Phytophthora ramorum in Eastern US Waterways
Detected by the National Early Detection Survey of Forests

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COMTF Webinar
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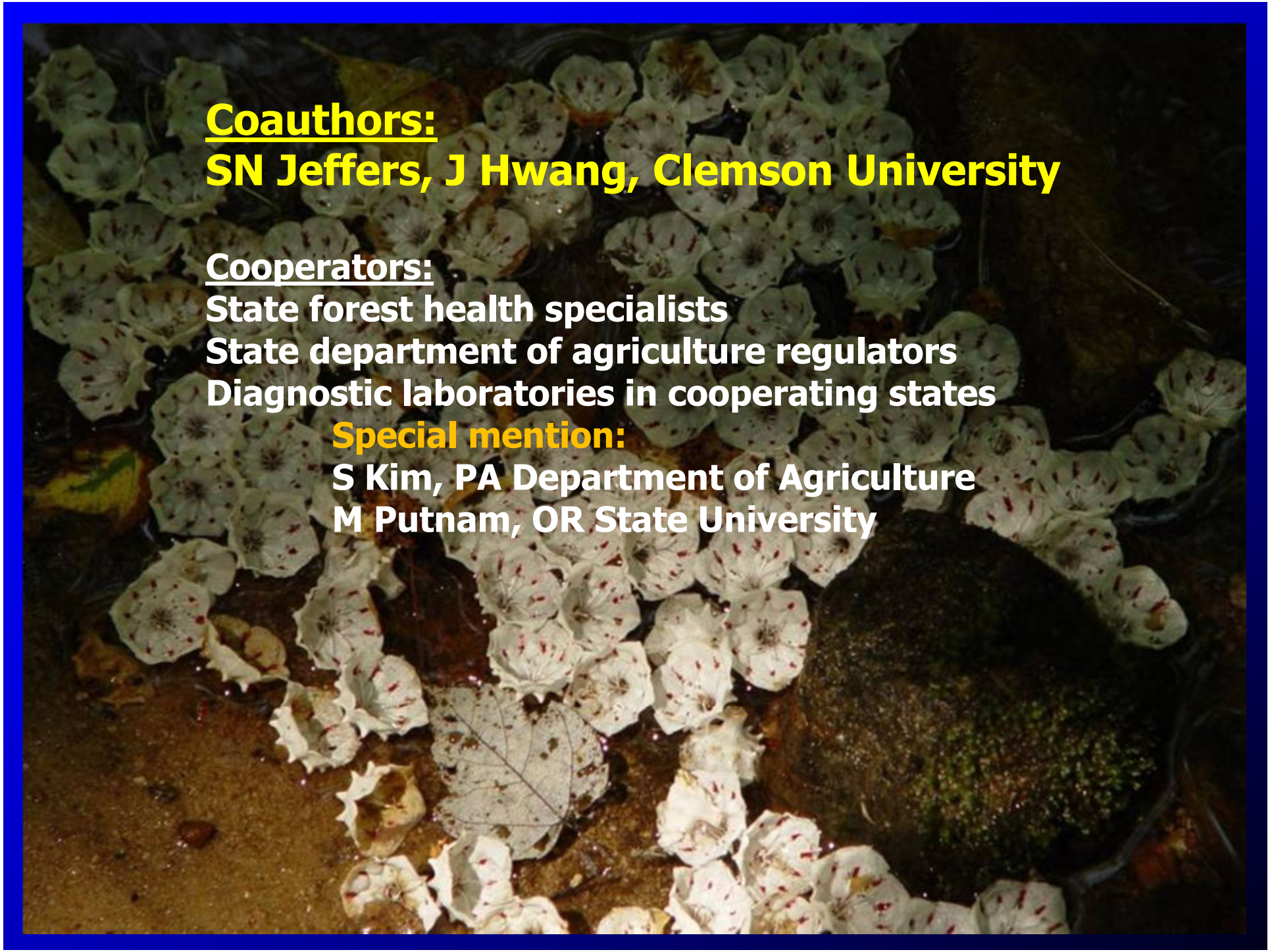

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Cooperators:

State forest health specialists

State department of agriculture regulators

Diagnostic laboratories in cooperating states

Special mention:

S Kim, PA Department of Agriculture

M Putnam, OR State University

If *P. ramorum* is confined to the west coast, why should easterners worry?

Worldwide *P. ramorum* Host & Associated Genera in Eastern Forests

- *Abies* (fir)
- *Acer* (maple)
- *Aesculus* (buckeye)
- *Arctostaphylos* (kinnikinick)
- *Calycanthus* (sweet bush)
- *Castanea* (chestnut)
- *Corylus* (hazelnut)
- *Euonymus*
- *Fagus* (beech)
- *Fraxinus* (ash)
- *Gaultheria* (teaberry)
- *Kalmia* (mountain laurel)
- *Hamamelis* (witch hazel)
- *Leucothoe* (doghobble)
- *Lonicera* (honeysuckle)
- *Magnolia*
- *Maianthemum* (false Solomon's seal)
- *Pieris* (fetterbush)
- *Prunus* (cherry)
- *Quercus* (oak)
- *Rhamnus* (buckthorn)
- *Rhododendron*
- *Rubus* (salmonberry, blackberry)
- *Salix* (willow)
- *Toxicodendron* (poison oak, ivy)
- *Vaccinium* (huckleberry, blueberry)
- *Viburnum* (arrowwood)

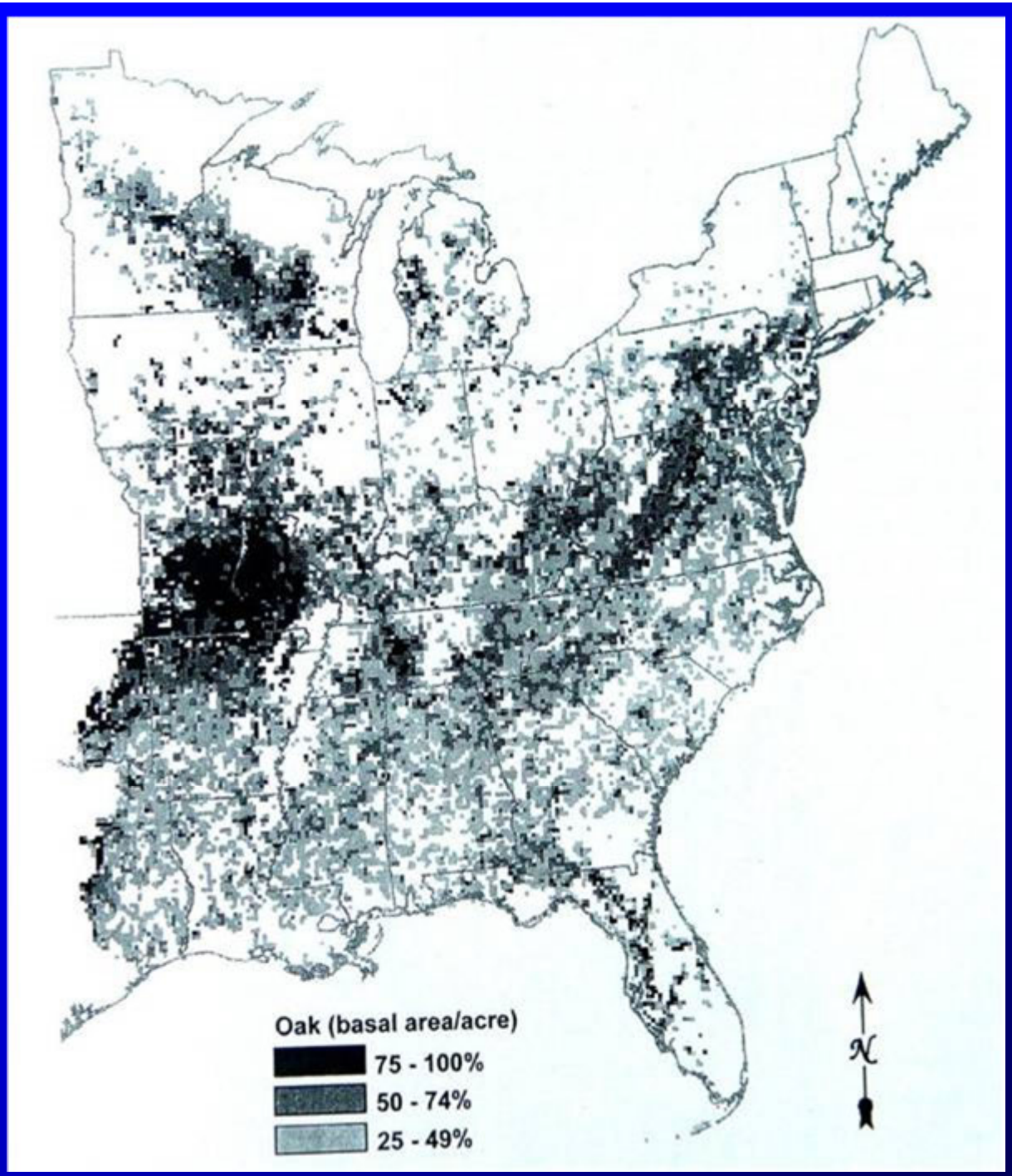
Prevalence of Oak Forests in the Eastern US

- **Oak-Hickory**
  - 9 forest types
  - 50.1 million ha
- **Oak Pine**
  - 8 forest types
  - 13.7 million ha
- **Lowland Oak**
  - 3 forest types
  - 4.1 million ha

20 forest types – 67.8 million ha

46 percent of timberland area in oak-dominated forests in 37 states

Source: FIA Eastwide Forest Inventory Database



Eastern Oak Density

Timberland with ≥ 25 % oak basal area

FIA Eastwide Forest Inventory Database (adapted from McWilliams, et al.)

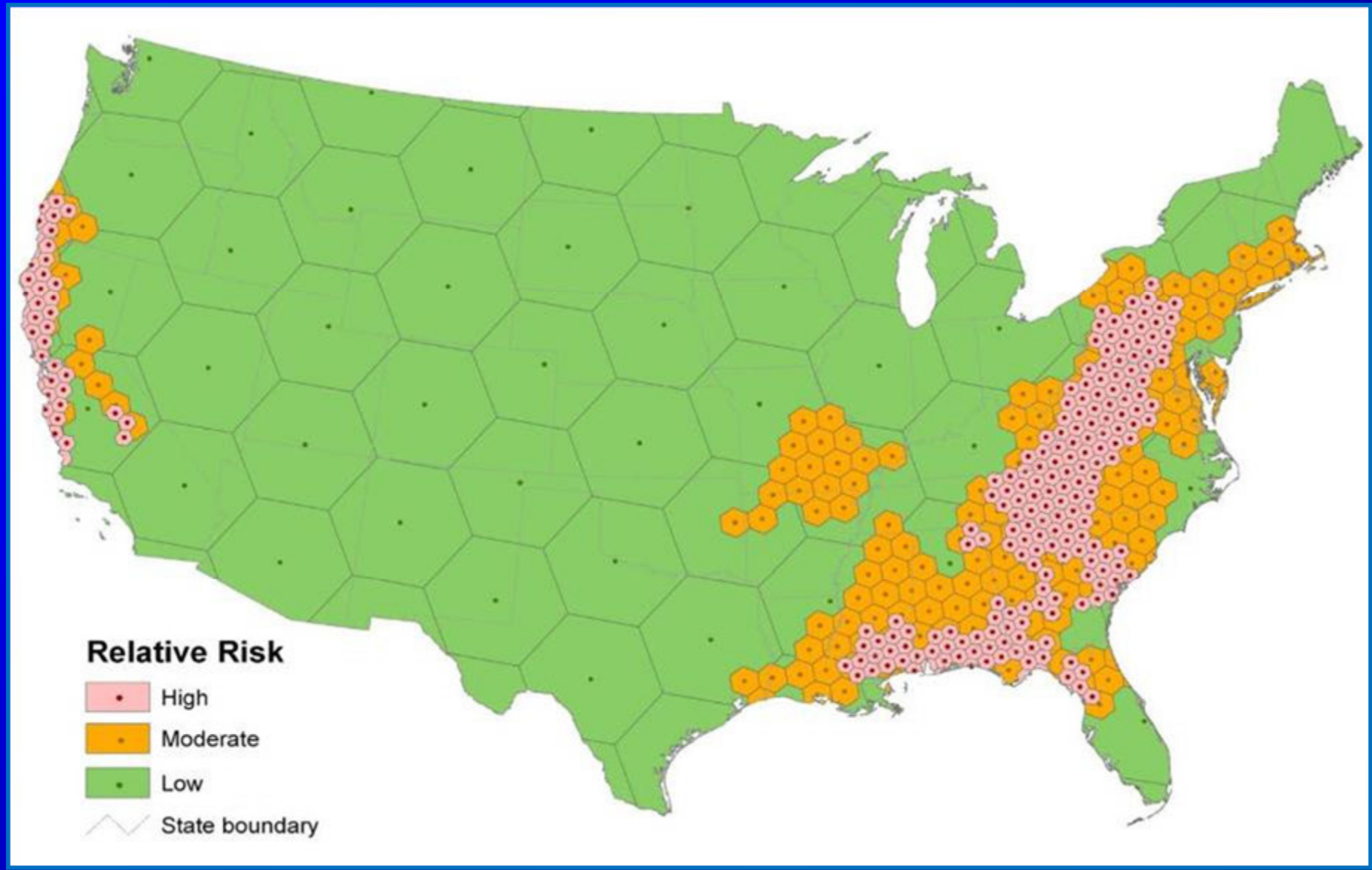
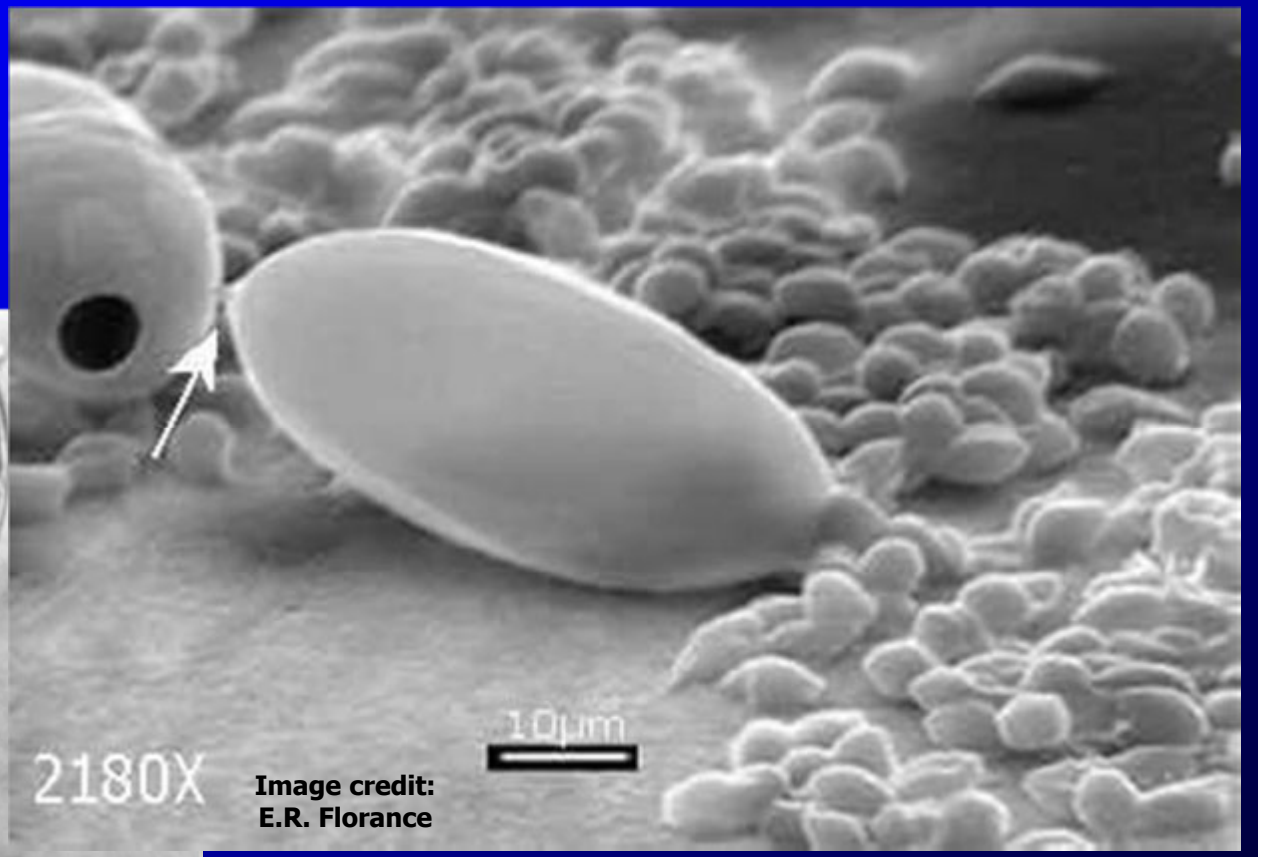

Relative Risk
High
Moderate
Low
State boundary

Photo credit- Dan Omdal

Phytophthora ramorum



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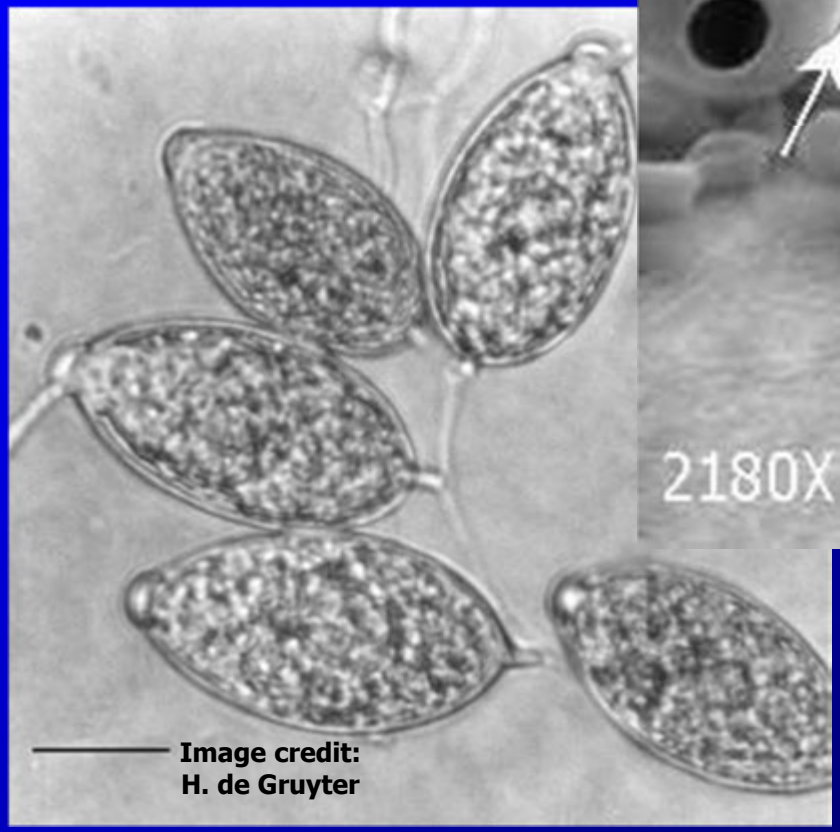
E.R. Florance



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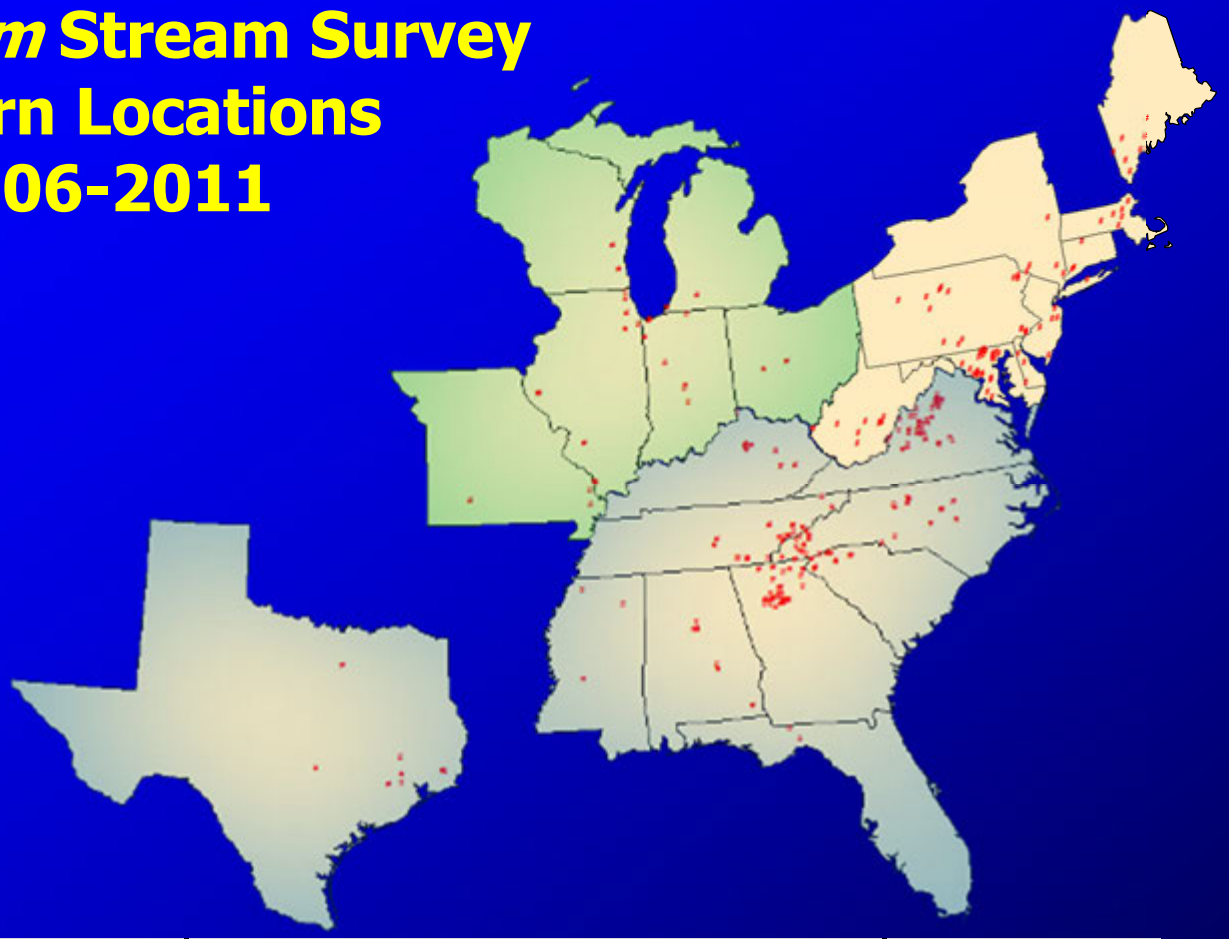
H. de Gruyter

The swimming zoospore is the life stage baited in water

Symptoms of Infection by *Phytophthora* spp. on Rhododendron Leaf Baits

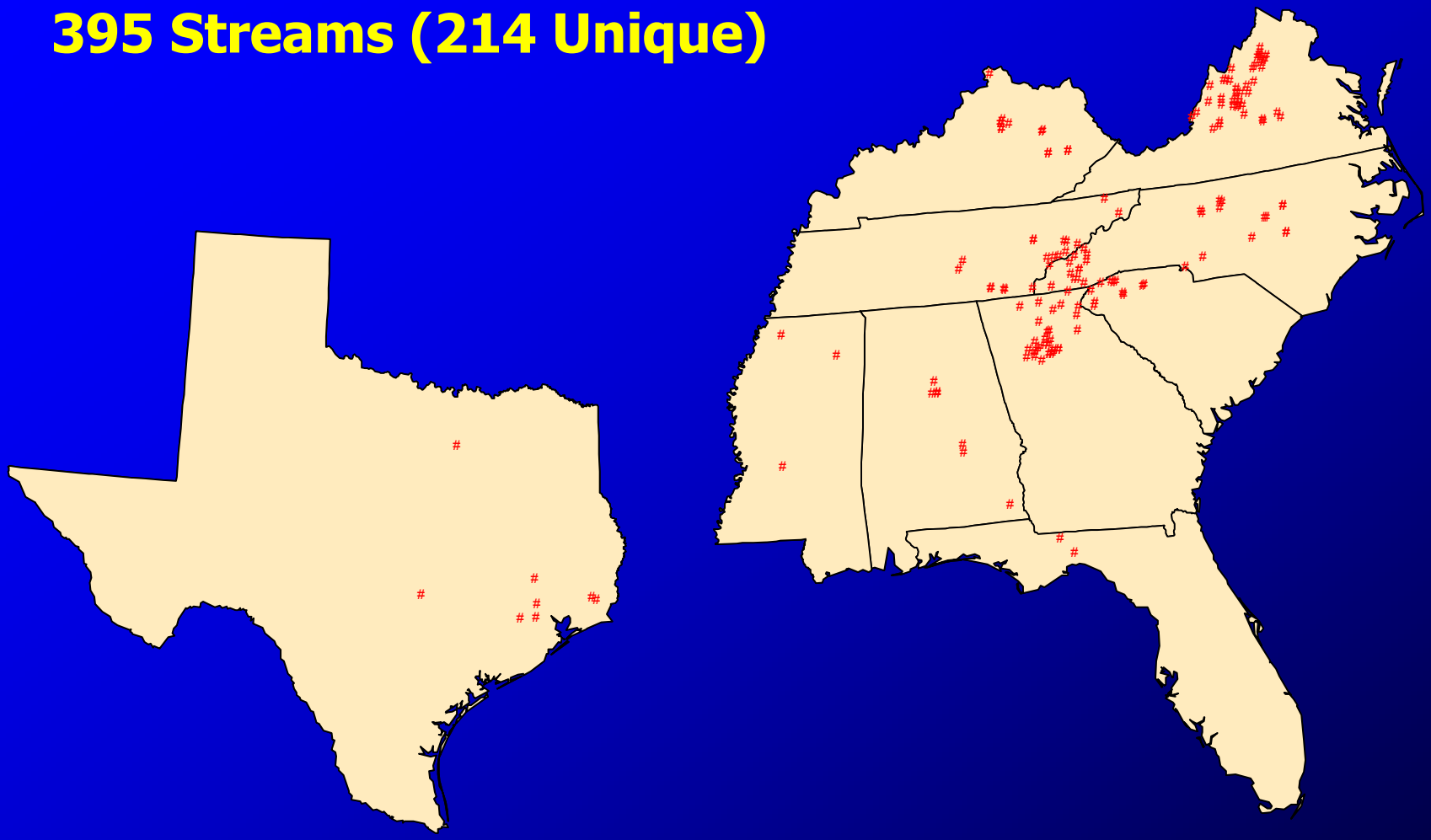
P. ramorum Stream Survey Eastern Locations 2006-2011



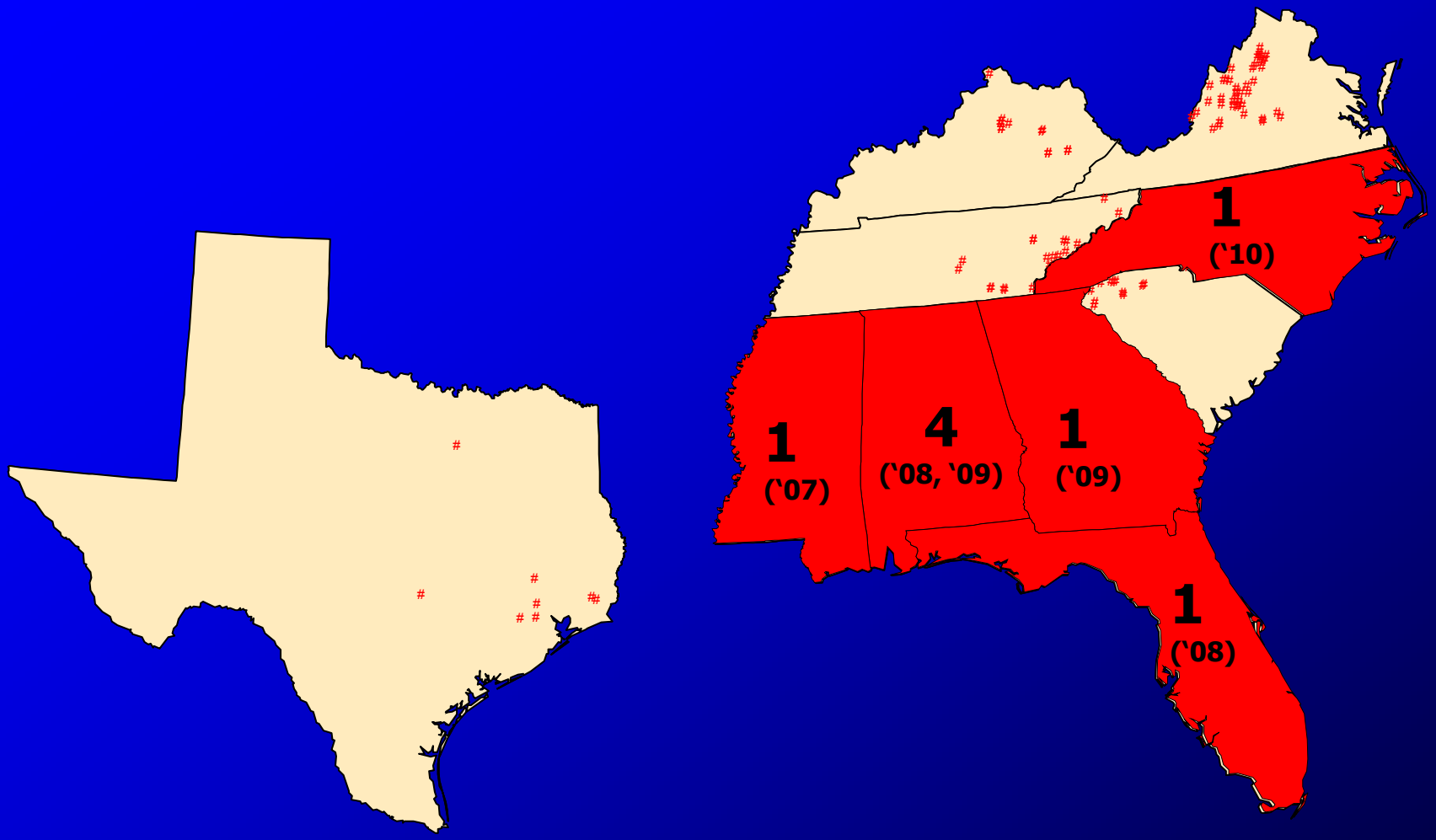
	Year						Streams Surveyed	
Region	2006	2007	2008	2009	2010	2011	Total	Unique
Northeast (9)	24	37	29	15	15	15	135	91
North Central (6)	0	20	15	0	2	2	39	30
South (10)	33	64	71	78	73	76	395	214
Eastern Total (25)	57	121	115	93	90	93	569	335

Many streams surveyed in more than one year

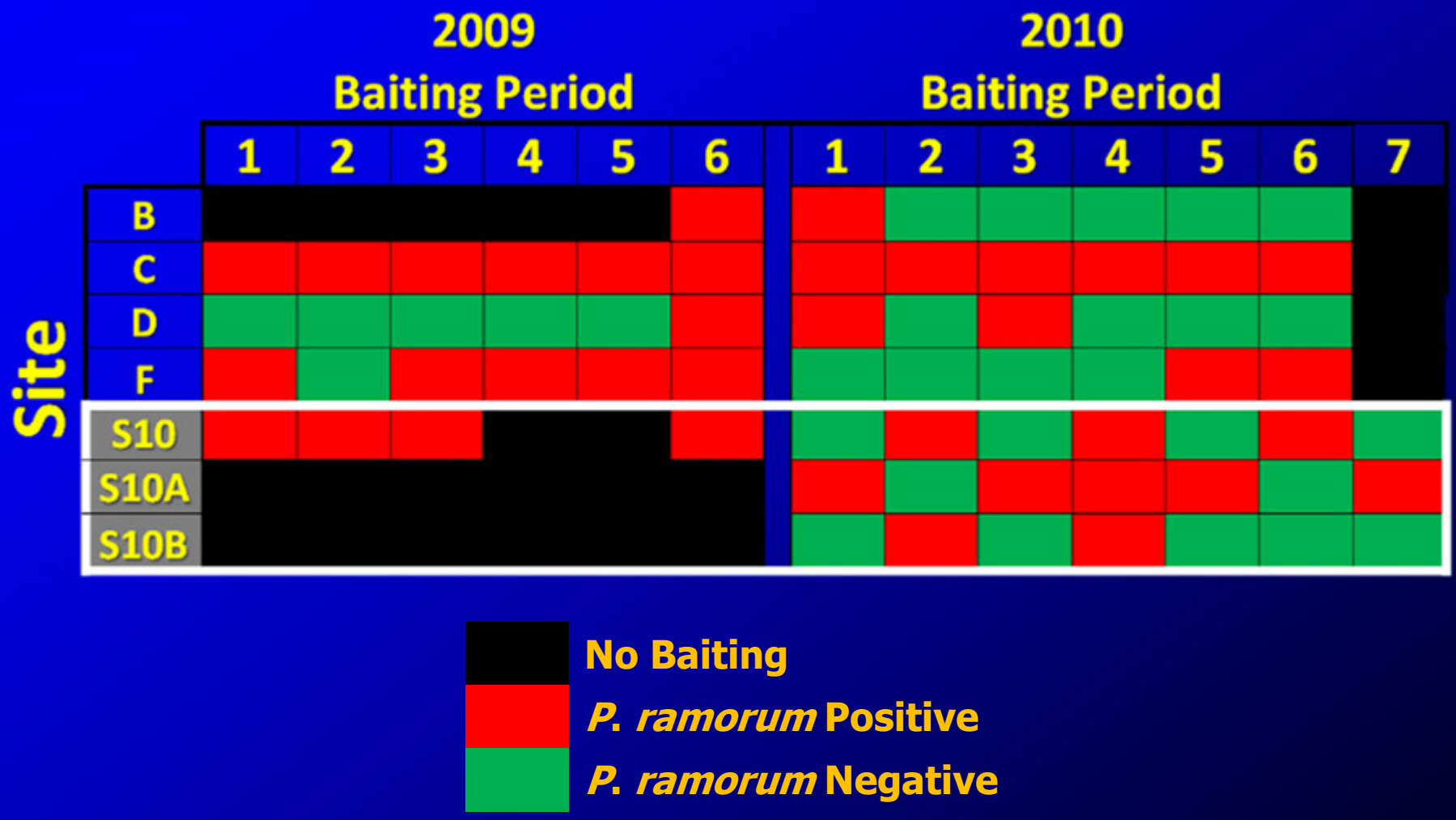
Southern Region Stream Baiting Sites 2007-2011
395 Streams (214 Unique)



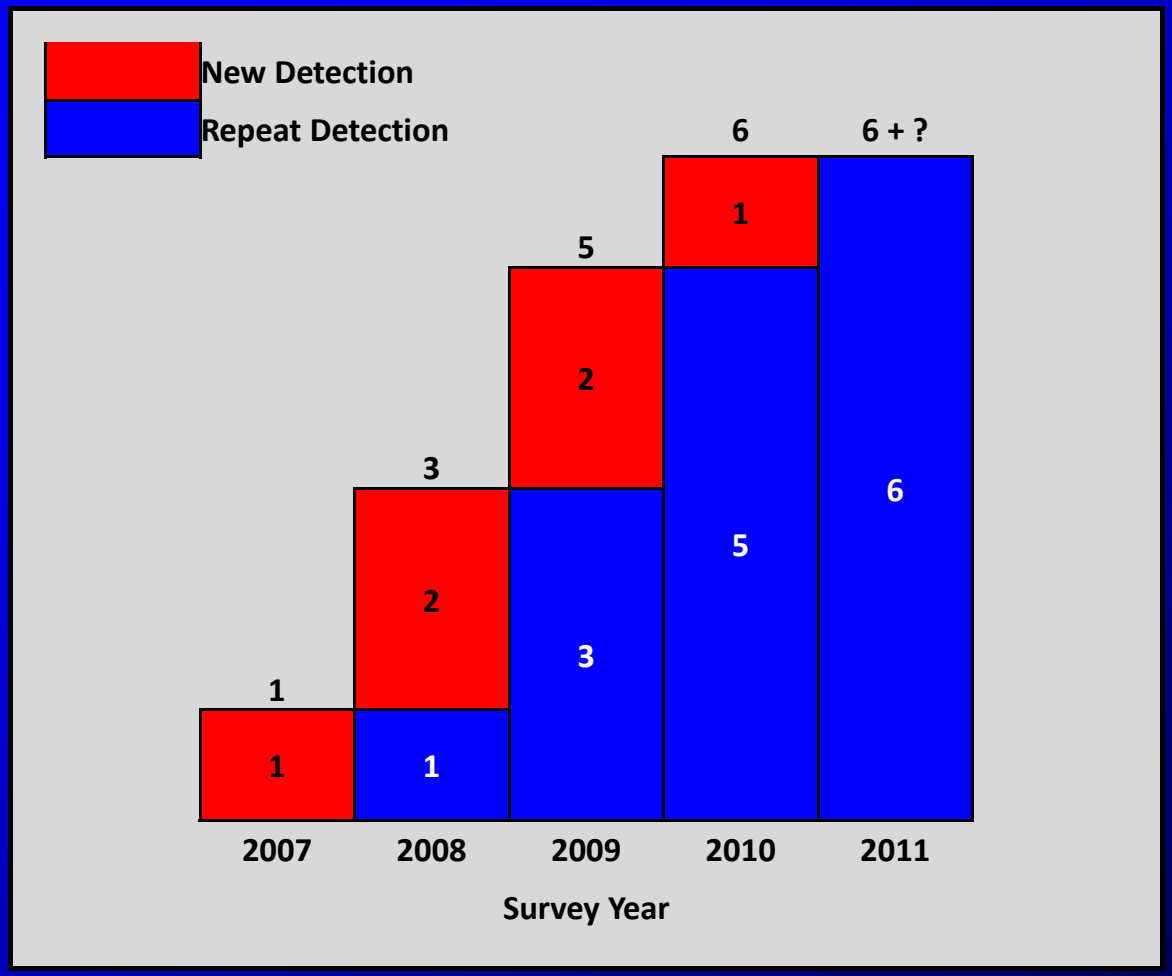
P. ramorum Positives 2007-2010 (Year of First Positive)



P. ramorum Detection by Baiting Period for Selected Streams, 2009-10



National Early Detection Survey of Forests
P. ramorum Positive Sites by Year, Eastern States



*All positive sites are outside current or formerly positive nurseries.
*All past positive sites are already positive in 2011.
*Once positive, no site has reverted to negative, despite *P. ramorum* mitigation in nursery.

P. ramorum Risk to Eastern Forests

What we know…

- The quarantine is "leaky".
- The pathogen persists in infested nurseries despite eradication measures.
- Inoculum is leaving infested nurseries in water.
- There is a plausible pathway from water to terrestrial ecosystems.
  - Two instances of terrestrial host plant infection
- Climate is at least seasonally suitable for infection.

P. ramorum Risk to Eastern Forests

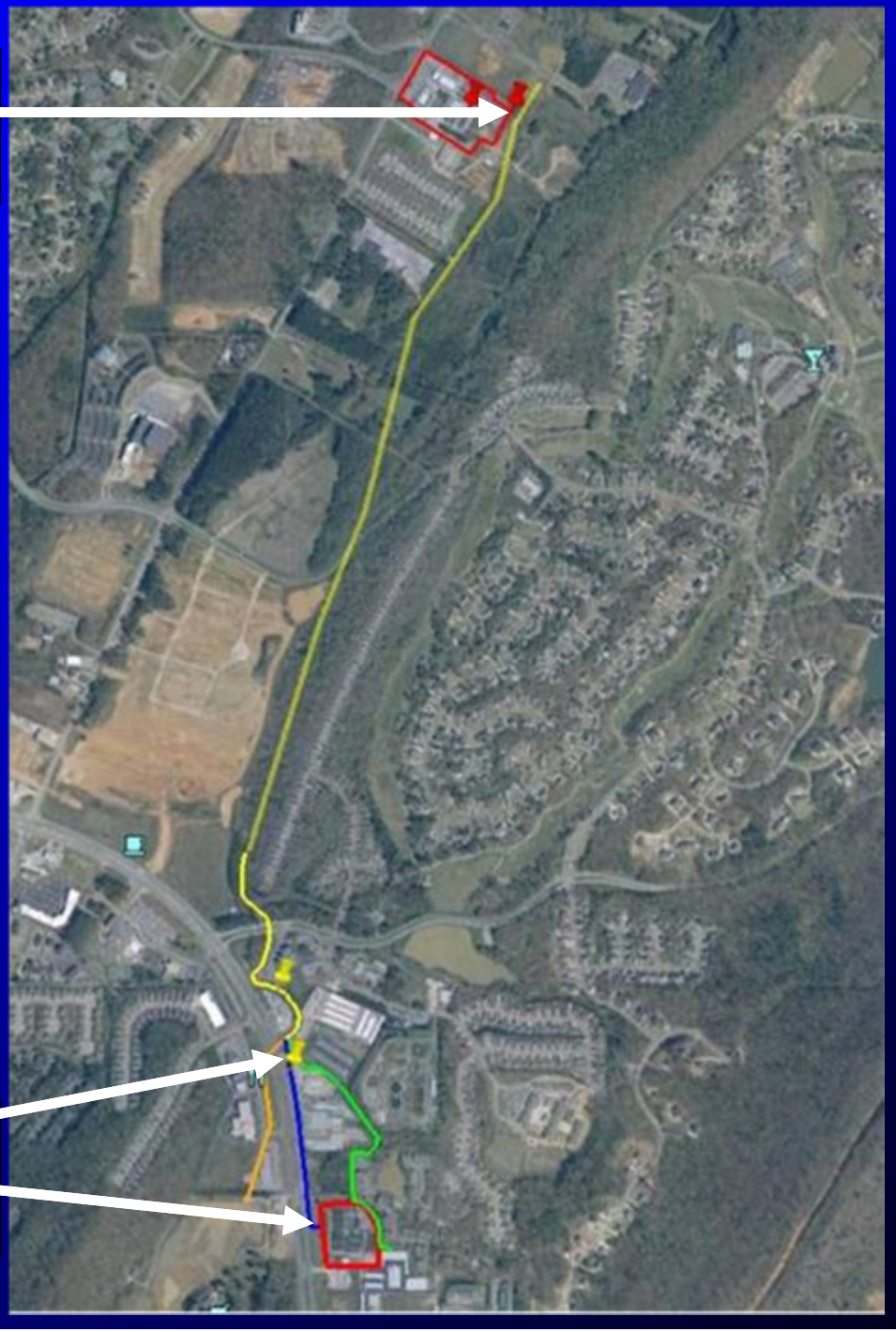
What we don't know…

- **Epidemiology.**
  - Coincidence of sporulating hosts in infested streamside zones?
  - Sufficient sporulation to initiate/sustain epidemics?
  - Suitable climate at the right time for infection?
  - Lag time from infection to establishment to epidemic?
- **Ecosystem effects?**

Settings of positive sites range from small ditches to moderate sized creeks;

and from urban forest to urban interface to rural forest.

Location A
First Detection- 2008

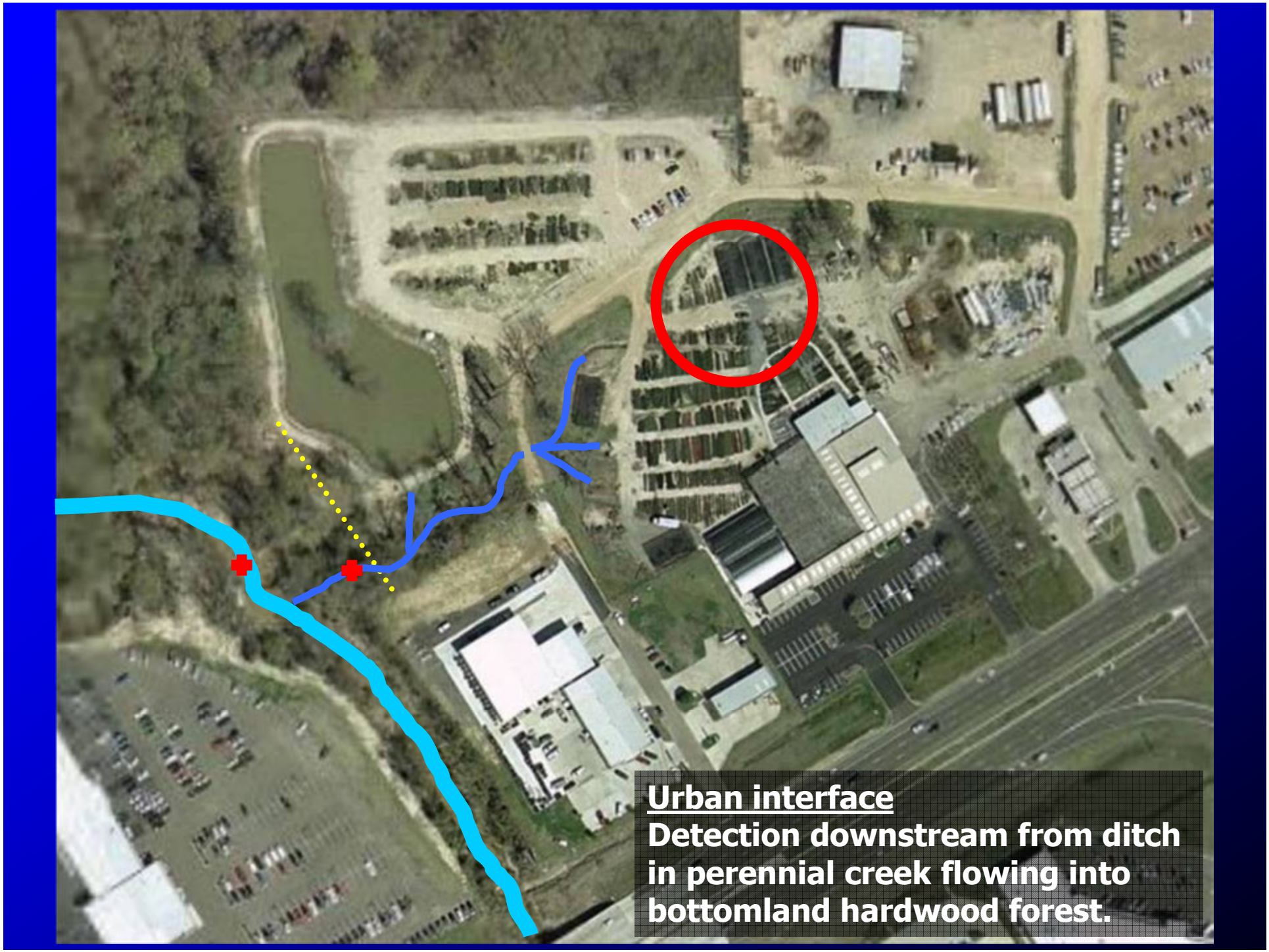


Urban Forest

While these two sites are on the same waterway, there is no evidence for water as the pathway for pathogen introduction downstream from Location B to Location A.

Both locations probably received plants from the same suppliers.

Location B
First Detection- 2009


Urban interface
Detection downstream from ditch in perennial creek flowing into bottomland hardwood forest.


Rural Forest ("wild land")
Positives have been obtained up to 600+ meters from nursery property boundaries.

Challenges

- **Web of interactions**
  - **Regulatory**
    - **APHIS**
    - **State Ag Departments**
  - **Forest Health**
    - **USFS**
    - **State Forestry Agencies**
- **Roles and responsibilities for eradication of an infestation in "wild lands"**