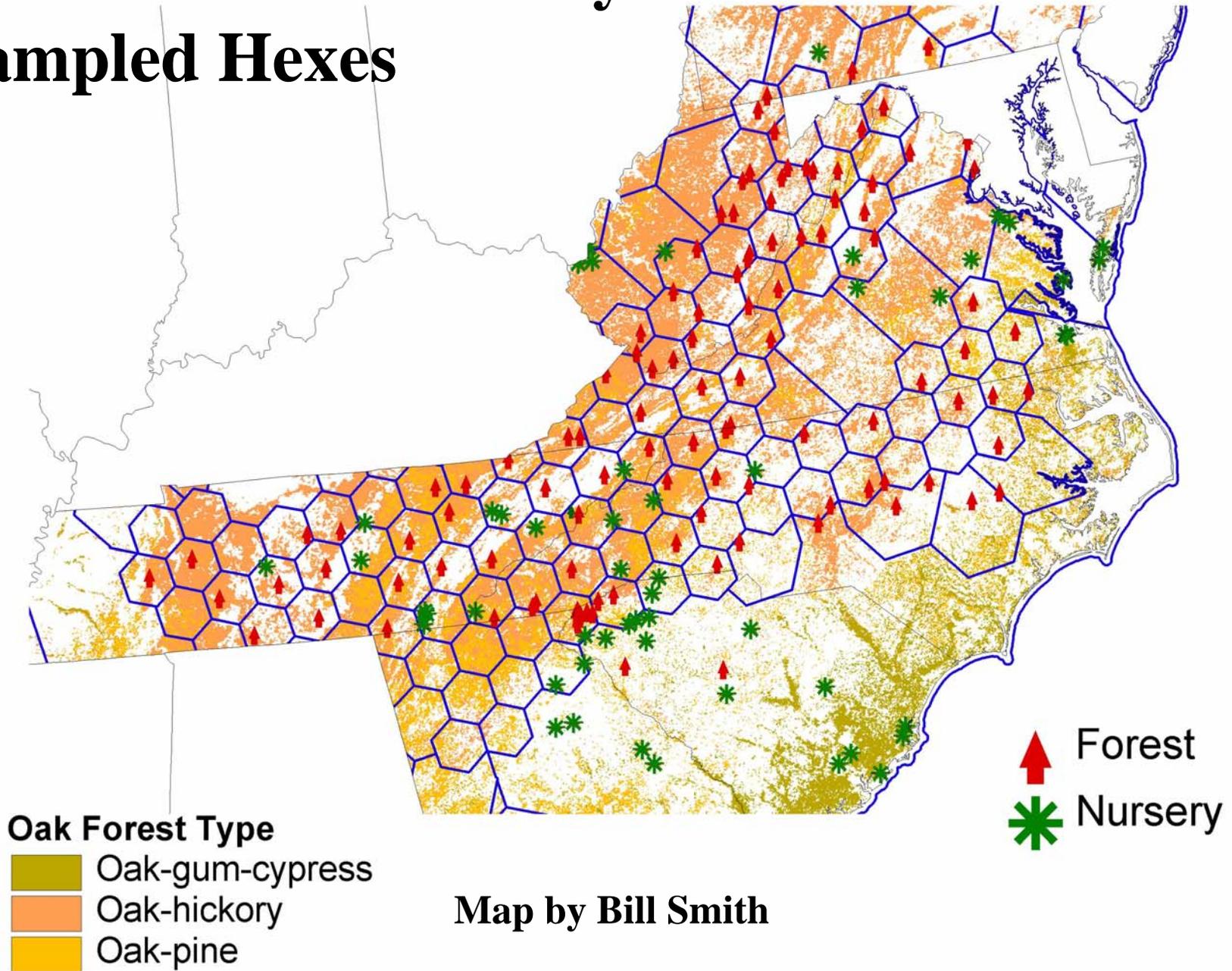


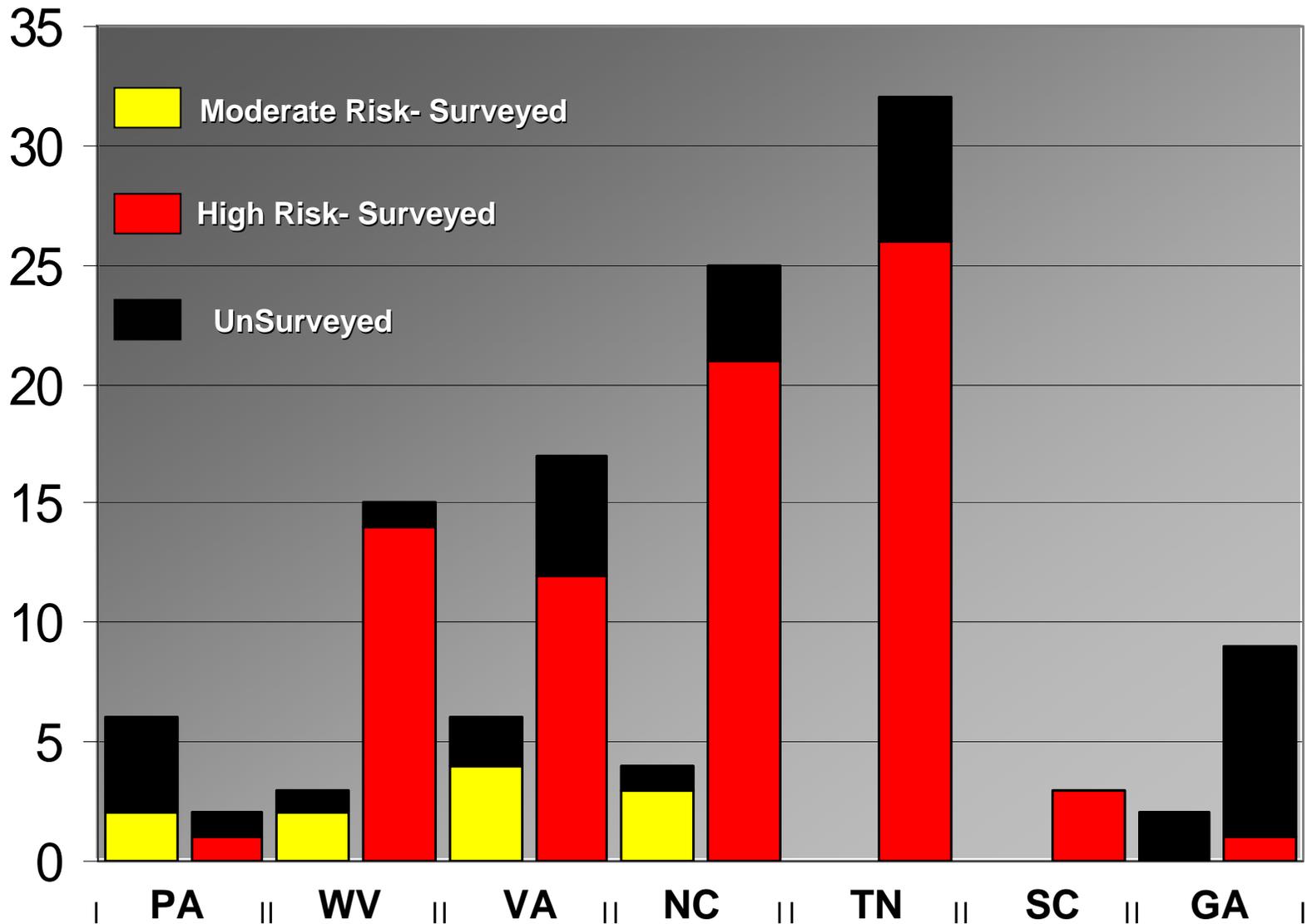
Image courtesy of
Tom Kubisiak

2003 SOD Pilot Survey- Eastern Forests

Sampled Hexes

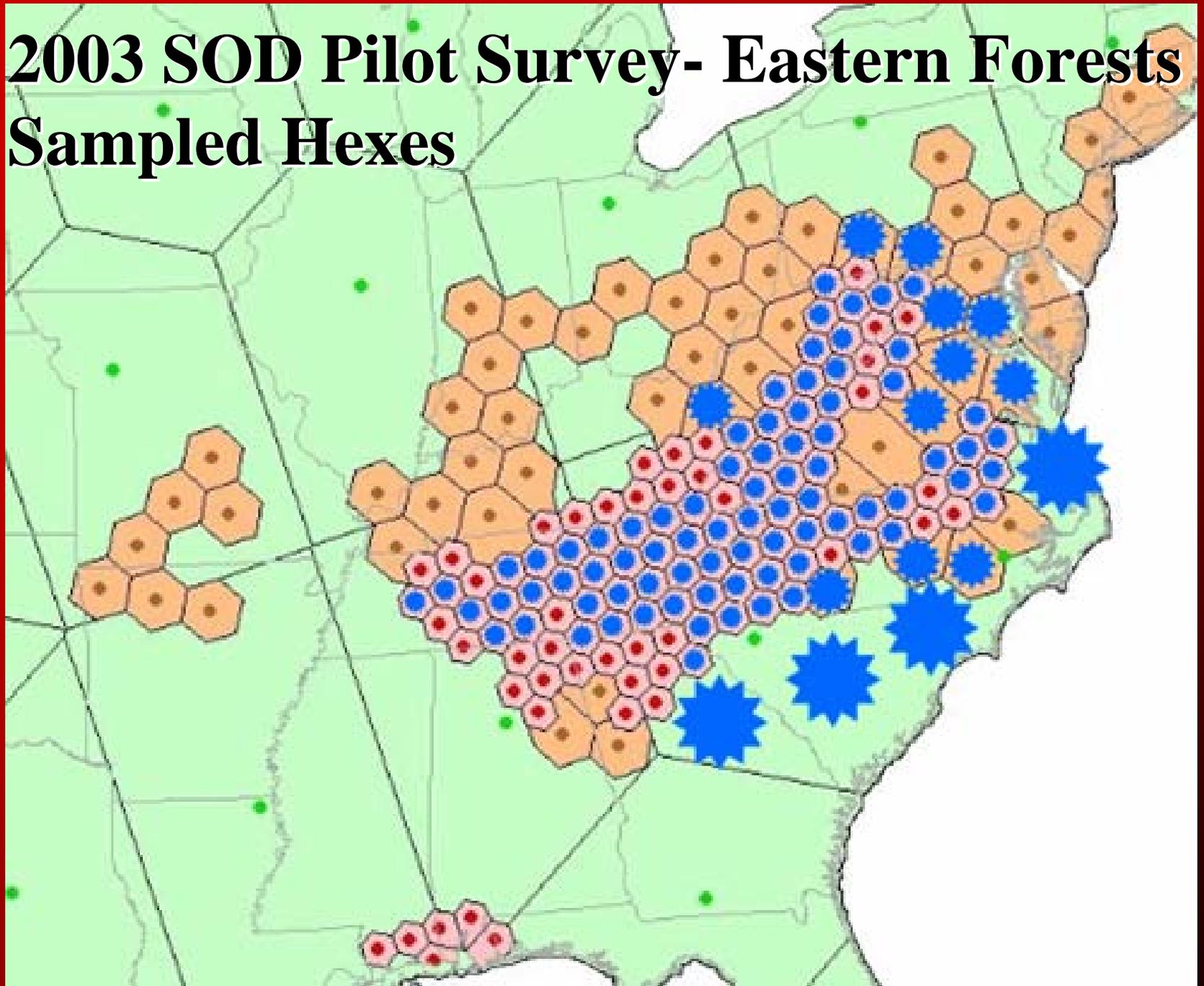


Distribution of Surveyed Hexes by State

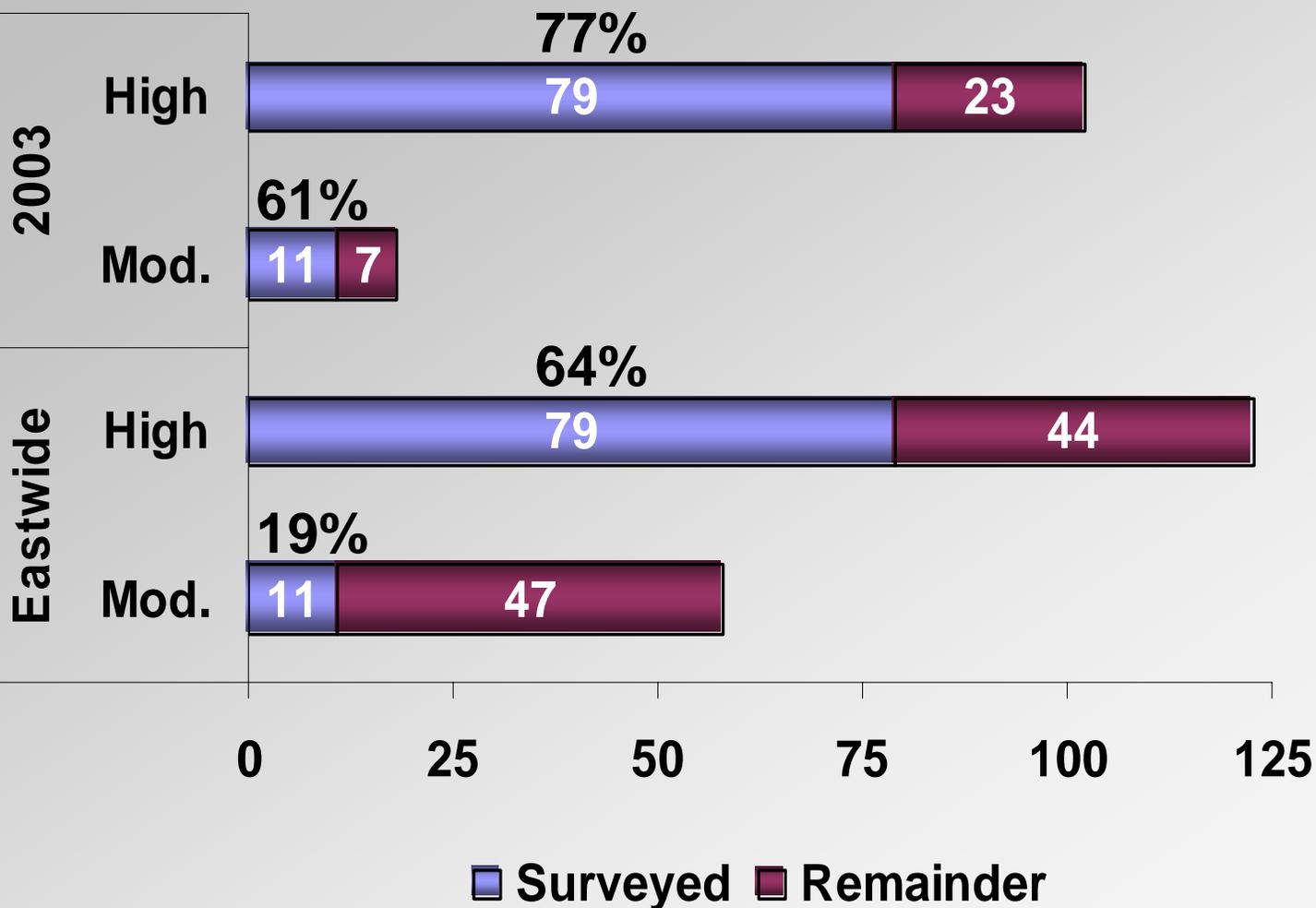
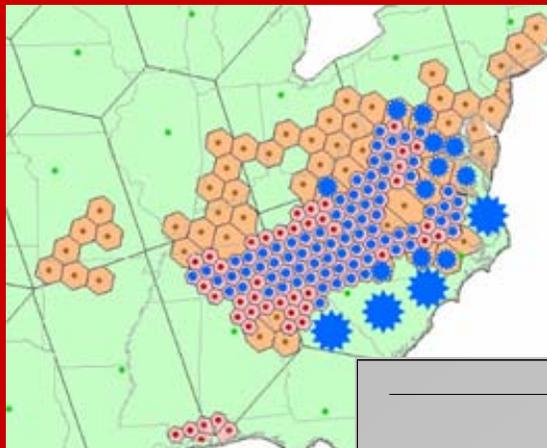


2003 SOD Pilot Survey- Eastern Forests

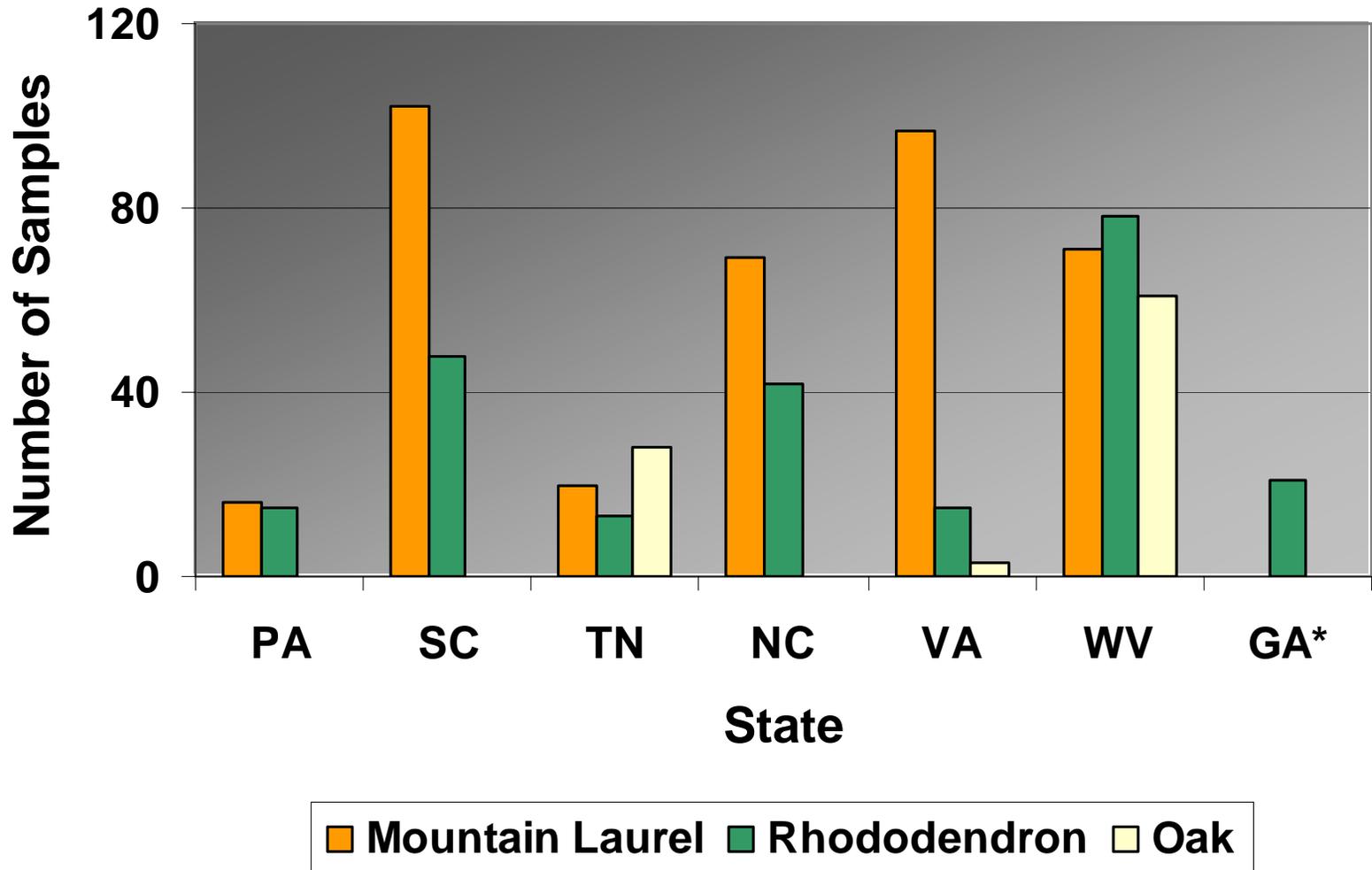
Sampled Hexes



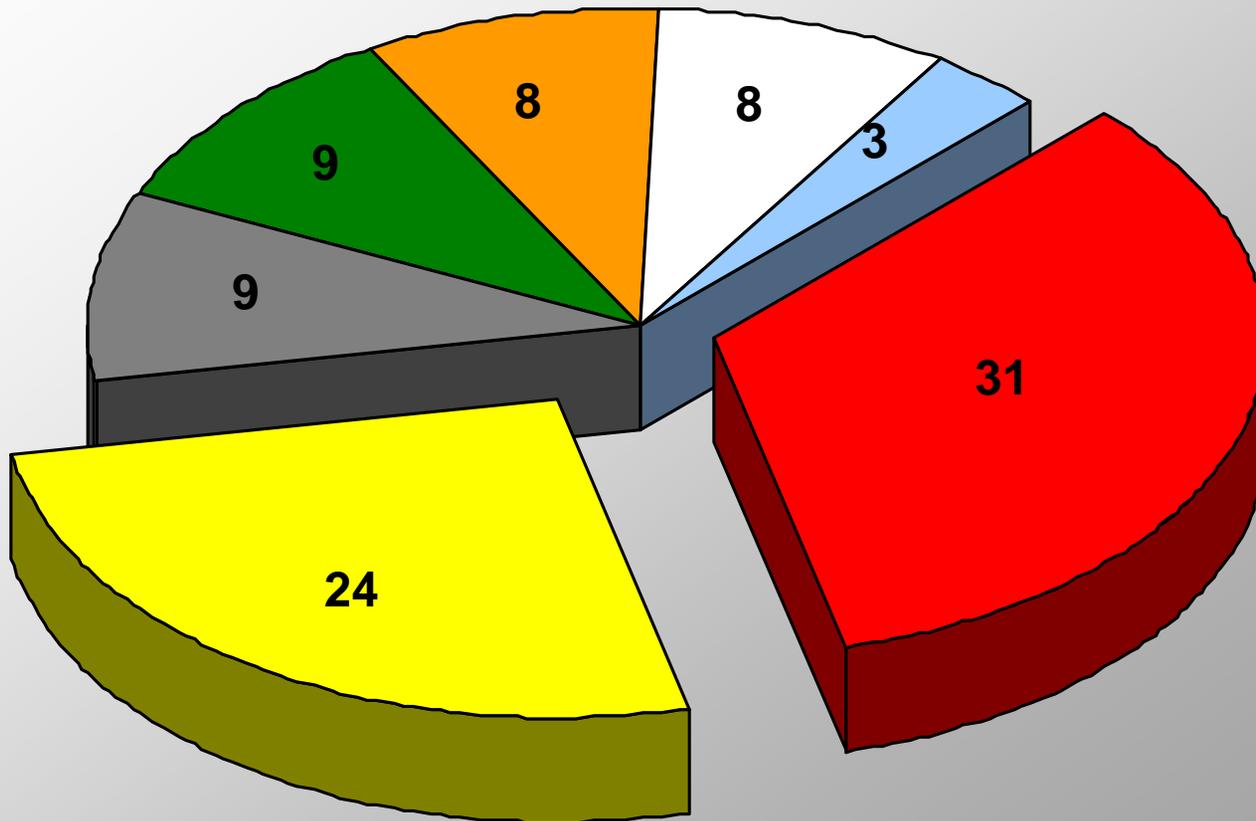
Hexes Surveyed By Risk Class 2003



Distribution of Sample Types by State (*417 samples of other species in GA)



Species Distribution- Oak Bark Samples



■ rubra ■ alba ■ velutina ■ prinus ■ falcata □ unknown ■ mixed

97 percent of all bark samples from 2 states

2003 SOD Pilot Survey- Eastern Forests

- 7 states assessed
 - PA, WV, VA, TN, NC, SC, GA
- 54 nursery perimeter locations surveyed with 155 transects
- 118 forest locations surveyed with 465 transects
- 1116 samples submitted for PCR diagnostics;
none positive for *P. ramorum*

Future of SOD in eastern hardwood forests?

