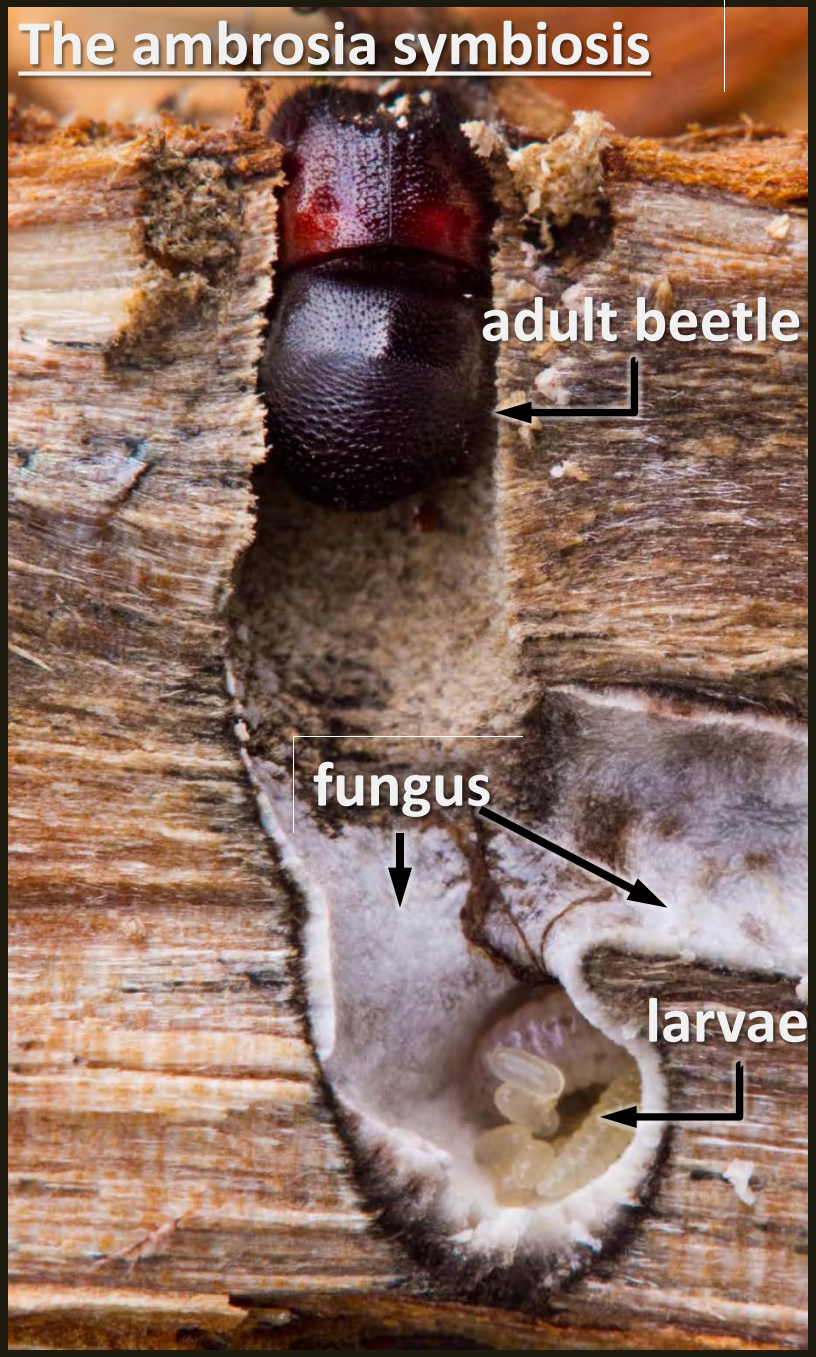
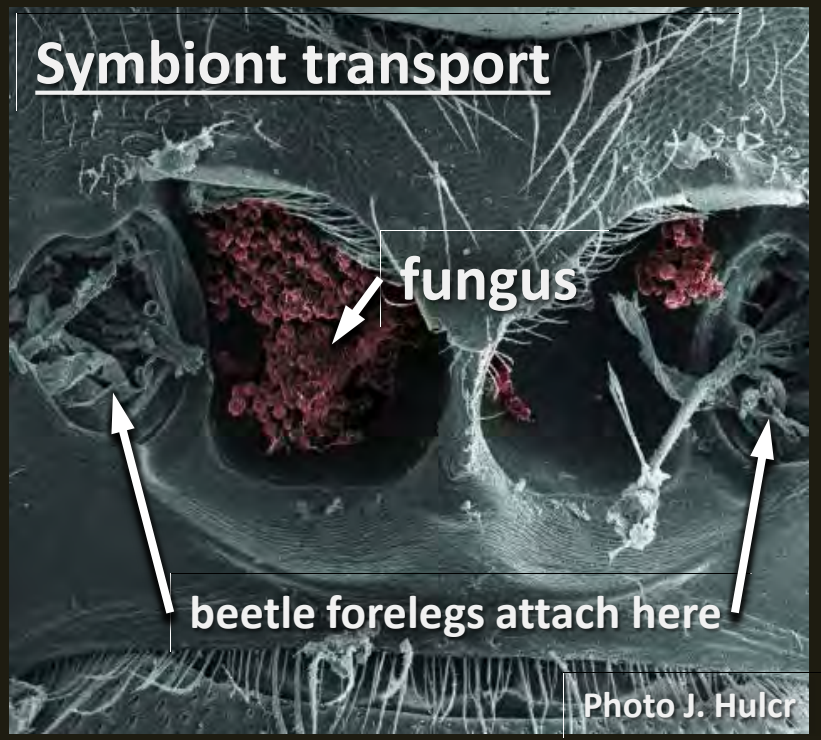
Predicting future exotic pathogens: A decision support tool for protecting American forests

Emerging Threats to Forests research group

Craig Bateman, Jiri Hulcr, Li You, Wang Bo, Wisut Sittichaya, Adam Black


The ambrosia symbiosis
adult beetle
fungus
larvae


Symbiont transport
fungus
beetle forelegs attach here
Photo J. Hulcr


Signs of fungus gardens

Ambrosia pathogens

Polyphagus shot-hole borer

Associated fungal pathogen

Ambrosia pathogens

Redbay ambrosia beetle

Associated fungal pathogen

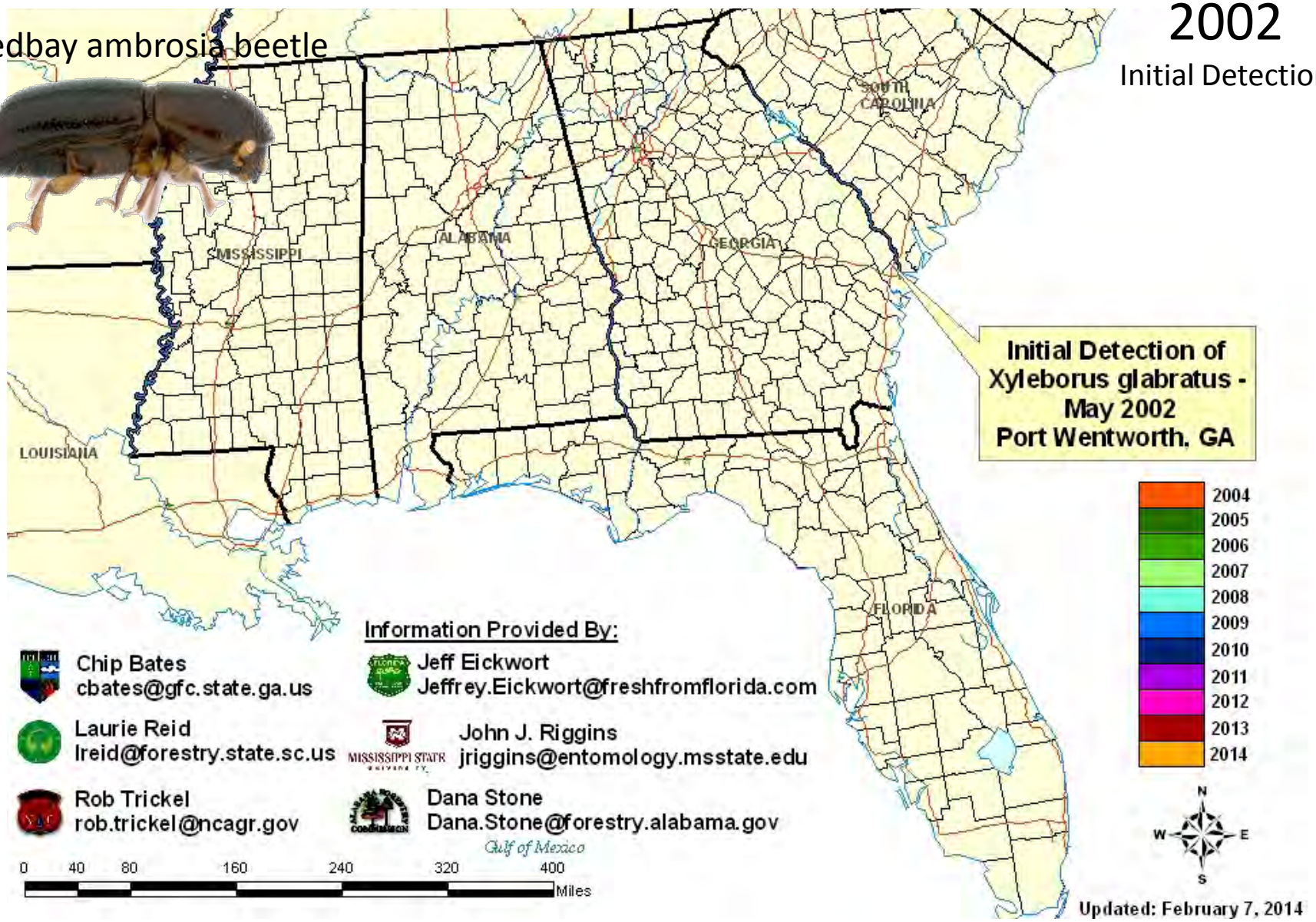
Redbay trees dead from Laurel Wilt

For context…

Redbay ambrosia beetle

2002

Initial Detection



For context…

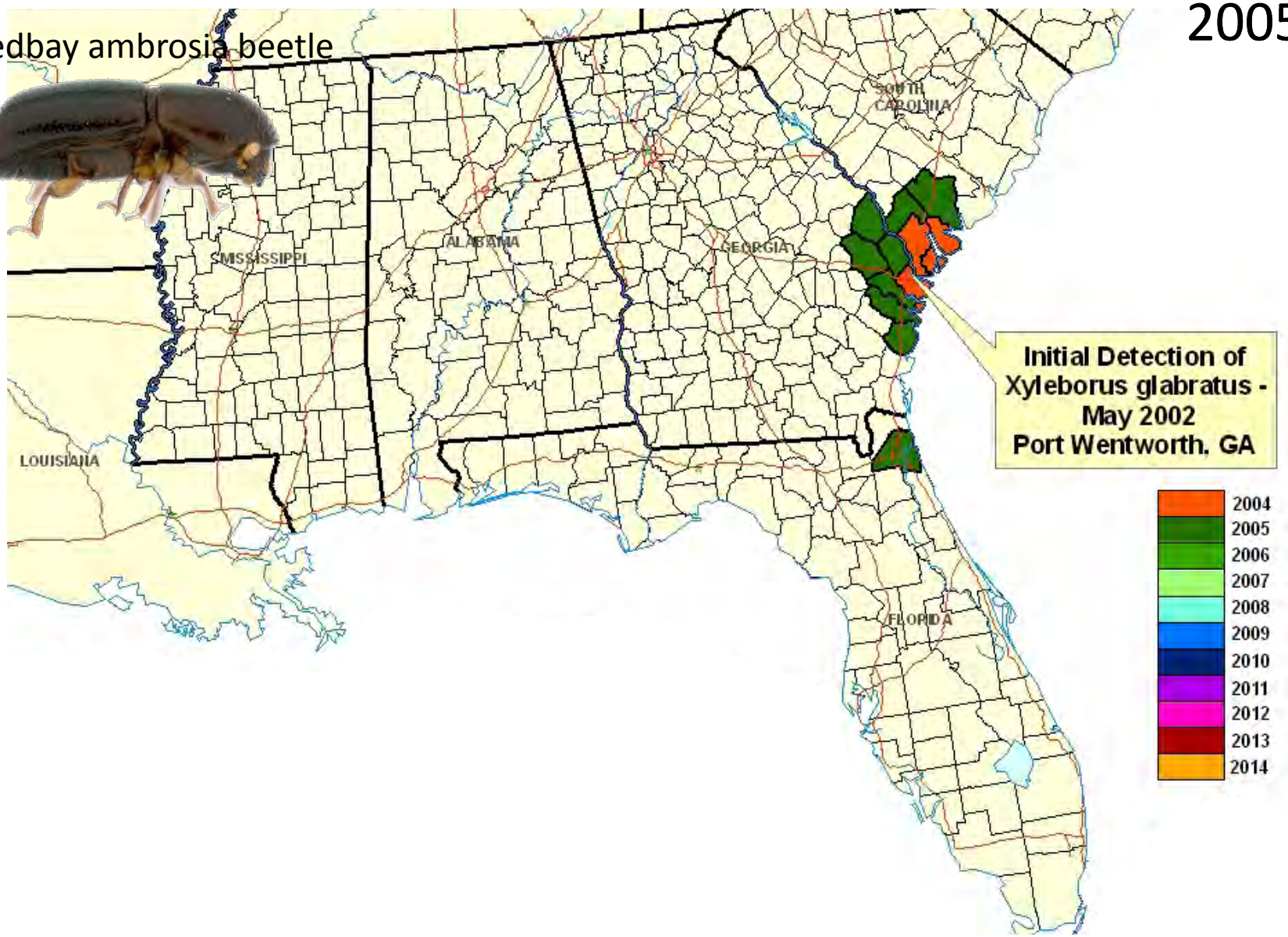
Redbay ambrosia beetle

2004

For context…

Redbay ambrosia beetle

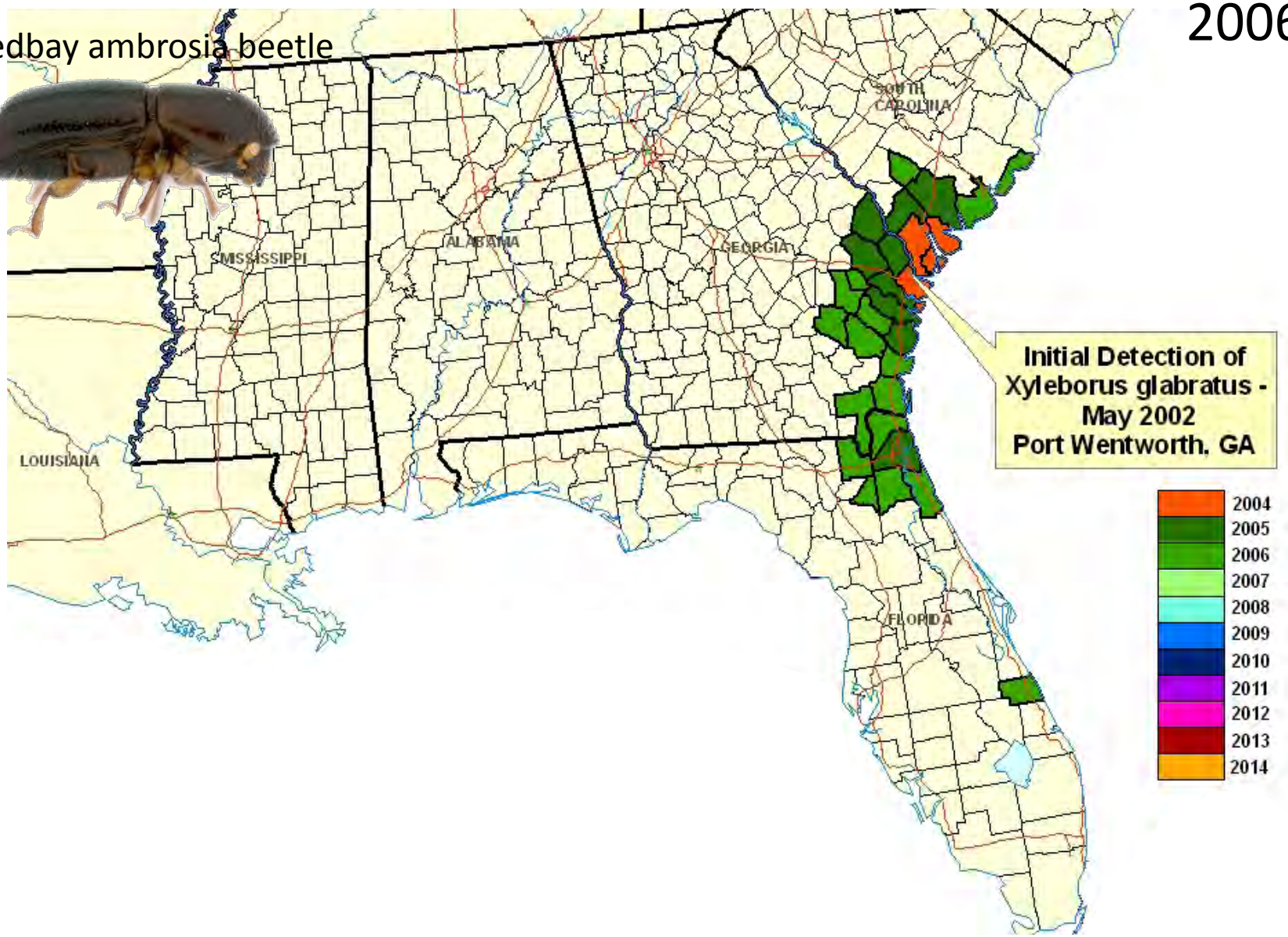
2005



For context…

Redbay ambrosia beetle

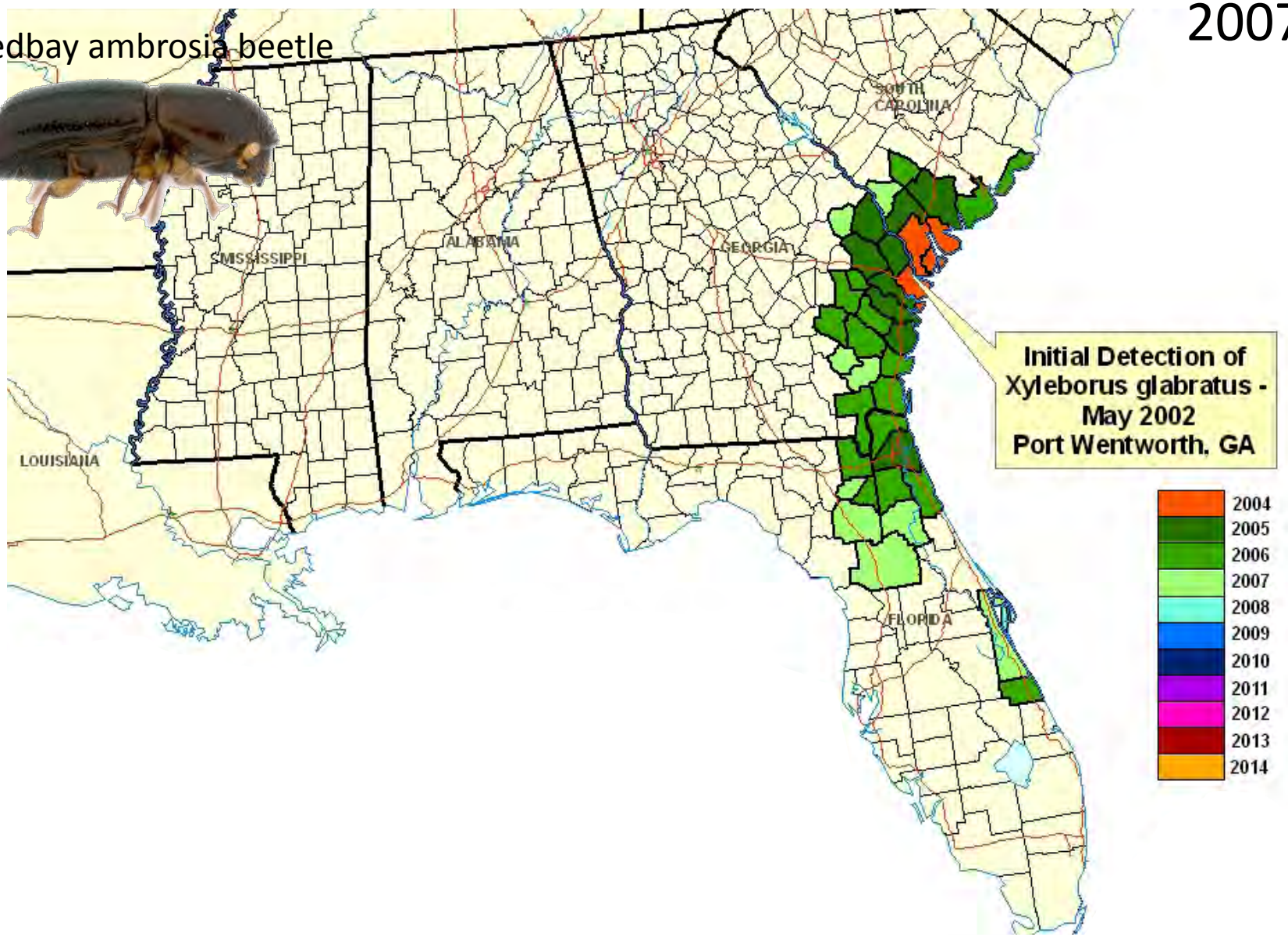
2006



For context…

Redbay ambrosia beetle

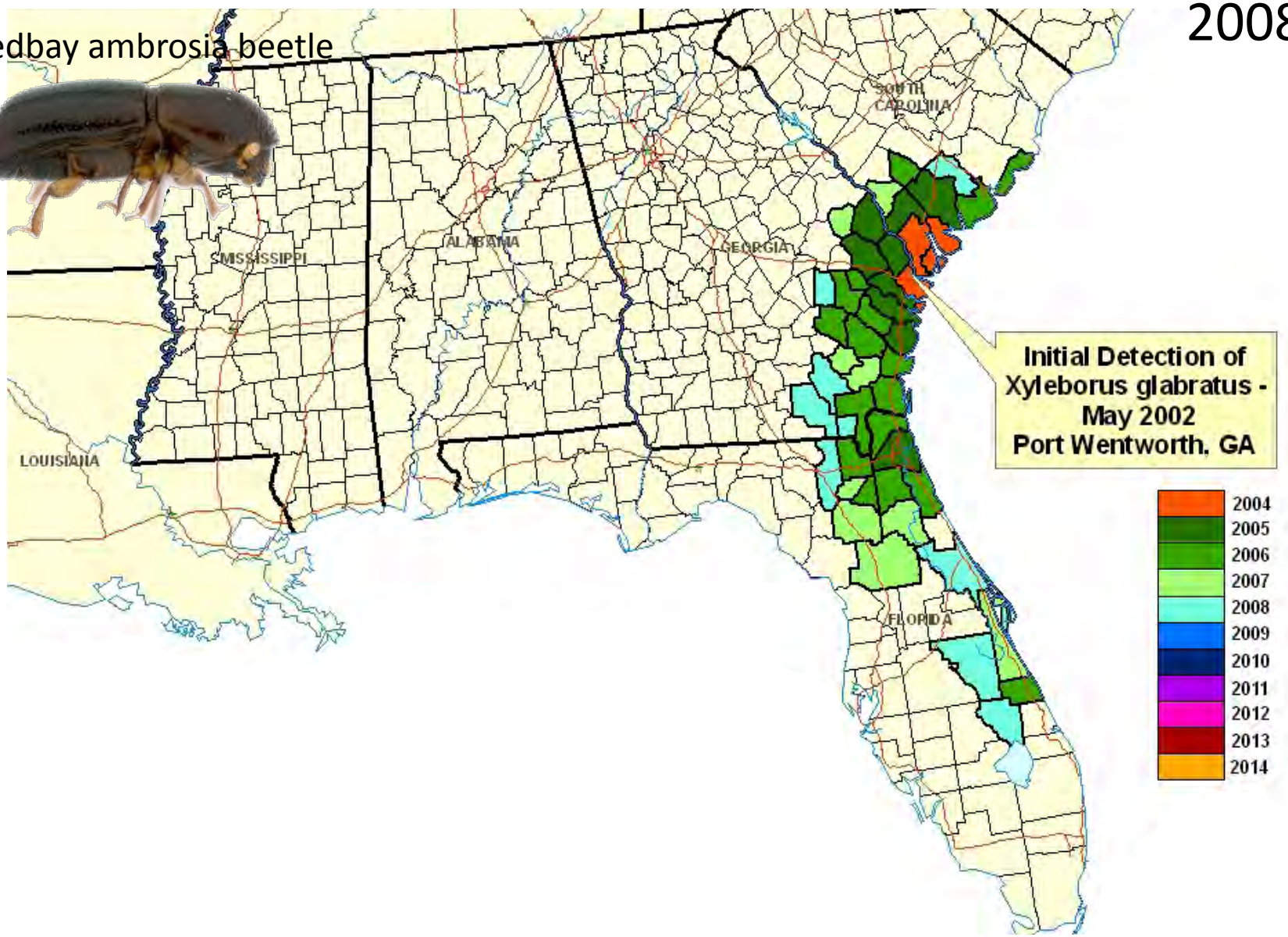
2007



For context…

Redbay ambrosia beetle

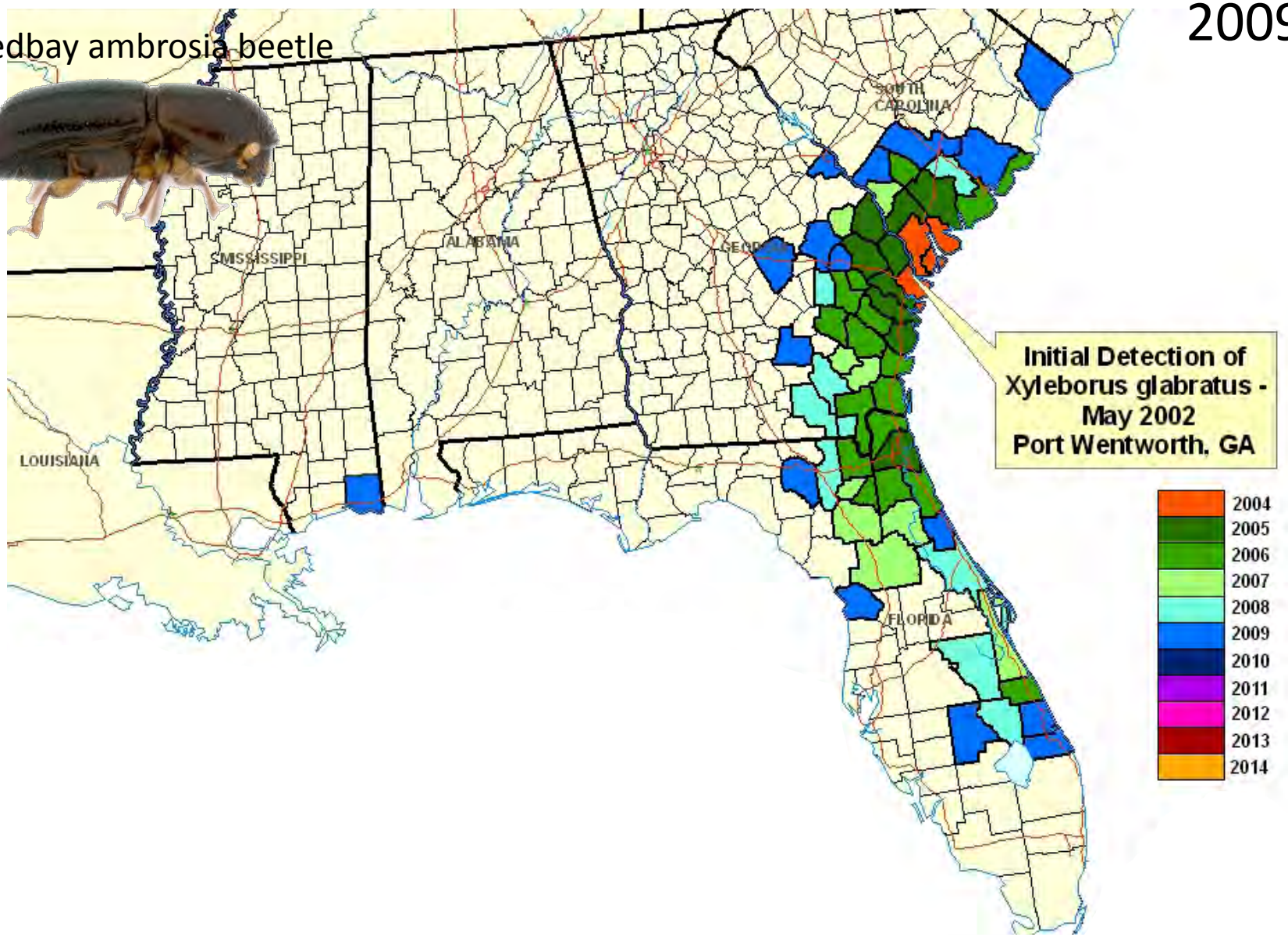
2008



For context…

Redbay ambrosia beetle

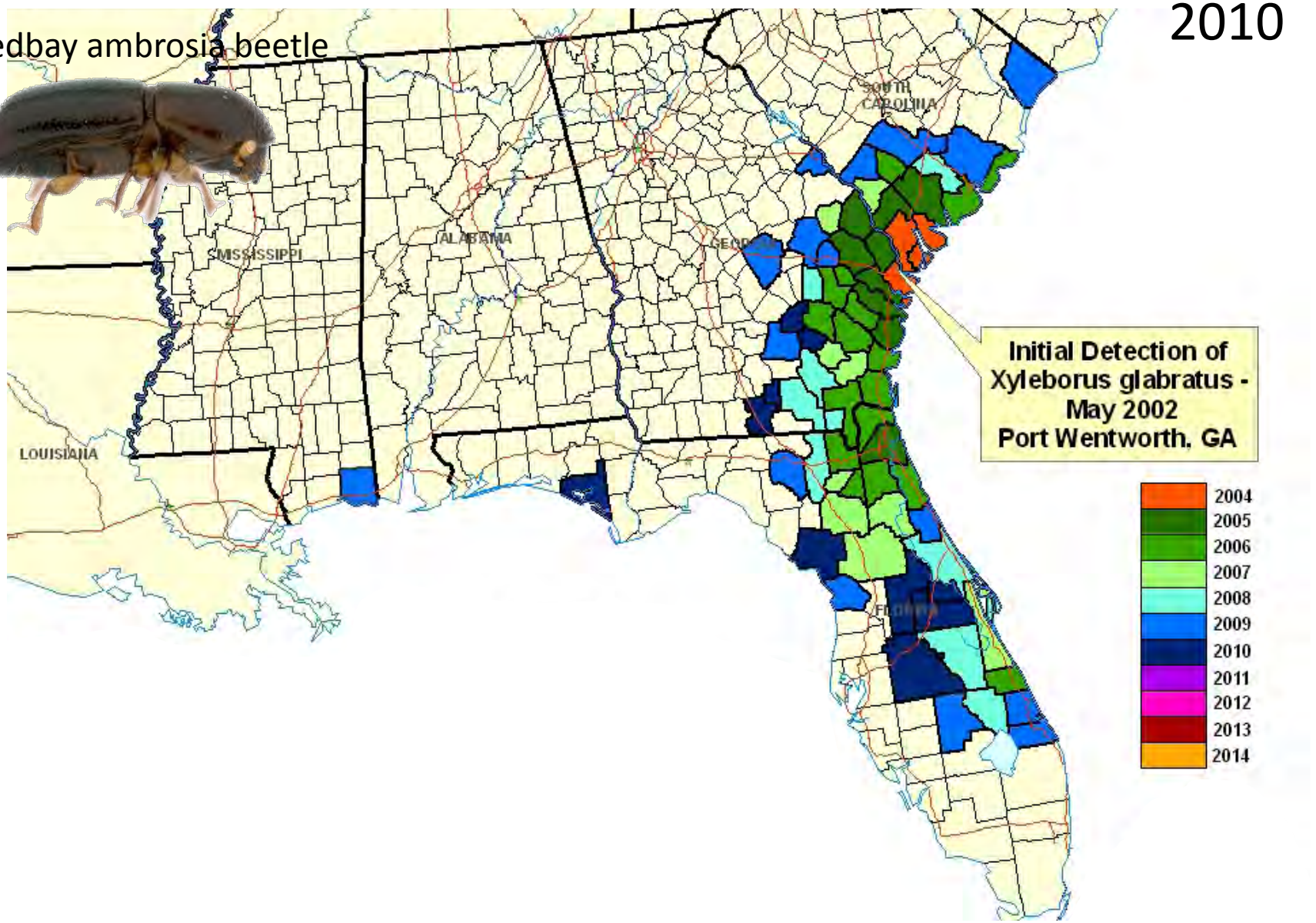
2009



For context…

Redbay ambrosia beetle

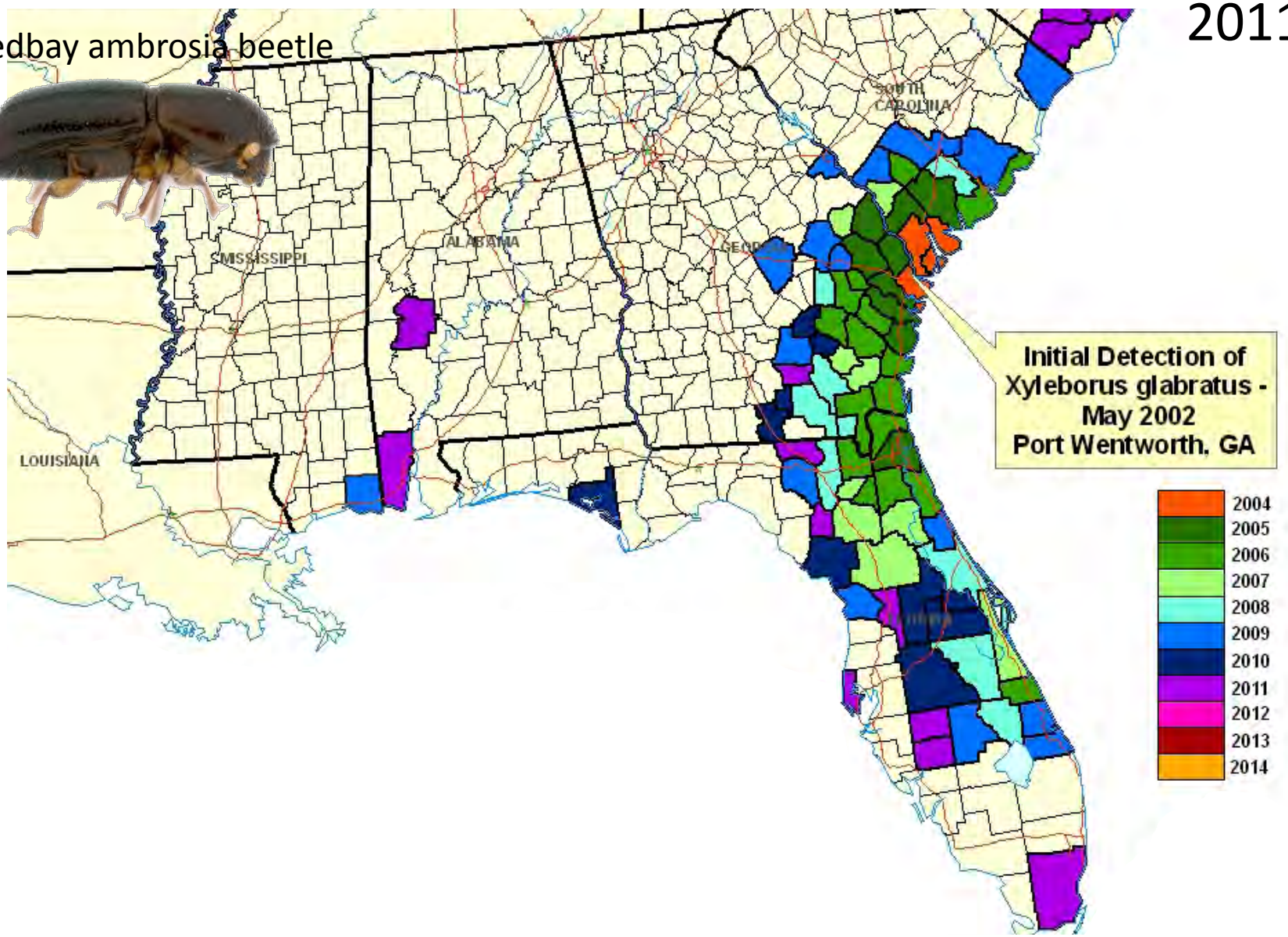
2010



For context…

Redbay ambrosia beetle

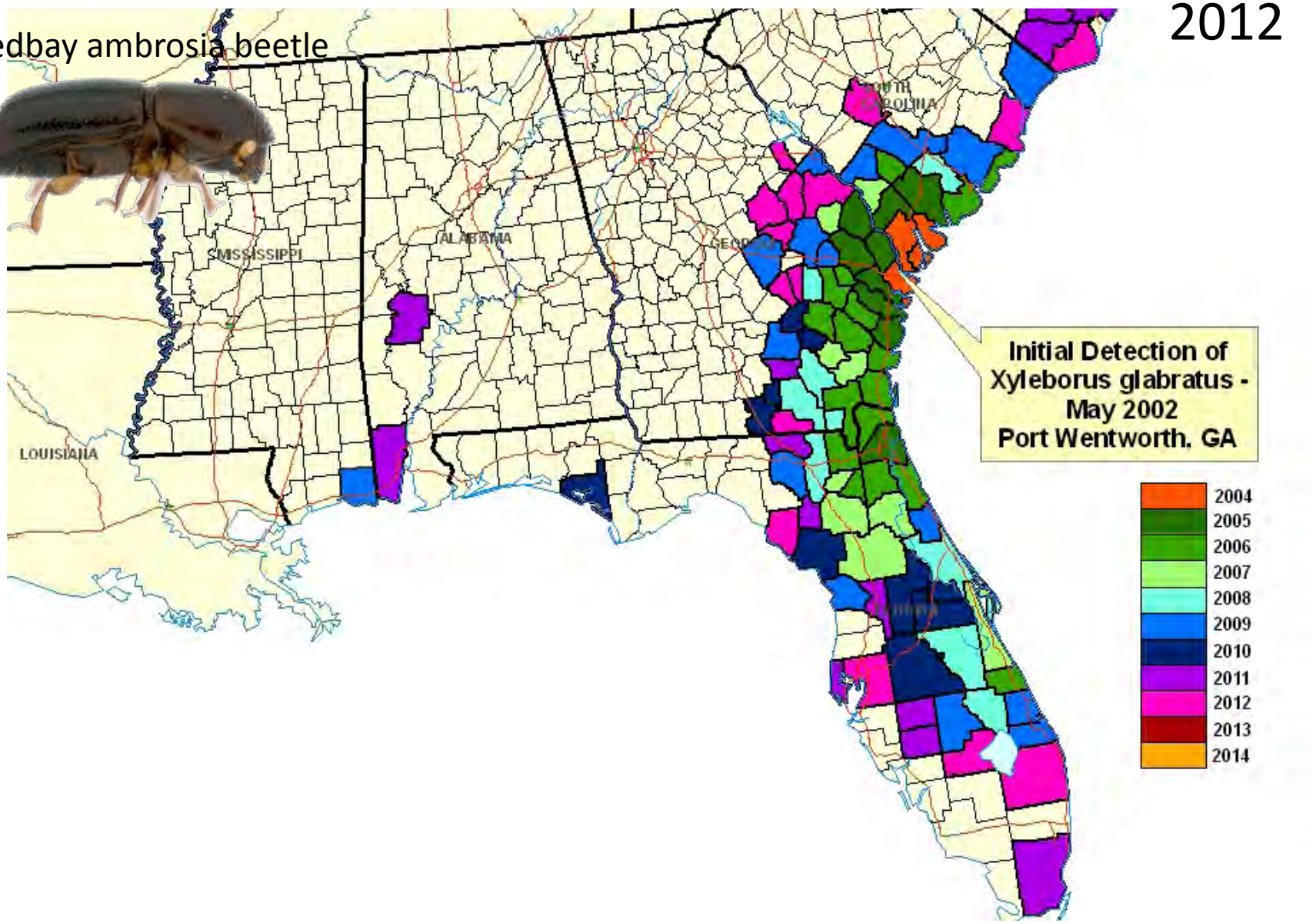
2011



For context…

Redbay ambrosia beetle

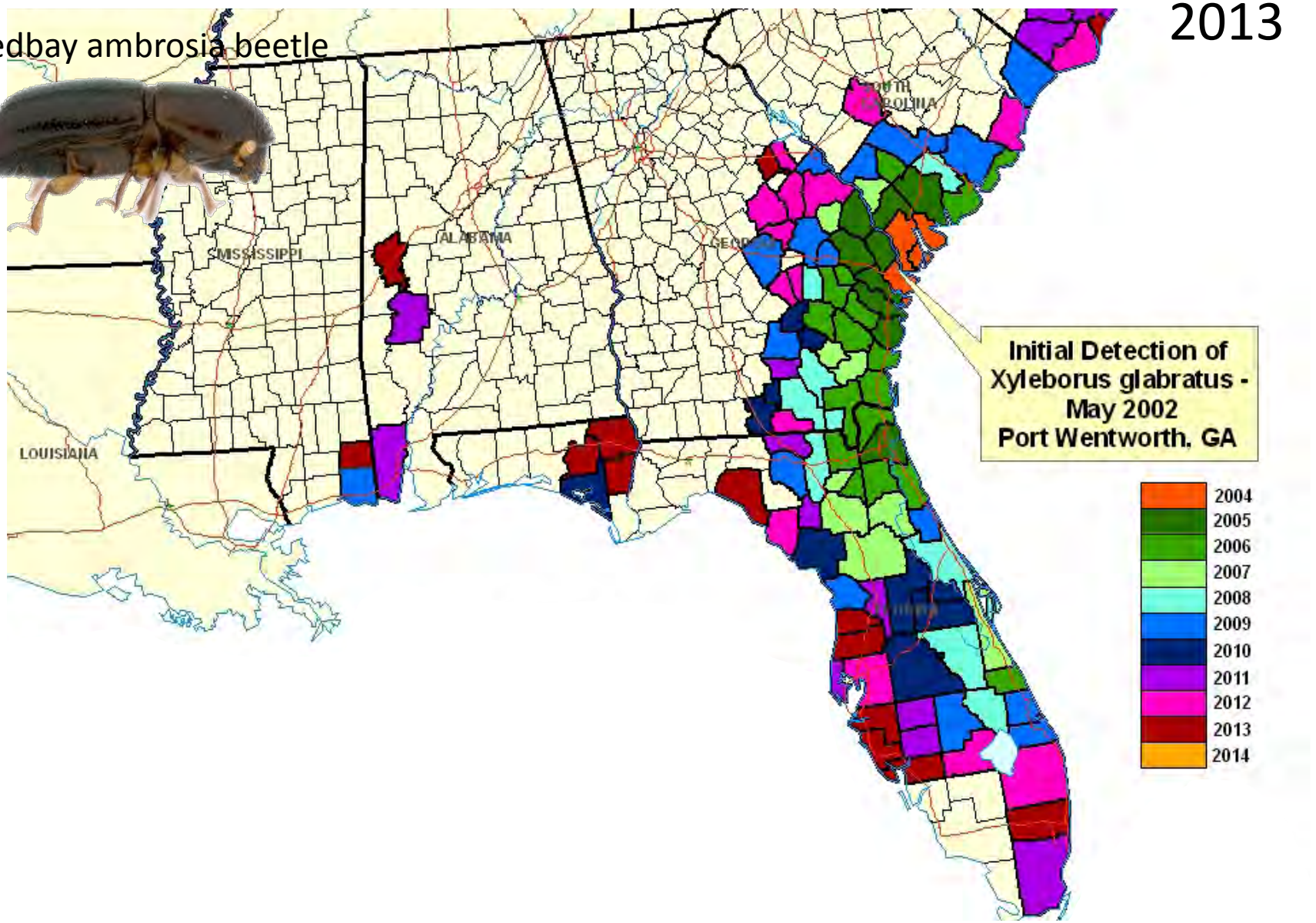
2012



For context…

Redbay ambrosia beetle

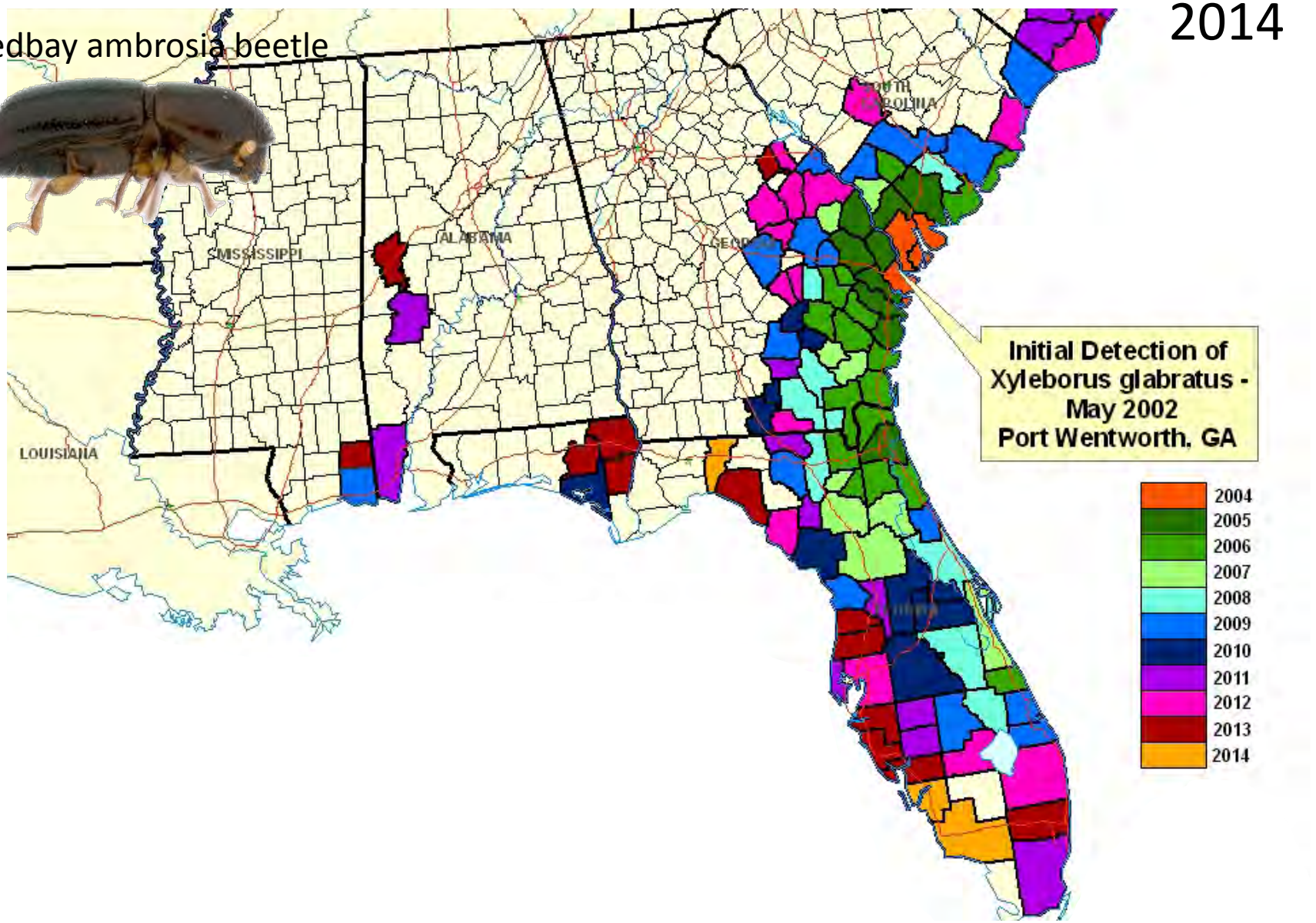
2013



For context…

Redbay ambrosia beetle

2014



But… most ambrosia beetles are harmless!

3,500 ambrosia beetles of which nothing is known…

Imagine a major pathogen of pines…

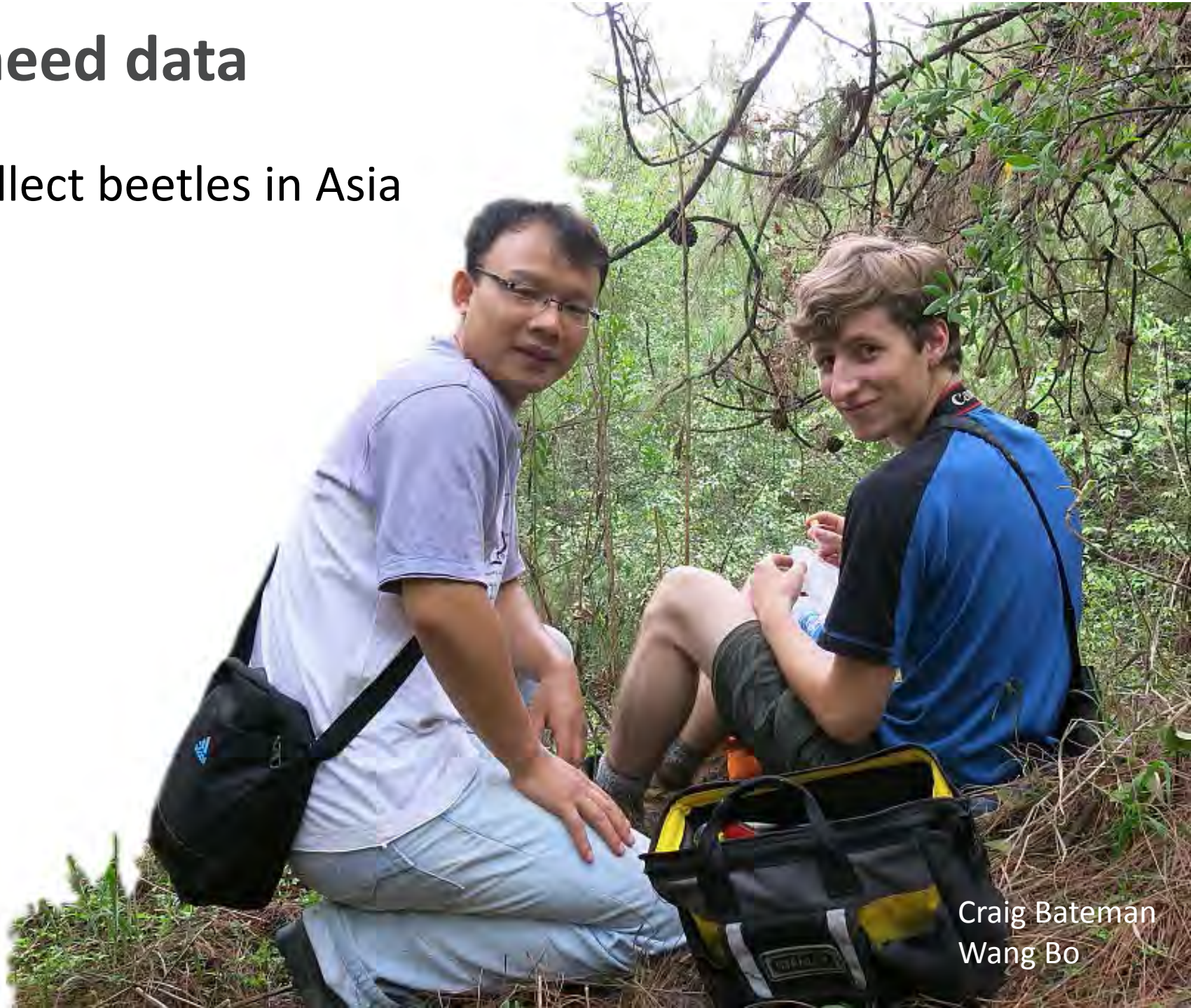
We need a decision-support tool

beetle-fungus:	In case of detection:
non-pathogenic	wait and see
weak pathogen	closely monitor
virulent pathogen	eradicate

…difficult decisions made easy

We need data

1. Collect beetles in Asia



Potential beetle carriers of fungal pathogens

Xyleborus pinicola, Tomicus minor, Ips chinensis

- Close associations to fungi
- Live in similar climate to the U.S.
- Specific to pines

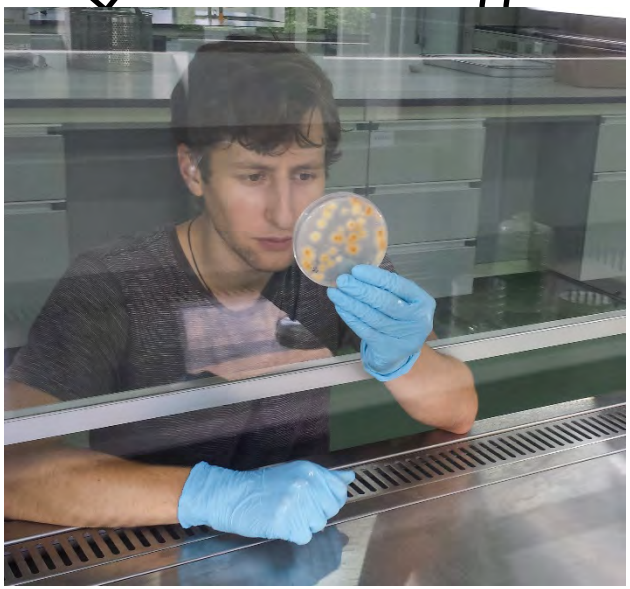
Specific beetle = specialized fungi
(Laurel wilt, Dutch elm disease,…)

Survey of potential pathogens

1. Collect beetles in Asia

Survey of potential pathogens

1. Collect beetles in Asia
2. Isolate fungi
3. Ship fungi to quarantine greenhouse in Florida
4. Test effect of fungi on American pines



Pathogen testing

1. Collect beetles in Asia
2. Isolate fungi
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5. After two months- **dead** or **alive**?

Pathogen testing

1. Collect beetles in Asia
2. Isolate fungi
3. Ship fungi to quarantine greenhouse in Florida
4. Test effect of fungi on American pines
5. After two months- dead or alive?

    -Further evaluation for ambiguous cases:

resin, cankers, needles

lesions

Results

Beetle	Country	Fungus
Ips chinensis	China	*Ophiostoma* sp.
		Ophiostoma ips
Tomicus minor	China	*Geosmithia* sp.
Xyleborus pinicola	Thailand	*Raffaelea* sp.
		Ophiostoma ips




Results

After 10 weeks… no tree mortality

No highly virulent pathogen!

Our test works

The approach is feasible

- Cost effective and easy

The test is robust

- Same test works with Dutch Elm Disease, Laurel Wilt…

This year…

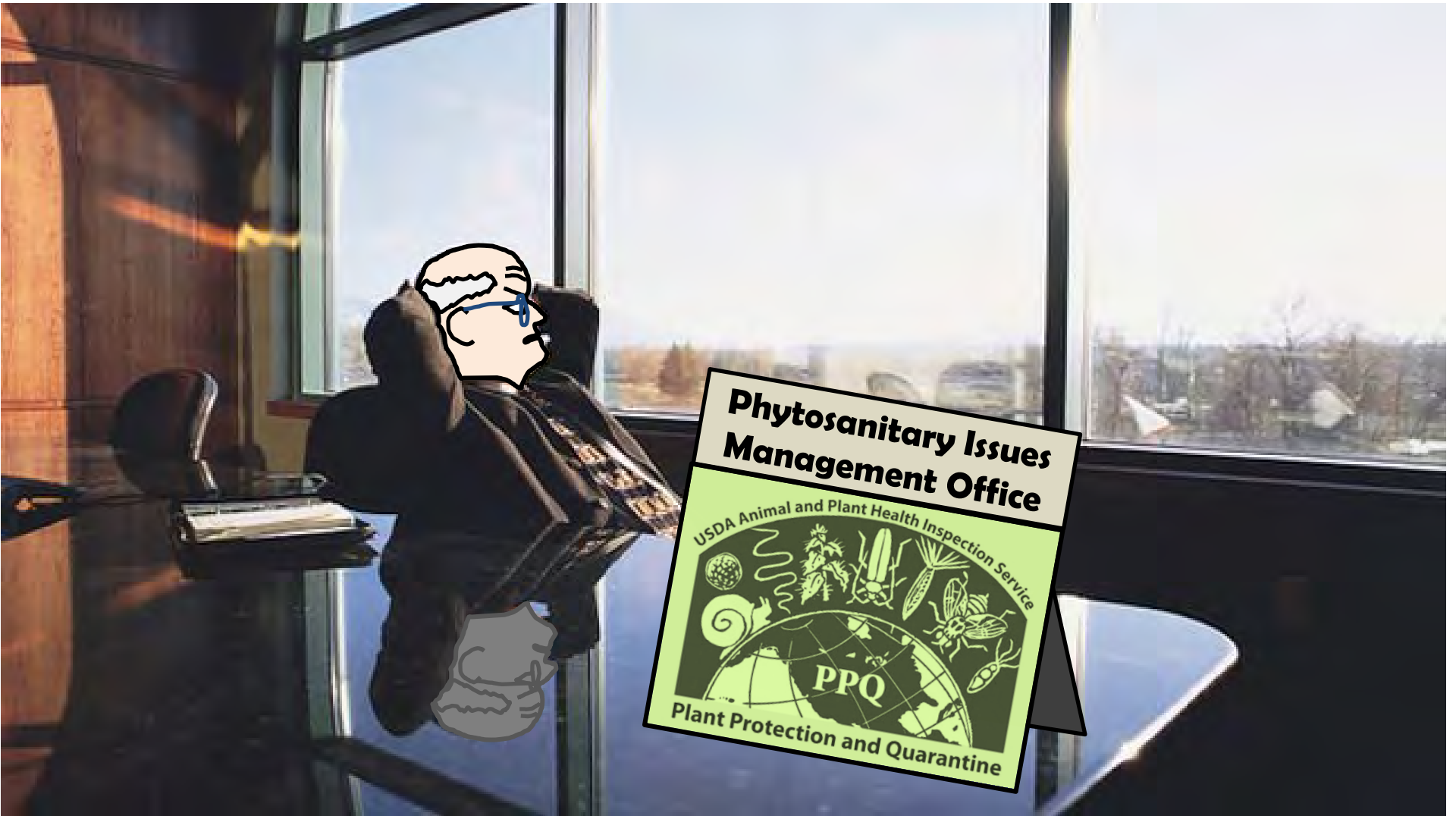
More pine specialists

Cyrtogenius sp.
Polygraphus sp.
Hylastes sp.

Oak specialists

Cyclorhipidion fukiensis
Webbia pabo
Platypus sp.

Imagine this is you…




I just received a distressing report…
Phytosanitary Issues Management Office
USDA Animal and Plant Health Inspection Service
PPQ
Plant Protection and Quarantine

Xyleborus pinicola

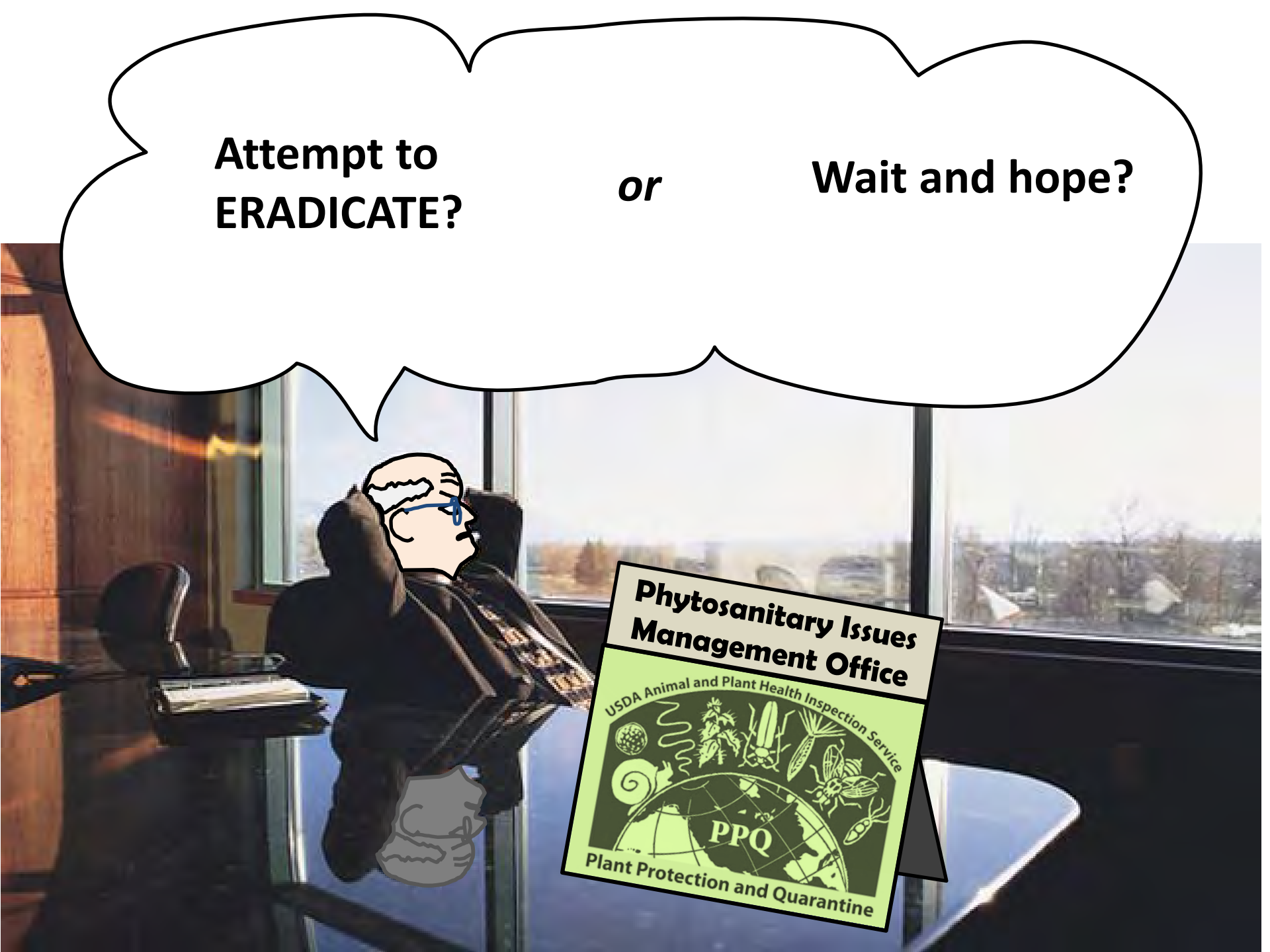
7 specimens trapped near port at Savannah, GA

Phytosanitary Issues Management Office

USDA Animal and Plant Health Inspection Service

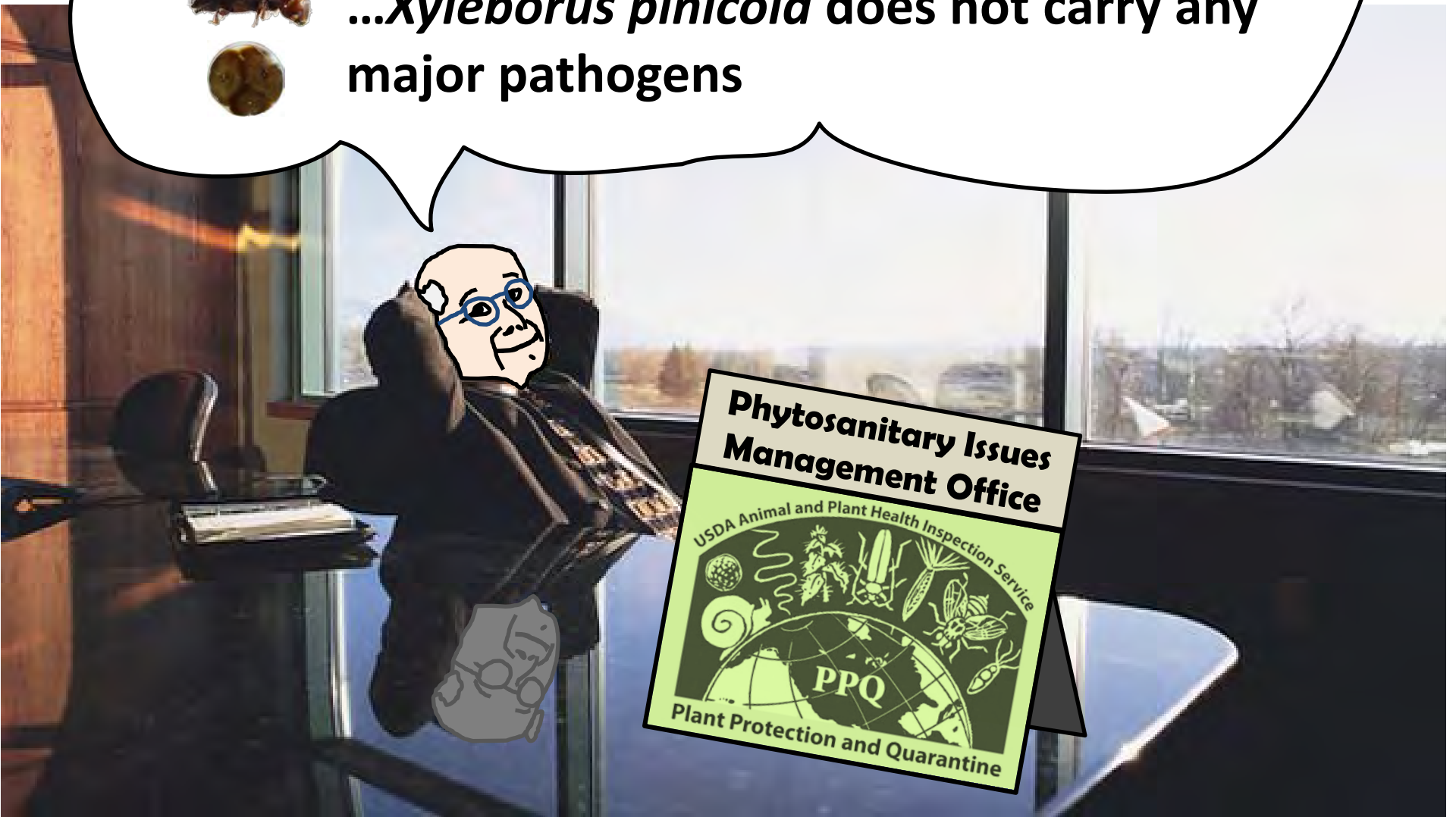
PPQ

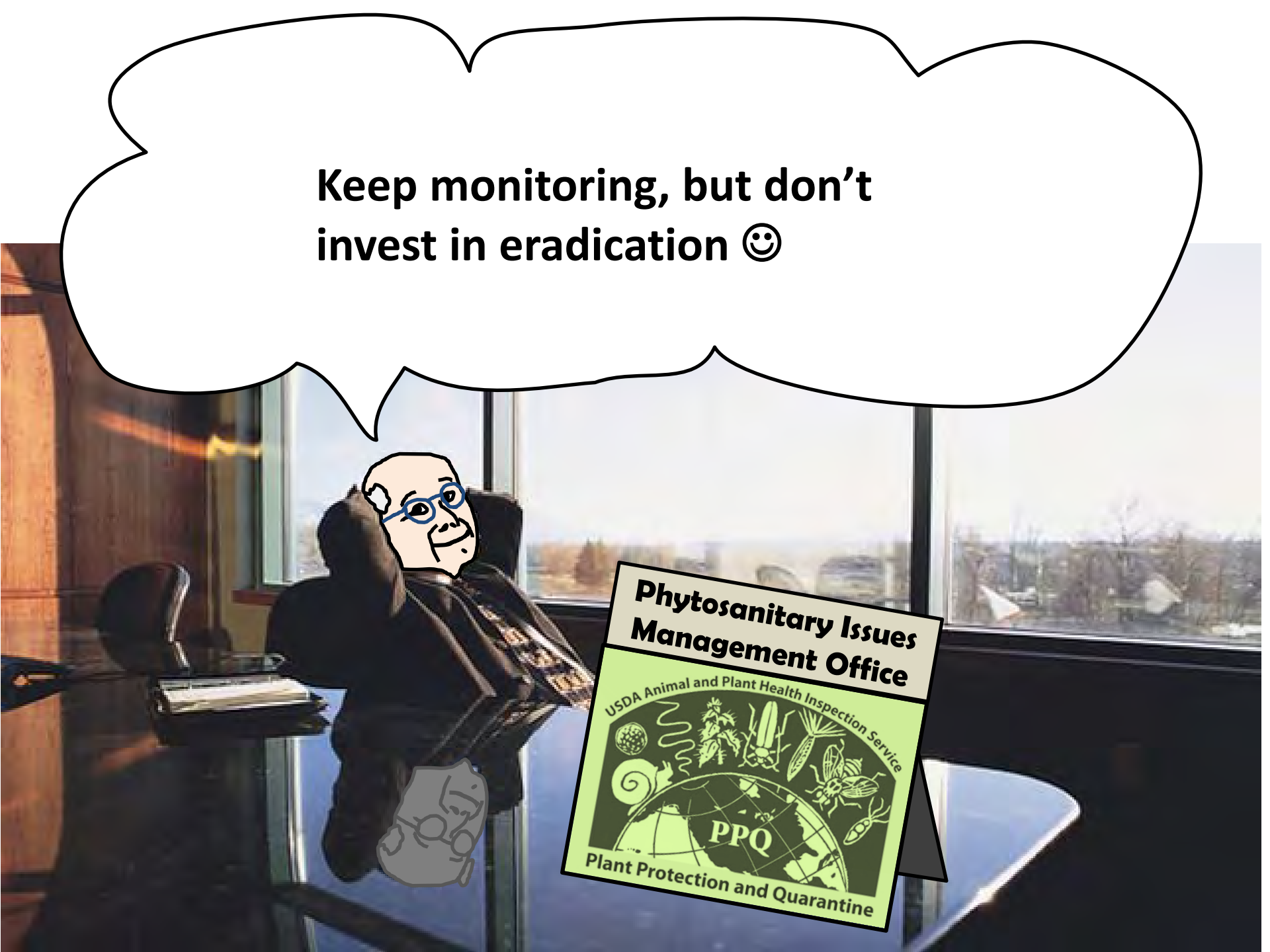
Plant Protection and Quarantine


Attempt to ERADICATE?
or
Wait and hope?
Phytosanitary Issues Management Office
USDA Animal and Plant Health Inspection Service
PPQ
Plant Protection and Quarantine

BUT WAIT… we have the decision support tool

…*Xyleborus pinicola* does not carry any major pathogens




Keep monitoring, but don't invest in eradication ☺
Phytosanitary Issues Management Office
USDA Animal and Plant Health Inspection Service
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Plant Protection and Quarantine

Thank you!

Emerging threats to forests research group
Jiri Hulcr, Damien Adams, Jason Smith

Hulcr and Smith labs
Li You, Adam Black, Martin Kostovcik,
Caroline Storer, Tyler Dreaden, Marc Hughes

Collaborators
Wang Bo (Xishuangbanna Trop. Bot. Gardens, CAS)
Jianghua Sun (Institute of Zoology, CAS)
Wang Zhiliang (Institute of Zoology, CAS)
Wisut Sittichaya (Prince of Songkla University)