

Firewood and the Forest Pest Multiverse: the influence of time on perceptions of regulation and detection

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Firewood and the Forest Pest Multiverse:

the influence of time on perceptions of regulation and detection

Life imitates Art

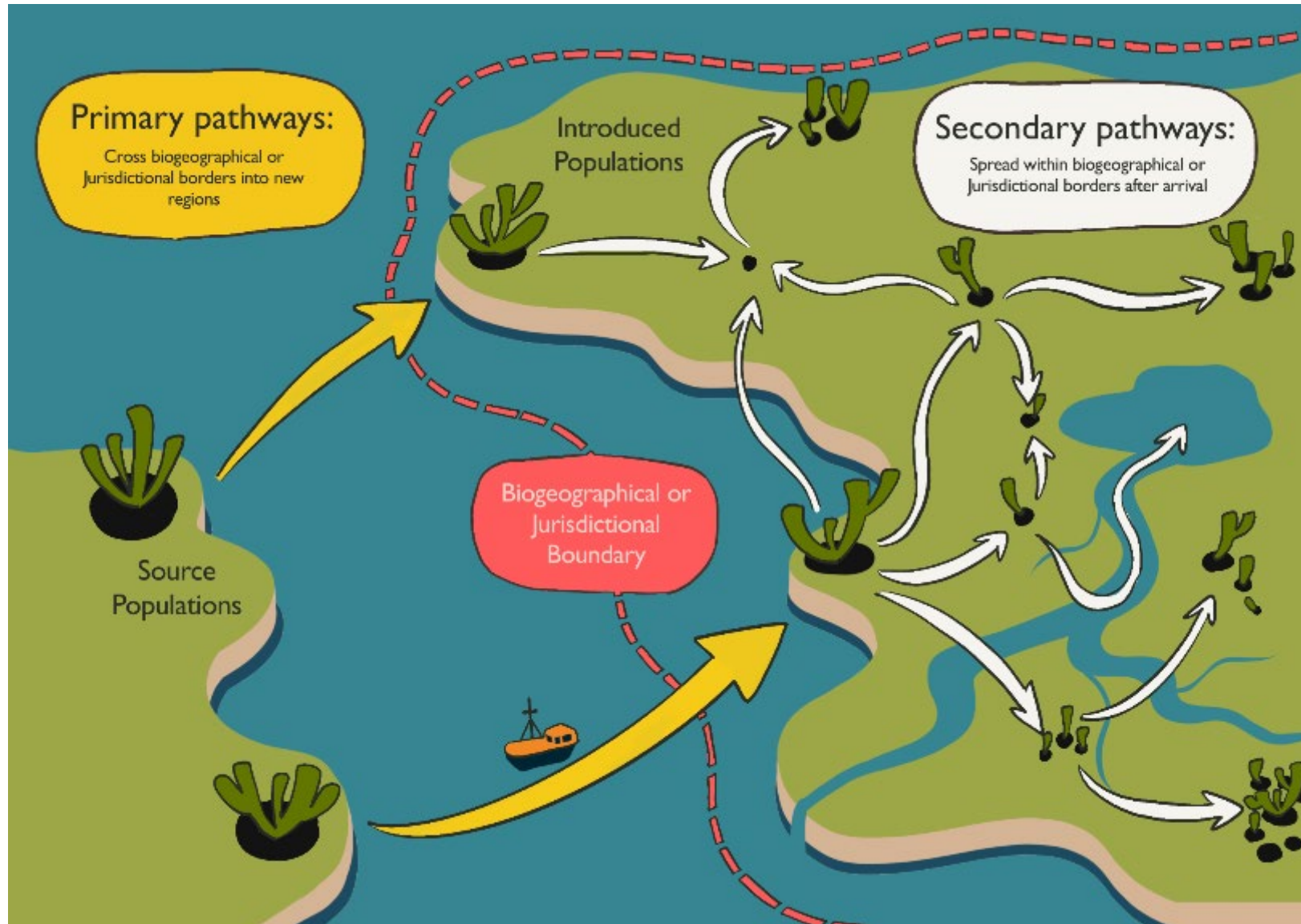
- **Bill and Ted's Excellent Adventure**
 - Time travel with single timeline, no multiverse
- **Back to the Future**, some **Star Trek**, Marvel's **Loki** Sacred Timeline, **About Time**, **Edge of Tomorrow**
 - Time travel to the past, with some multiversal or "do-over" results
- **Marvel Cinematic Universe**
 - Time travel as well as multiverses upon multiverses

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the influence of time on perceptions of regulation and detection

Life imitates Art

- **Bill and Ted's Excellent Adventure**
 - Time travel with single timeline, no multiverse
 - **One group's invasive species management in one area, over time.**
- **Back to the Future**, some **Star Trek**, Marvel's **Loki** Sacred Timeline, **About Time**, **Edge of Tomorrow**
 - Time travel to the past, with some multiversal or "do-over" results
 - **Metaphors of learning from the experiences, successes, and failures of others elsewhere.**
- **Marvel Cinematic Universe**
 - Time travel as well as multiverses upon multiverses
 - **Multiverses can be thought of as like statistical models, e.g. a Monte Carlo model.**
 - **Unlike the MCU's multiverses, real life cannot run the counterfactual**



Primary and secondary invasion pathways: why the distinction matters

Figure 2. Conceptual diagram illustrating the distinction between primary and secondary pathways of non-native species movement... (in press, see preprint, <https://doi.org/10.32942/X2KQ2W>)

Let's review quarantines, briefly

- External (exterior) quarantines:
 - Keep things out of area you want to protect
 - Greek for 40 days, e.g. keeping a boat, that might contain diseased sailors, offshore for 40 days
- Internal (interior) quarantines
 - Keep known problem in a contained area
 - Like the famous plague village of Eyam
 - Sad history such as “Leper’s colonies”

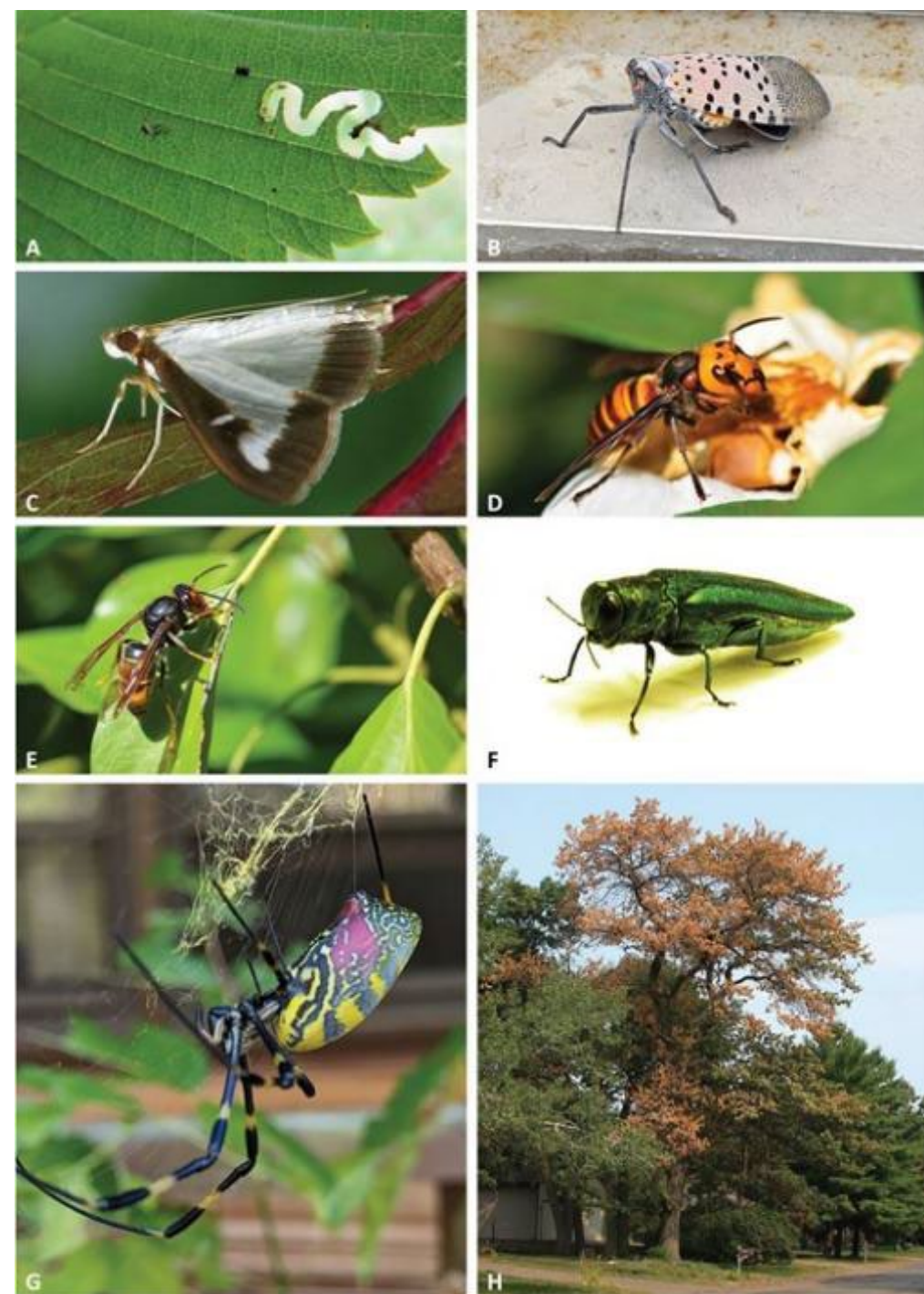


Time between invasive forest pest establishment and detection depends on many factors:

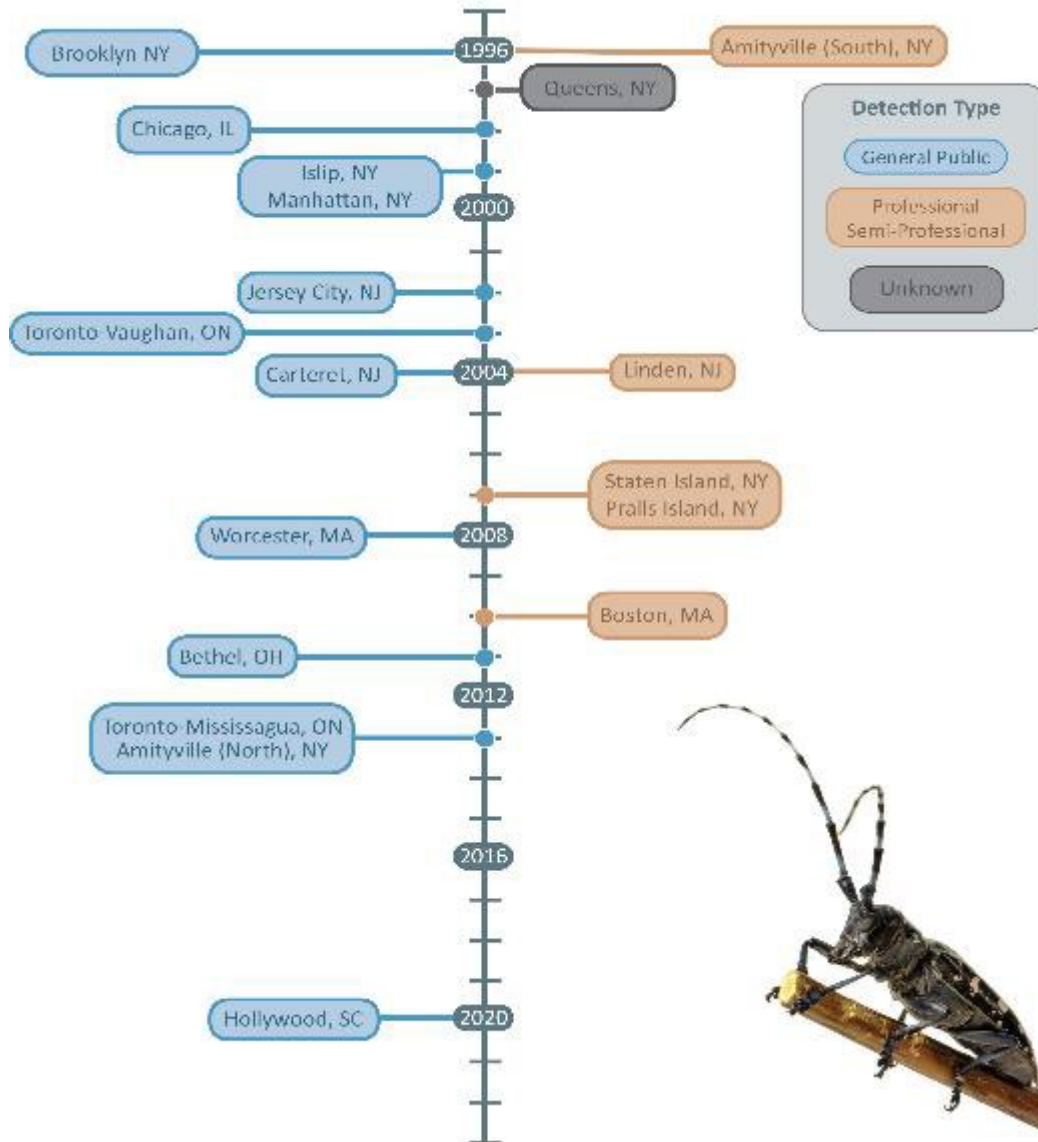
- Visual distinctiveness of pest or damage
- Public engagement on detection
- Damage to high value trees
- Effective lures
- *Search area*

Catching invasives with curiosity: the importance of passive biosecurity surveillance systems for invasive forest pest detection

Fig. 3. Conspicuous invasive species first identified by members of the general public or off-duty professionals. <https://doi.org/10.1093/ee/nvae082>



TIMELINE OF NORTH AMERICAN ALB DETECTIONS



Case study: Asian longhorned beetle

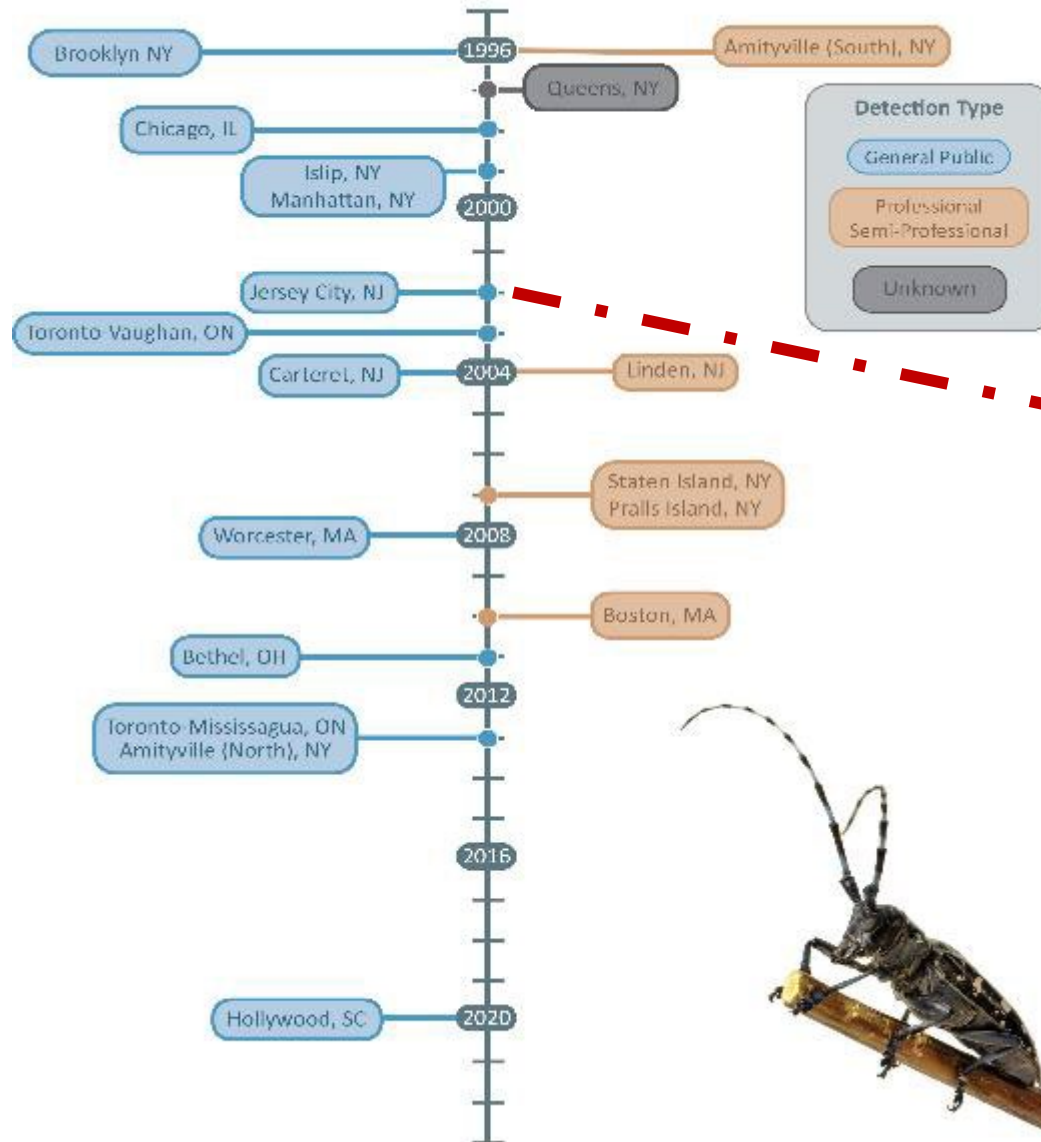
- Visual distinctiveness of pest or damage ☒
- Public engagement on detection ☒
- Damage to high value trees ☒
- Effective lures ✗
- Search area ✗

Catching invasives with curiosity: the importance of passive biosecurity surveillance systems for invasive forest pest detection

Fig. 2. Timeline of Asian longhorned beetle detections in North America indicating the level of professional training of the first detector. <https://doi.org/10.1093/ee/nvae082>



TIMELINE OF NORTH AMERICAN ALB DETECTIONS



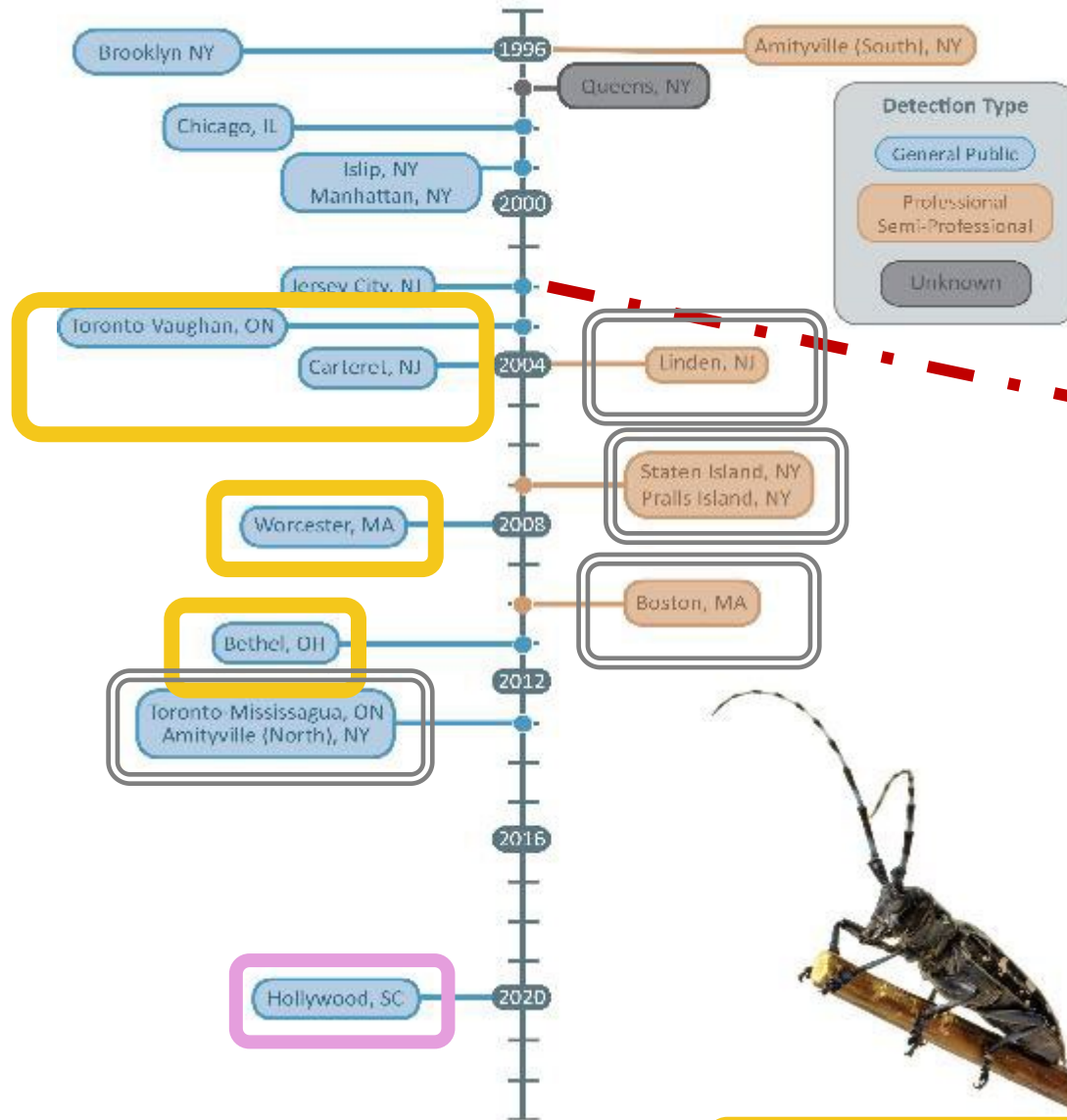
2002 marks full implementation of ISPM 15, which serves as **an exterior quarantine**. It is a global regulation mandating proper treatment of wood packaging materials used in international trade.

Catching invasives with curiosity: the importance of passive biosecurity surveillance systems for invasive forest pest detection

Fig. 2. Timeline of Asian longhorned beetle detections in North America indicating the level of professional training of the first detector. <https://doi.org/10.1093/ee/nvae082>



TIMELINE OF NORTH AMERICAN ALB DETECTIONS



Type of Detection Event



Primary



Secondary or contiguous



Likely secondary

2002 marks full implementation of ISPM 15, which serves as **an exterior quarantine**. It is a global regulation mandating proper treatment of wood packaging materials used in international trade.

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Detection lag research shows Primary event **establishments** pre-date ISPM 15

Perception therefore skewed without time

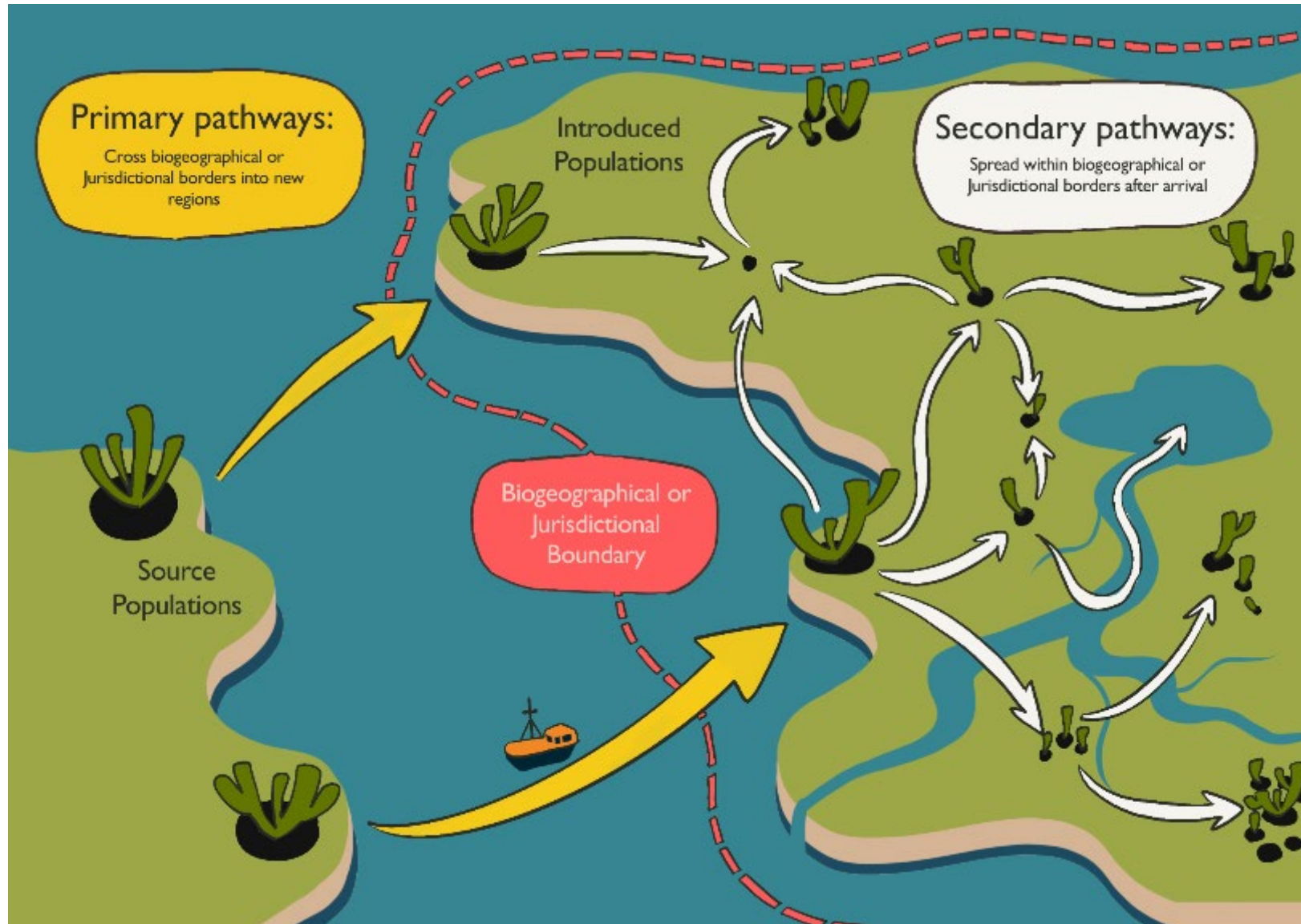
- External quarantines can look ineffective due to detection lags
 - **Primary Spread Case study: ISPM 15** (global wood packaging)
 - Can look like it kept letting ALB enter- but evidence is strong that's a detection lag bias.
 - Perfection is never achievable; “maybe one” got in is a lot better than eleven
 - Change over time is meaningful



Exploring pest mitigation research and management associated with the global wood packaging supply chain: What and where are the weak links?

Fig. 1 Wood packaging material (WPM) is the term for solid wood products used to aid in the transportation, protection, or containment of commodities.

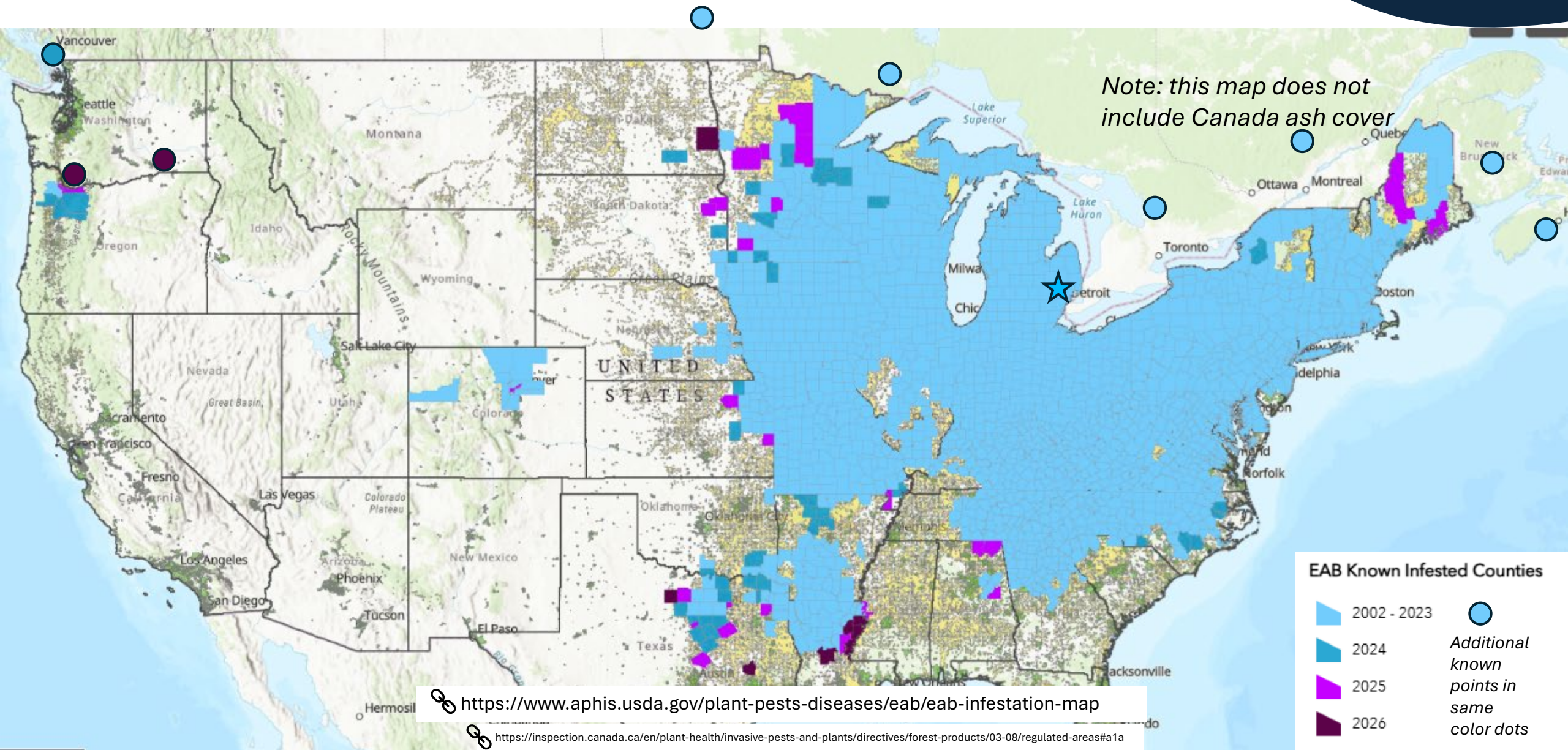
<https://doi.org/10.1007/s10530-023-03058-8>



Primary and secondary invasion pathways: why the distinction matters

Figure 2. Conceptual diagram illustrating the distinction between primary and secondary pathways of non-native species movement... (in press, see preprint, <https://doi.org/10.32942/X2KQ2W>)

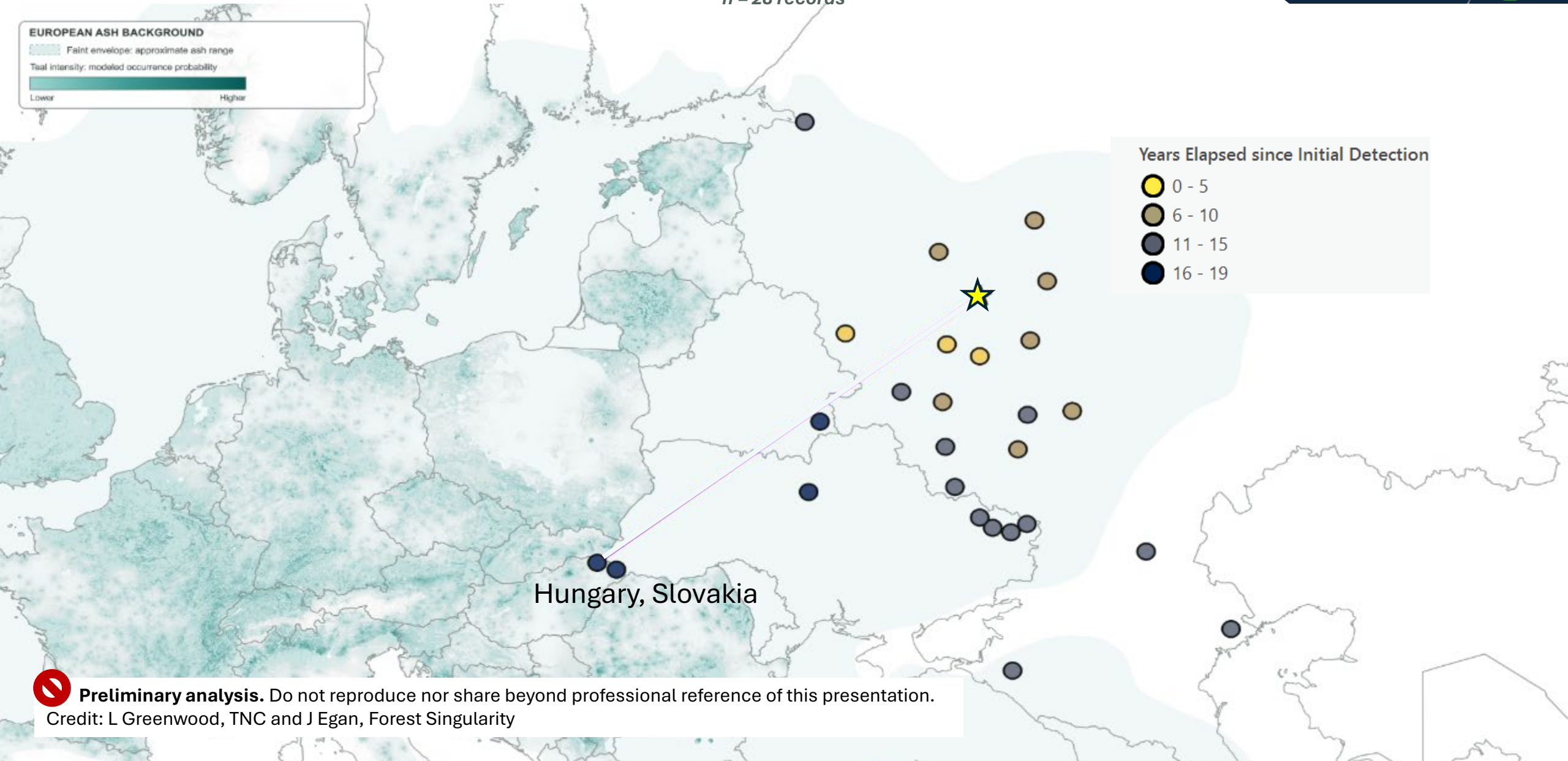
EAB in the contiguous US and Canada



Recorded EAB Detections for Europe and European Russia, 2007-2026

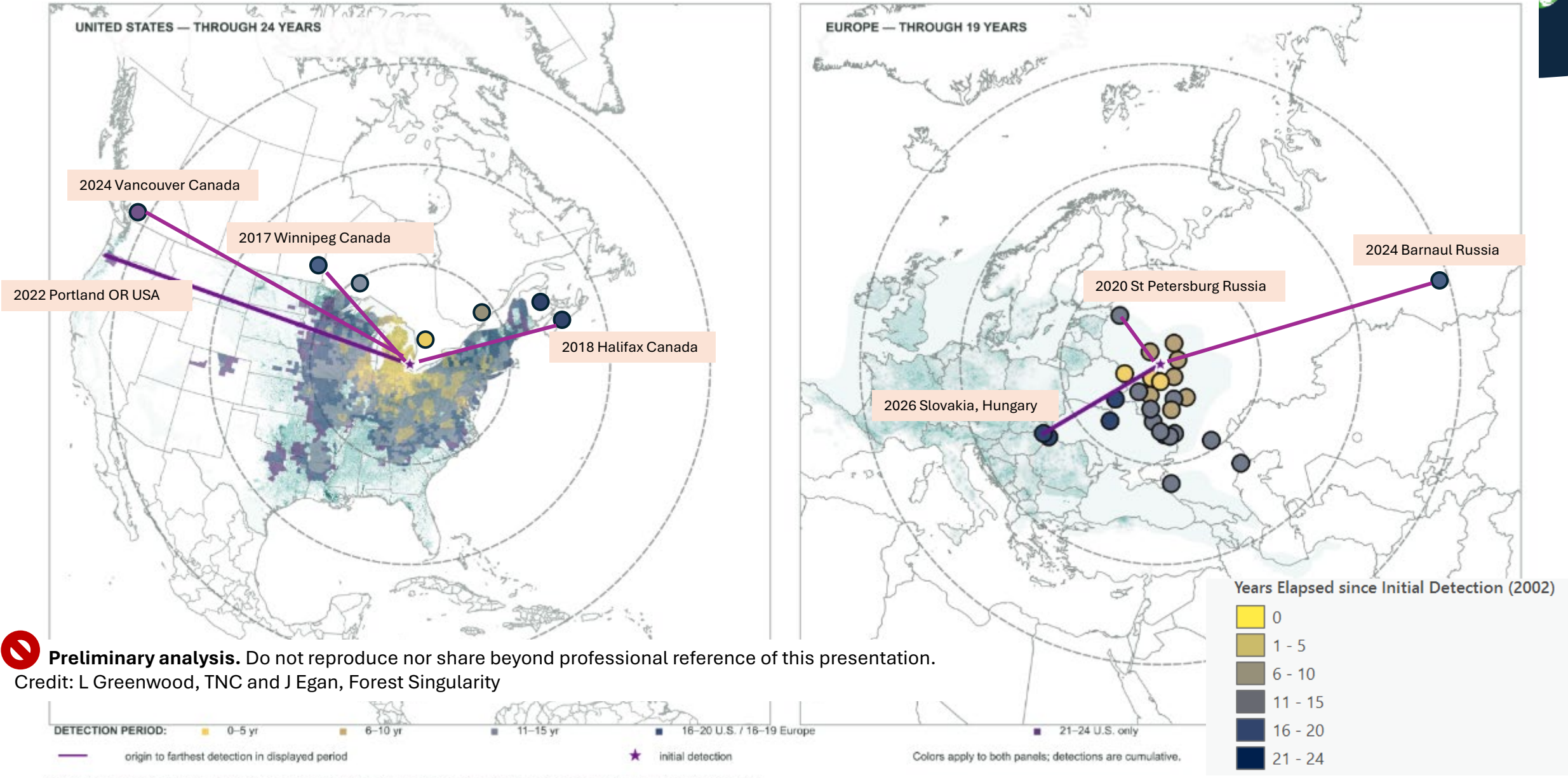
source: European and Mediterranean Plant Protection Organization (EPPO) Global Database and Reporting Service

n = 28 records

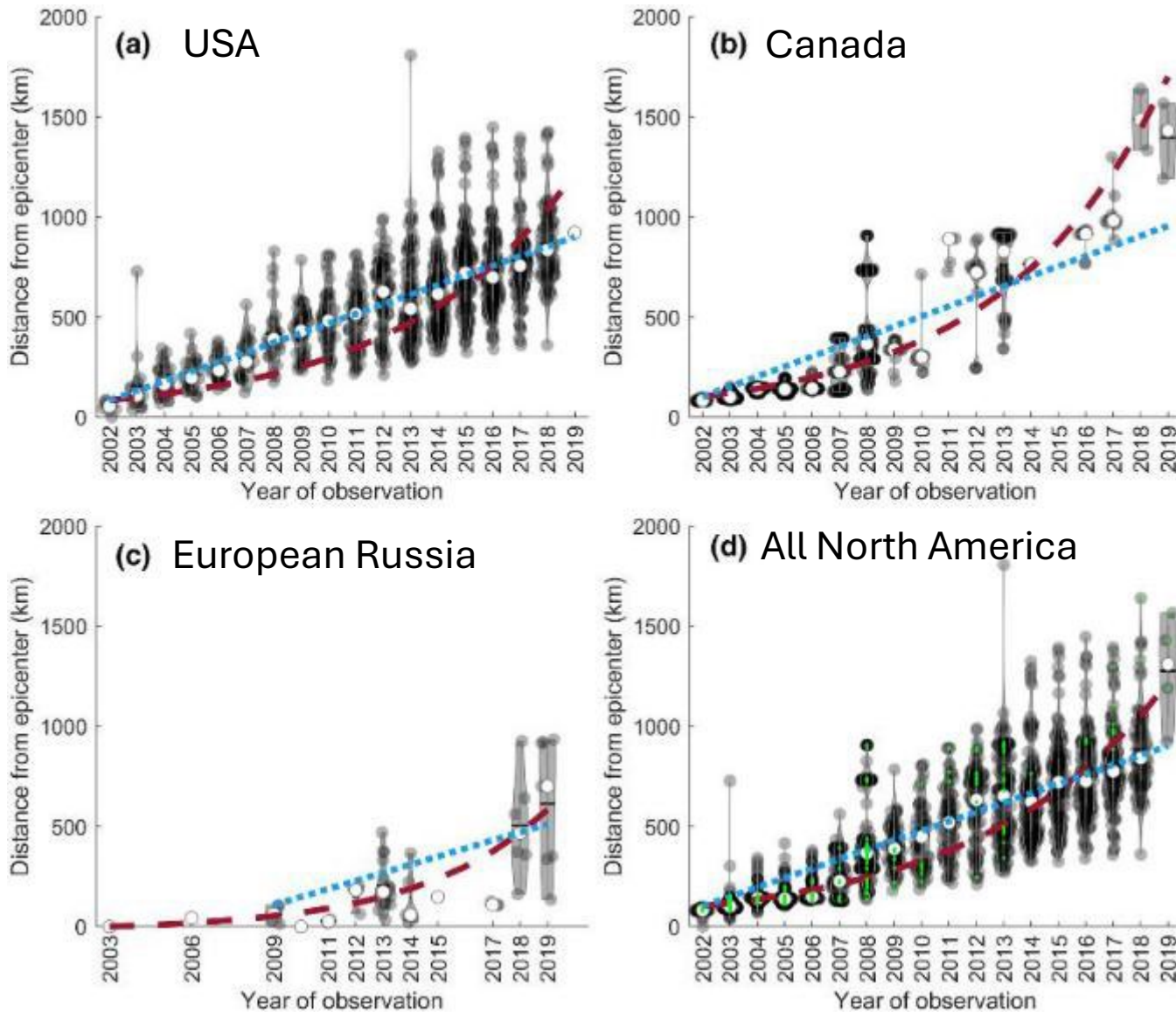


Recorded EAB Detections for Europe, European Russia and United States, 2002-2026

n = 1,535 records



 **Preliminary analysis.** Do not reproduce nor share beyond professional reference of this presentation.
Credit: L Greenwood, TNC and J Egan, Forest Singularity

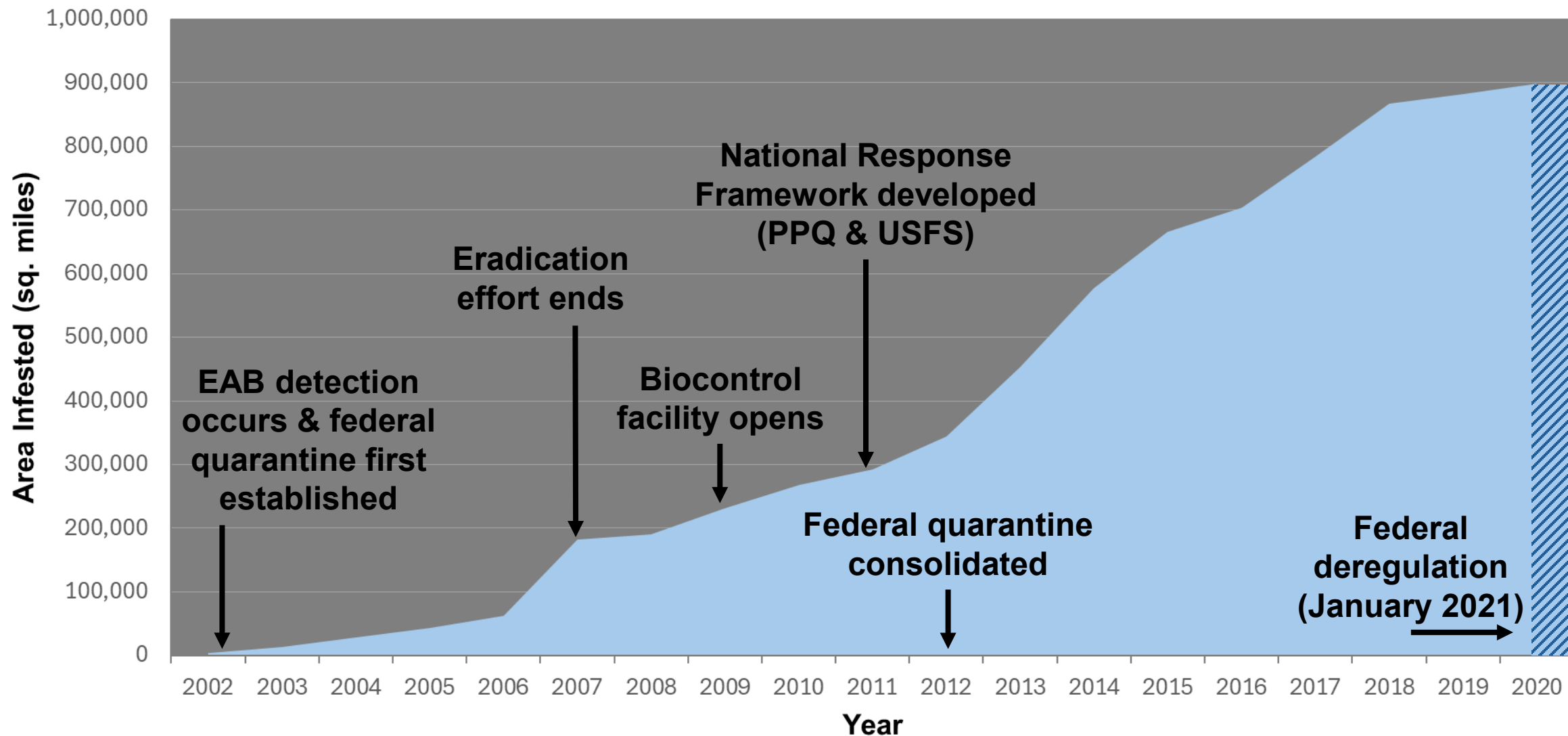


← Note: this analysis is through 2019

Predicting the potential for spread of emerald ash borer (*Agrilus planipennis*) in Great Britain: What can we learn from other affected areas? (Webb 2021)

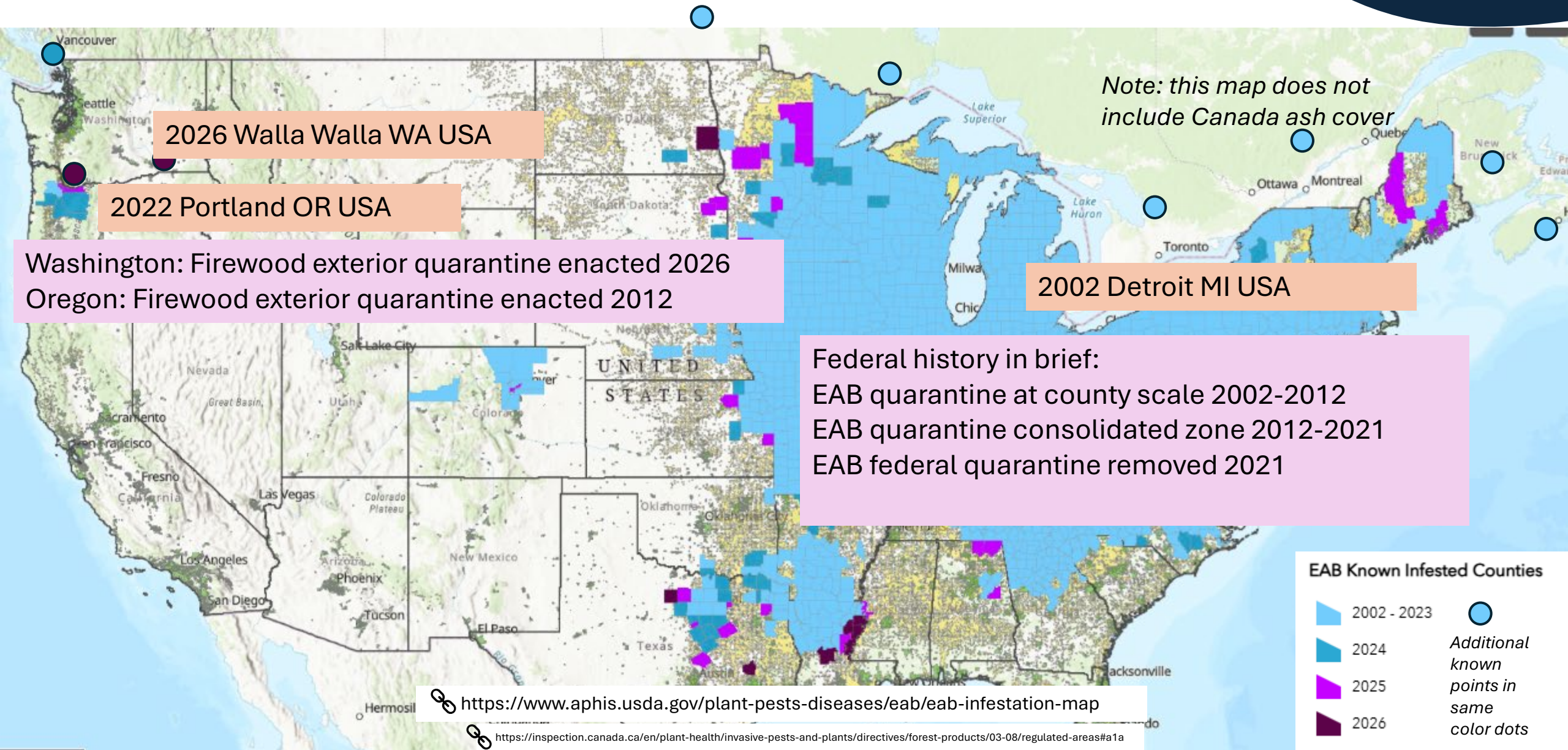
Figure 2. Relationship between reported year of infestation by emerald ash borer and distance from the reported epicentre of the outbreaks in (a) the United States, (b) Canada, (c) European Russia and (d) combined data for North America.

USA Actions and Regulatory Timeline Highlights atop Cumulative Area Infested by Emerald Ash Borer in the United States, 2002-2020

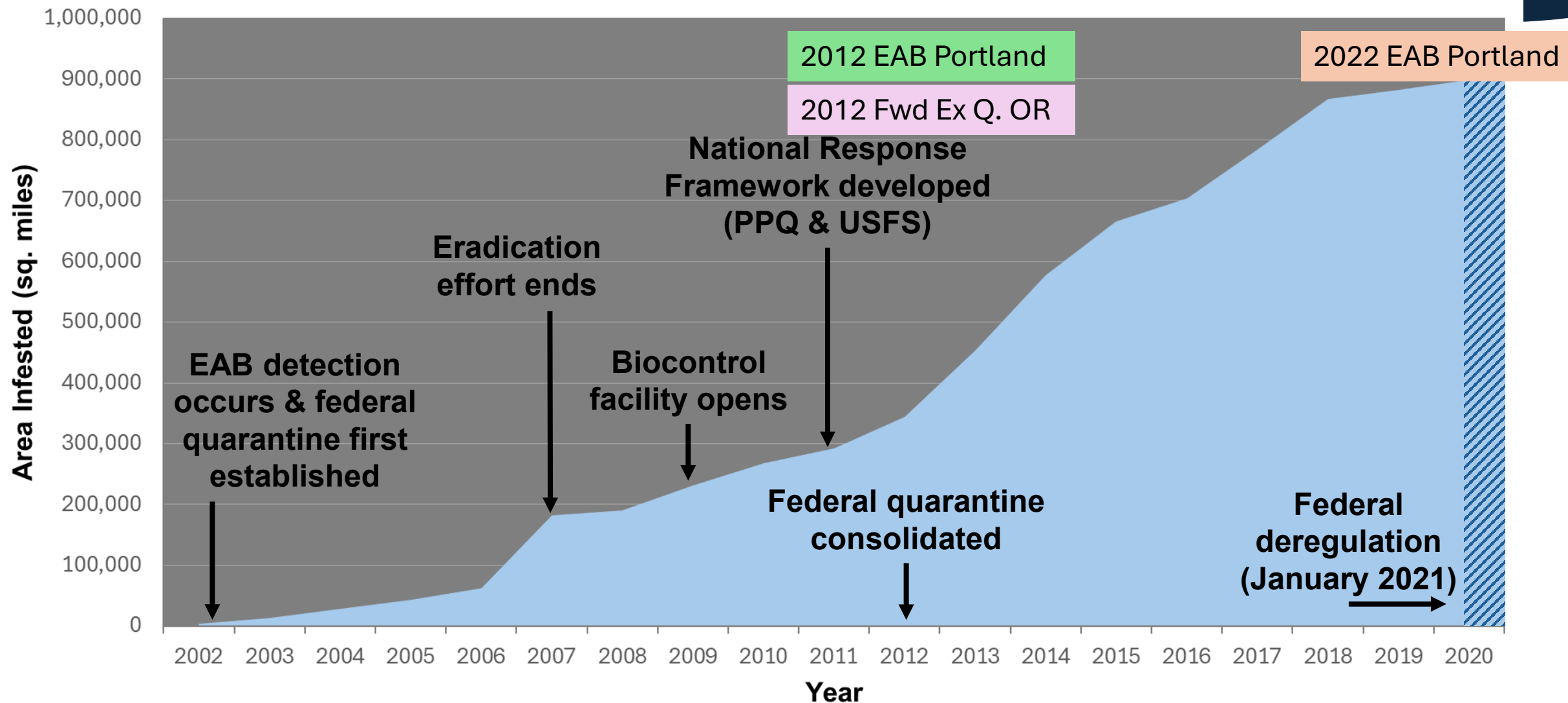


Modified from graph courtesy of N.W. Siegart, USFS unpublished data

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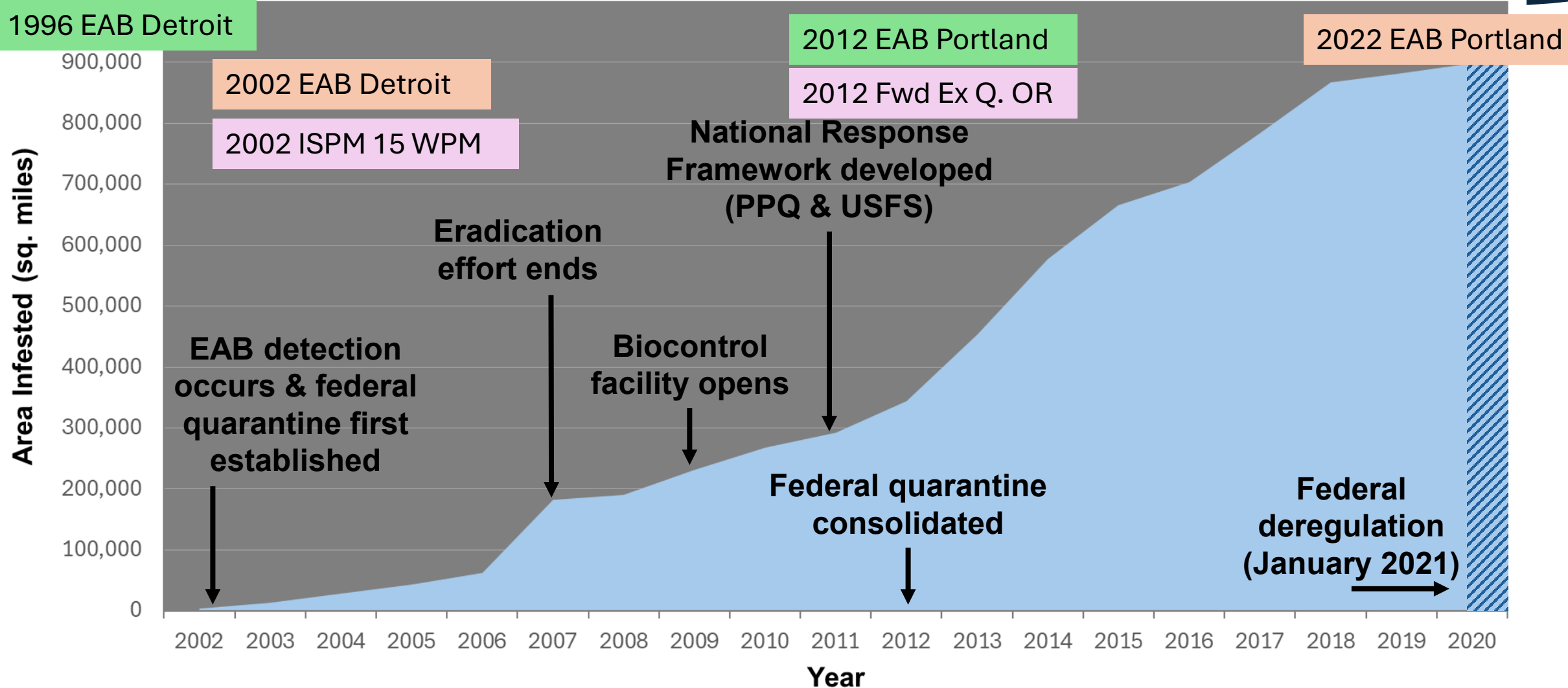


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Perception therefore skewed without time

- **Quarantines can look ineffective due to detection lags**
 - **Primary Spread Case study: ISPM 15** (global wood packaging)
 - Can look like it kept letting ALB enter- but evidence is strong that's a detection lag bias.
 - Perfection is never achievable; “maybe one” is a lot better than eleven
 - Change over time is meaningful
 - **Secondary Spread Case study: emerald ash borer in the USA**
 - **Interior and exterior quarantines can look like they kept letting EAB move-** but evidence is strong that's partially a detection lag bias.
 - Perfection is never achievable; **reduction of propagule pressure saves gobs of money**
 - *Suggested additional reading:*
 - *Hudgins et al 2024 Spread management priorities to limit emerald ash borer (Agrilus planipennis) impacts on United States street trees* <https://doi.org/10.1111/csp2.13087>
 - *Hudgins et al 2022 Hotspots of pest-induced US urban tree death, 2020–2050* <https://doi.org/10.1111/1365-2664.14141>

Discussion Points

- **Accept and Communicate Reality**
 - **Primary and secondary spread can be mitigated.**
 - Perfection is never achievable
 - Improvements over time are meaningful ecologically, environmentally, and financially
 - **Eradication and management of spread are deeply impacted by detection lags**
 - “Early detection” can be misleading – is 5 years early? Is 10? Earlier than what?
 - Often, detection lag for both primary and secondary is 10 years or more.
- **Professional partnerships and embracing reality enable the best possible forest pest multiverse**
 - Be like **Bill and Ted’s Excellent Adventure** at each local level
 - You are Tom Cruise in **Edge of Tomorrow** if professional communities learn from every success and every mistake and tries again, every time, to do better
 - Make data on negative data, frustratingly flawed efforts, and other challenges public and accessible
 - **Multiverses can be thought of as like statistical models, e.g. a Monte Carlo model.**
 - **Real life cannot run the counterfactual. All models are wrong, but some models are useful.**



Thank you!

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Joel Egan for data analysis and map co-development.

Nathan Siegert for consultation and graph sharing.

Please reach out.

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