Department
for Environment
Food & Rural Affairs

# Tick tock, pest clock: Time matters in PRA

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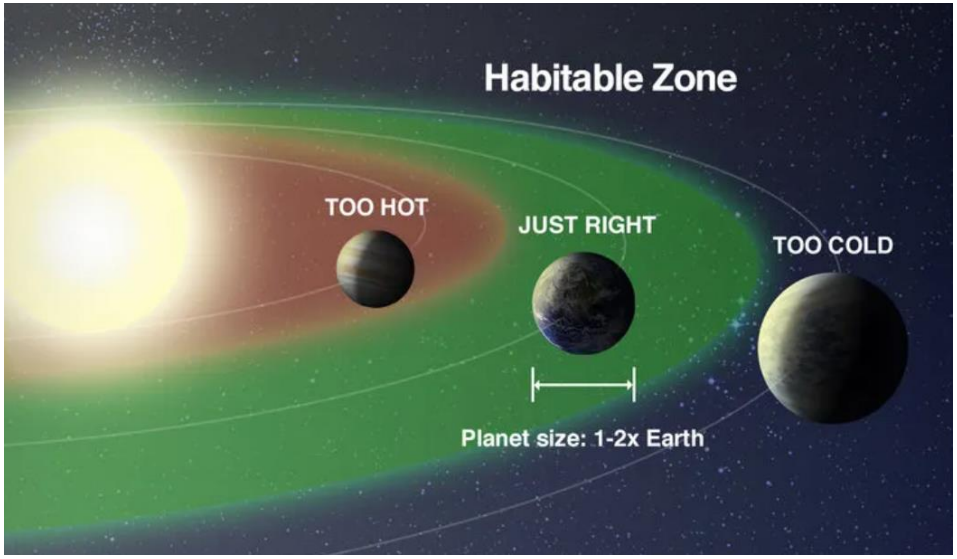
# The Goldilocks Principle

- The "Goldilocks zone“ is the region around a star where conditions are "just right" for liquid water to exist on the planet's surface




- Goldilocks economy: economy growing not too fast to cause inflation, not too slow to cause recession
- Goldilocks reading level: Books that are not too hard, not too easy, but just right for a student’s reading ability

Image: https://aerospacelectures.com/

# Is there a Goldilocks time to conduct a PRA?

**Too Early**

- Assessment based on very little information
- May lead to over- or under-estimation of risk
- Resources might be spent on threats that would never materialize
- Breaches IPPC principle of necessity

**Too Late**

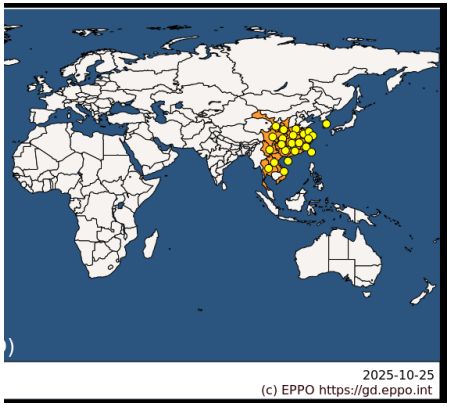
- The pest has already established and become widespread
- Risk mitigation becomes more costly and less effective

**Just Right** (Goldilocks timing)

- Enough data is available to make informed, evidence-based decisions
- Measures are justified
- Measures have minimal impact providing appropriate level of protection

# Too early: *Anoplophora horsfieldii*

- *Anoplophora horsfieldii* yellow banded longhorn beetle
- Native to SE Asia; came to attention 2019 when detected in South Korea in urban area between docks and airport
- Exit holes detected 2022 in *Celtis sinensis,* other hosts include *Citrus, Quercus, Ulmus*
- Given known risks from *A. glabripennis* & *A. chinensis* was cause for concern
- Insufficient information to do PRA; lack of information on many aspects of the biology and of damage caused
- Koreans studying the pest; may do PRA for EPPO region once studies from Korea published
- Added to EPPO Alert List 2023



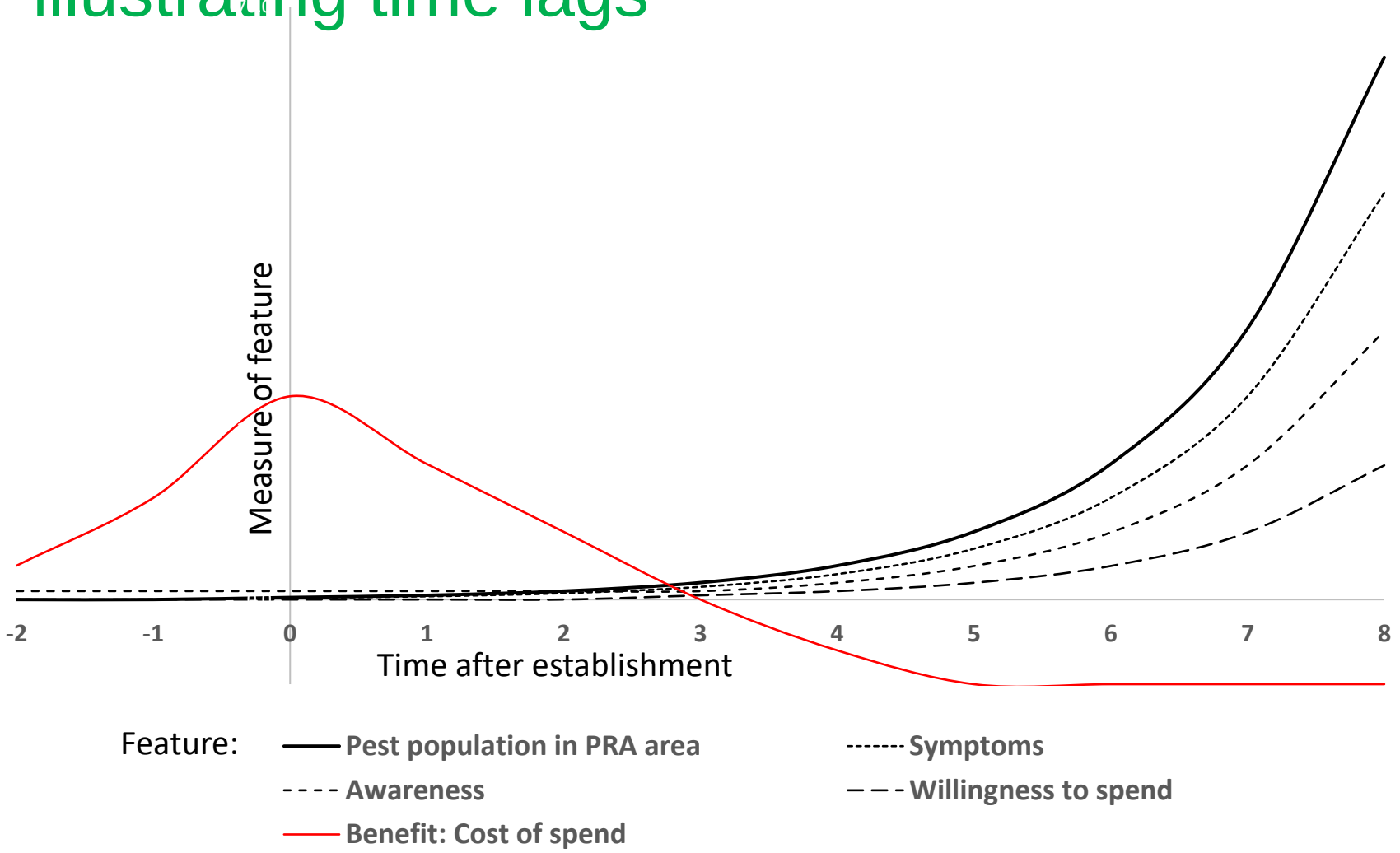

https://gd.eppo.int/reporting/article-7710 http://bezbycids.com/byciddb/wdetails.asp?id=32237&w=o

# Too late: *Tuta absoluta*

- South American tomato borer (Lep: Gelechiidae)
- 2000: French NPPO noted spread from Central America to most of South America
- 2005: EU risk managers discussed risks but no knowledge of tomato imports from Central or South America: no decision on measures
- 2007: outbreaks in Spain, blamed on “illegal imports”, “easy to control with pesticides”
  - EU risk managers not aware of legal imports from South America
- 2008: Outbreaks in Algeria, Morocco, Netherlands
- 2009: Outbreaks in Bulgaria, Greece, Italy, Portugal, Slovenia, UK
- 2009: Dutch PRA; concludes pest damaging and difficult to control, was established and widespread in EU: not an EU quarantine pest

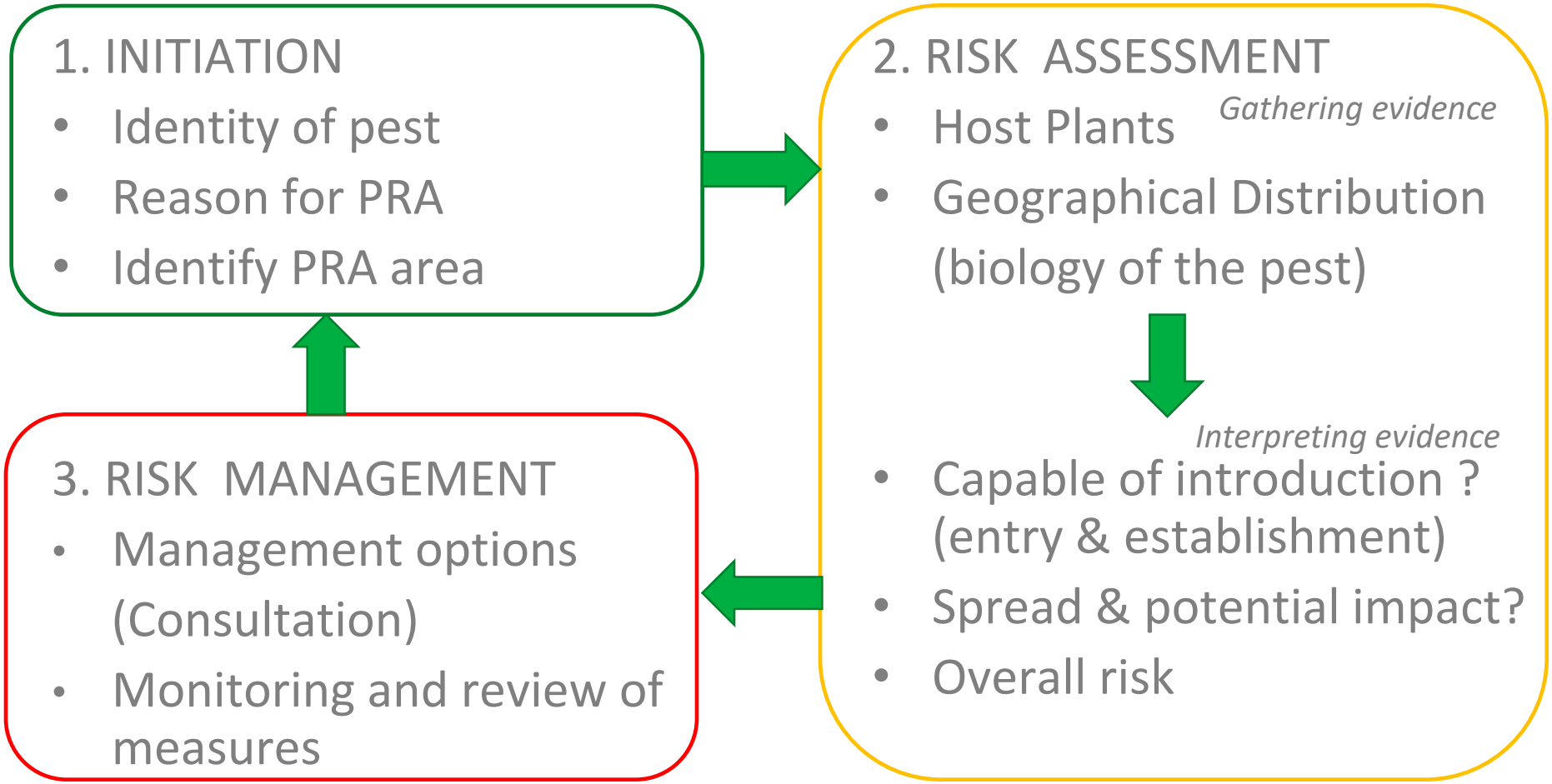
https://gd.eppo.int/taxon/GNORAB

# Progression of features of an outbreak illustrating time lags




Ward (2016) *Food Security,* **8** (1) 77-81.

# Typical structure of PRA




Devorshak, C. (2012) *Plant Pest Risk Analysis, Concepts and Application*, CAB International, Wallingford, UK

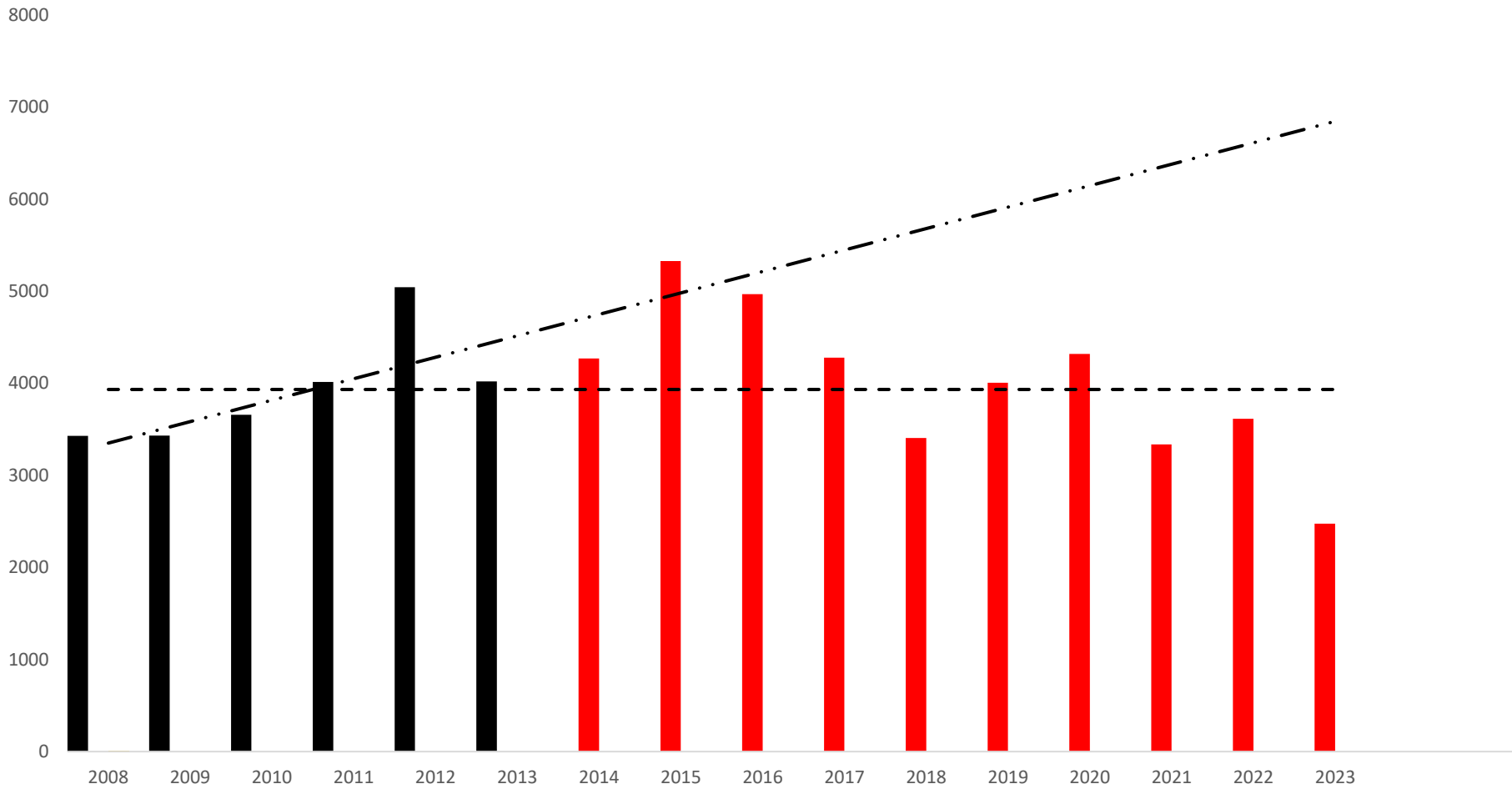
# Time dependent elements (well recognised)

- **Initiation**: Time-series data on pest interceptions at borders can indicate emerging threats
- **Entry**: seasonality affects pest's prevalence and likelihood of association with pathway at different times of the year
- Import volumes and routes fluctuate seasonally and annually, affecting the likelihood of pest entry
- Time being transported can influence pest survival and subsequent entry (mode of transport; road, rail, sea, air freight)
- **Establishment**: environmental factors (seasonality); climate change
- **Spread & consequences:** increase over time
- **Risk management:** import only at certain times of year; surveillance intensity can vary over time due to fluctuating funding; policy changes in relation to pest spread

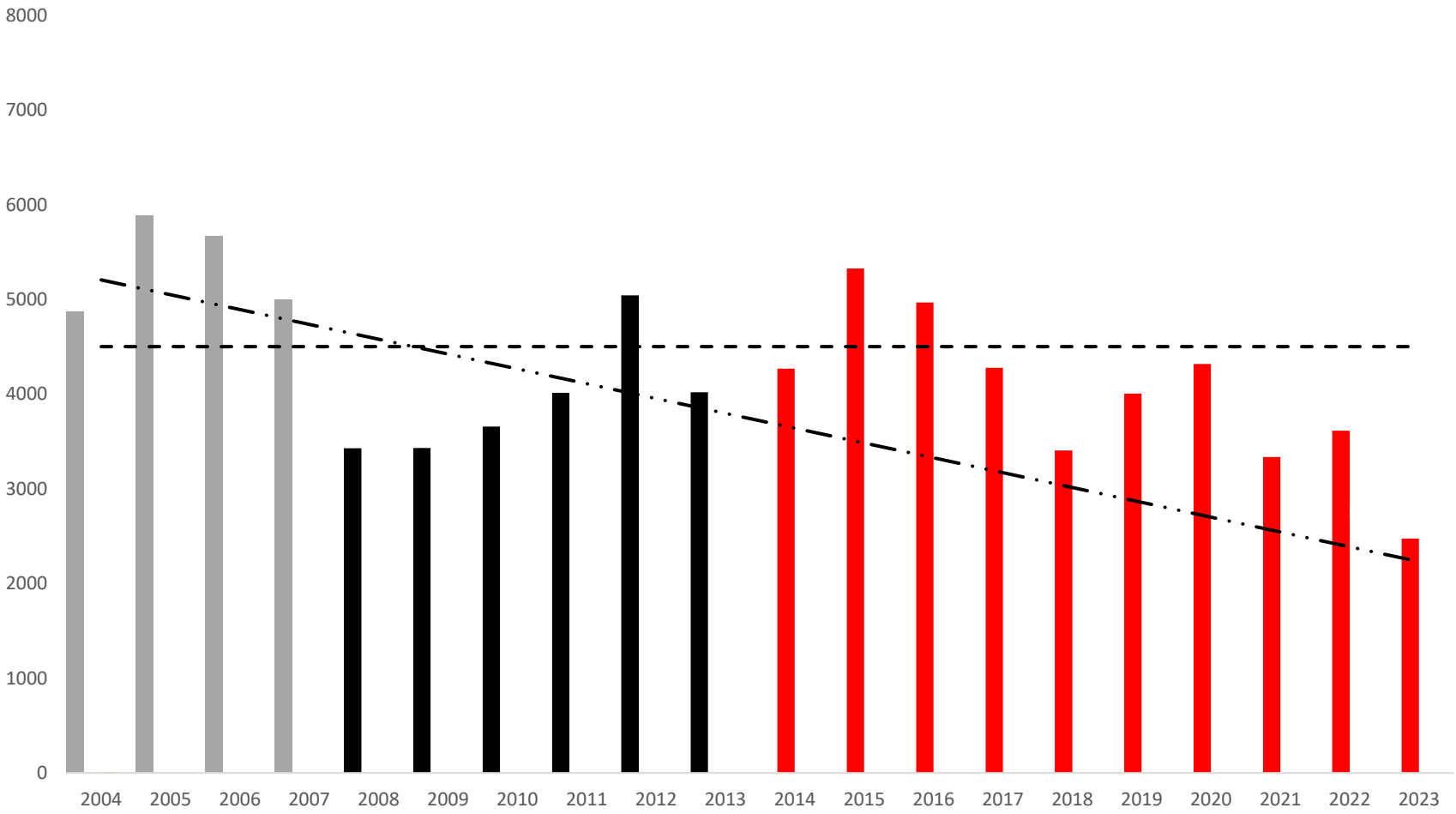
# Entry: Trade data

- **Scenario**: PRA initiated when pest expands its international distribution and establishes in a country exporting hosts to the PRA area
- To assess likelihood of entry, would probably look back at the amount of imports in the past and project forwards to estimate potential future imports
- How far back in time are import data considered?
- How far into the future should we project imports?

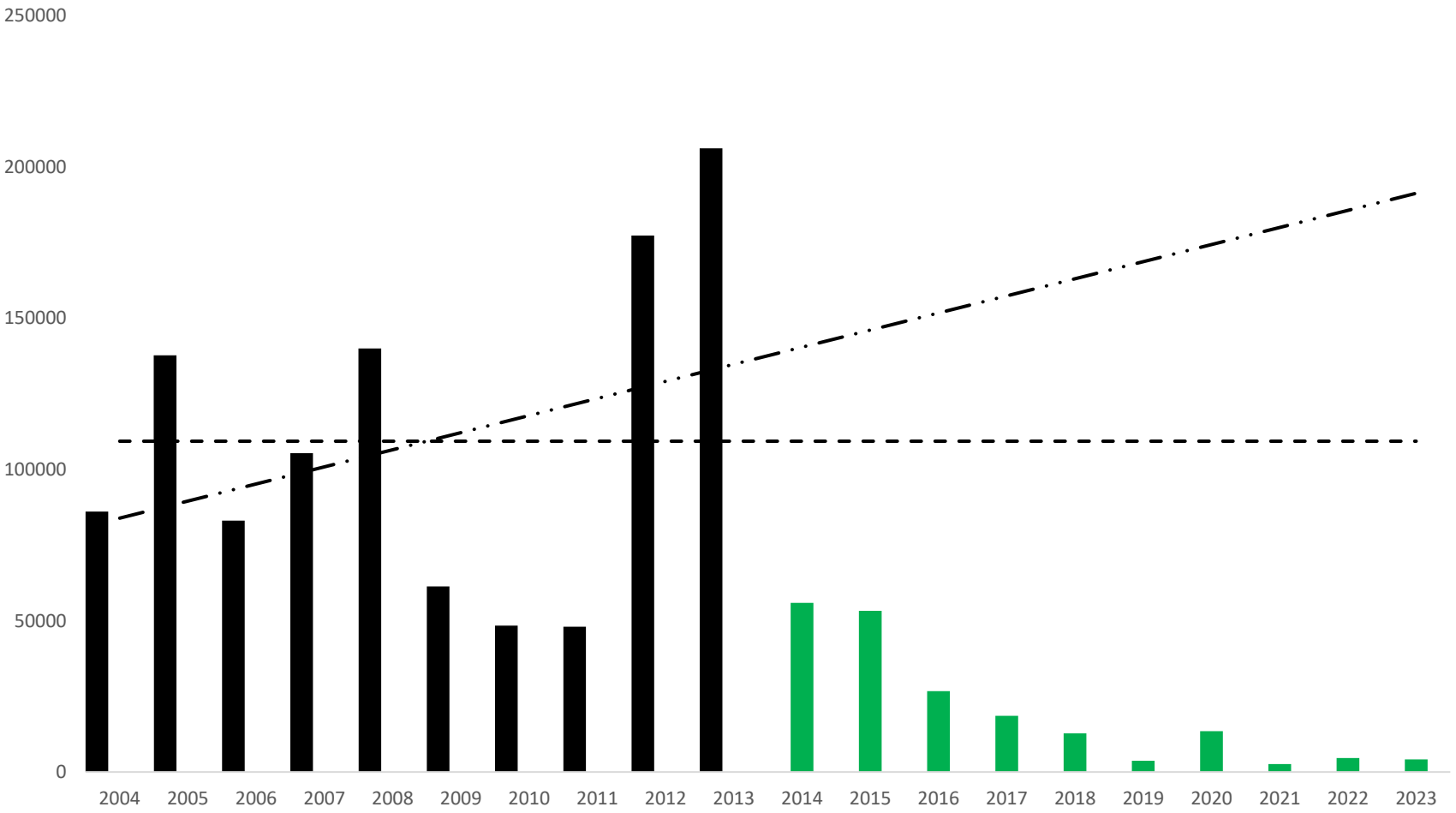
# UK imports strawberries; country X, go back 6 years



# UK imports strawberries; country X, go back 10 years



# UK imports of potatoes, country Y, go back 10 years



# Economic factors over time

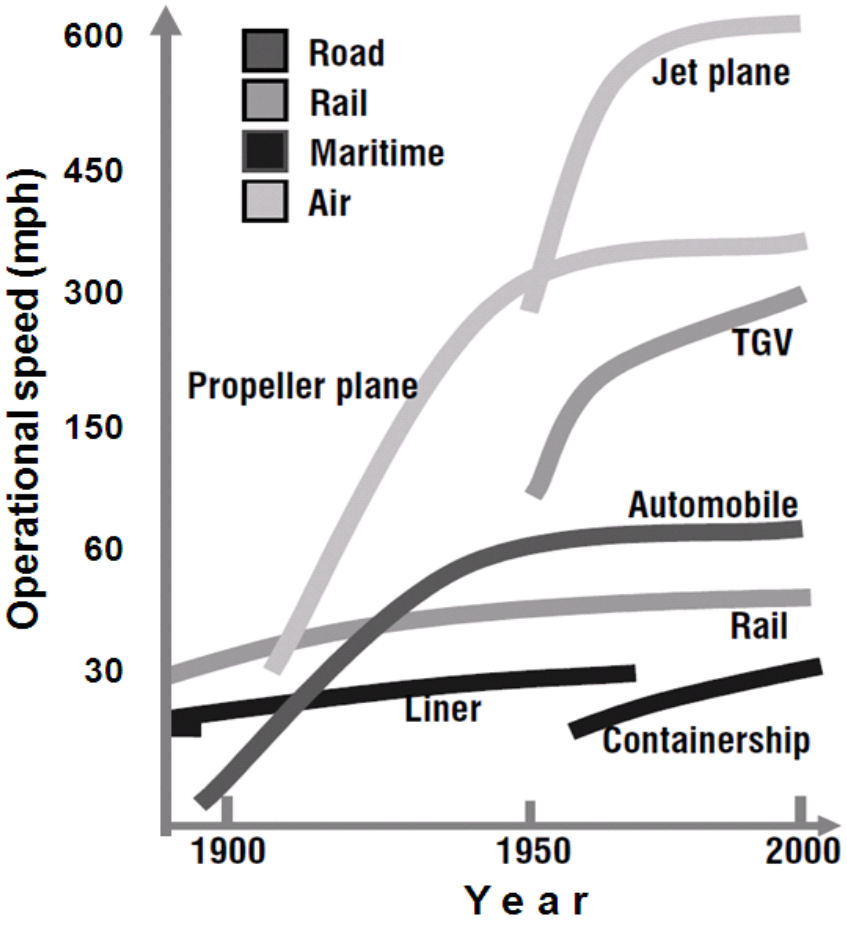
- Competition in a market measured using Herfindahl-Hirschman Index (HHI)
  - HHI < 1500 = competitive market
  - HHI 1500 to 2500 = moderately competitive market
  - HHI > 2500 = concentrated market

$$HHI = \sum_{i=1}^{N} s_i^2$$

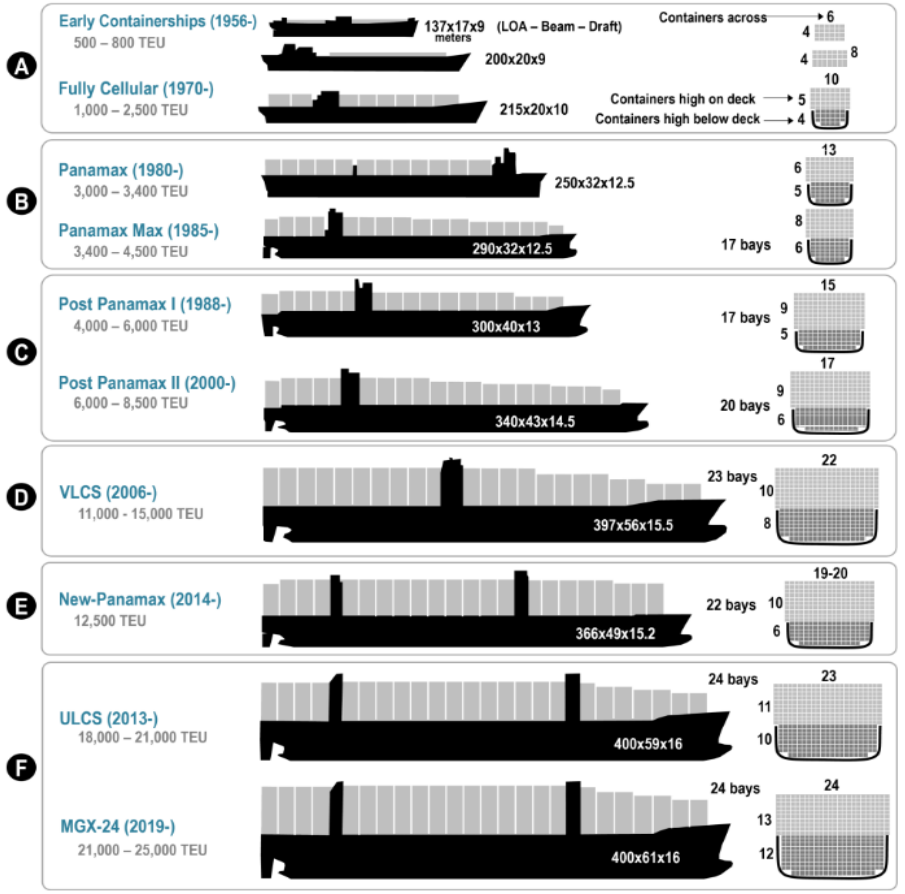
- Strawberries highly concentrated (HHI> 3,400; majority UK imports from a few major sources)
  - Relatively stable import patterns due to relatively predictable demand and established supply chains
  - mean is better to forecast future imports?
- Potatoes (HHI ~1690; moderately competitive; UK imports from many countries (2004-2013 = 20 countries; 2014-2023 = 22 countries; diversified import sources, reducing reliance on country Y
  - Import pattern not stable due to competition
  - Forecasting future imports more challenging (greater uncertainty)

# Transport influences trade / pest entry

## Increased transport speed




## Increased shipping capacity



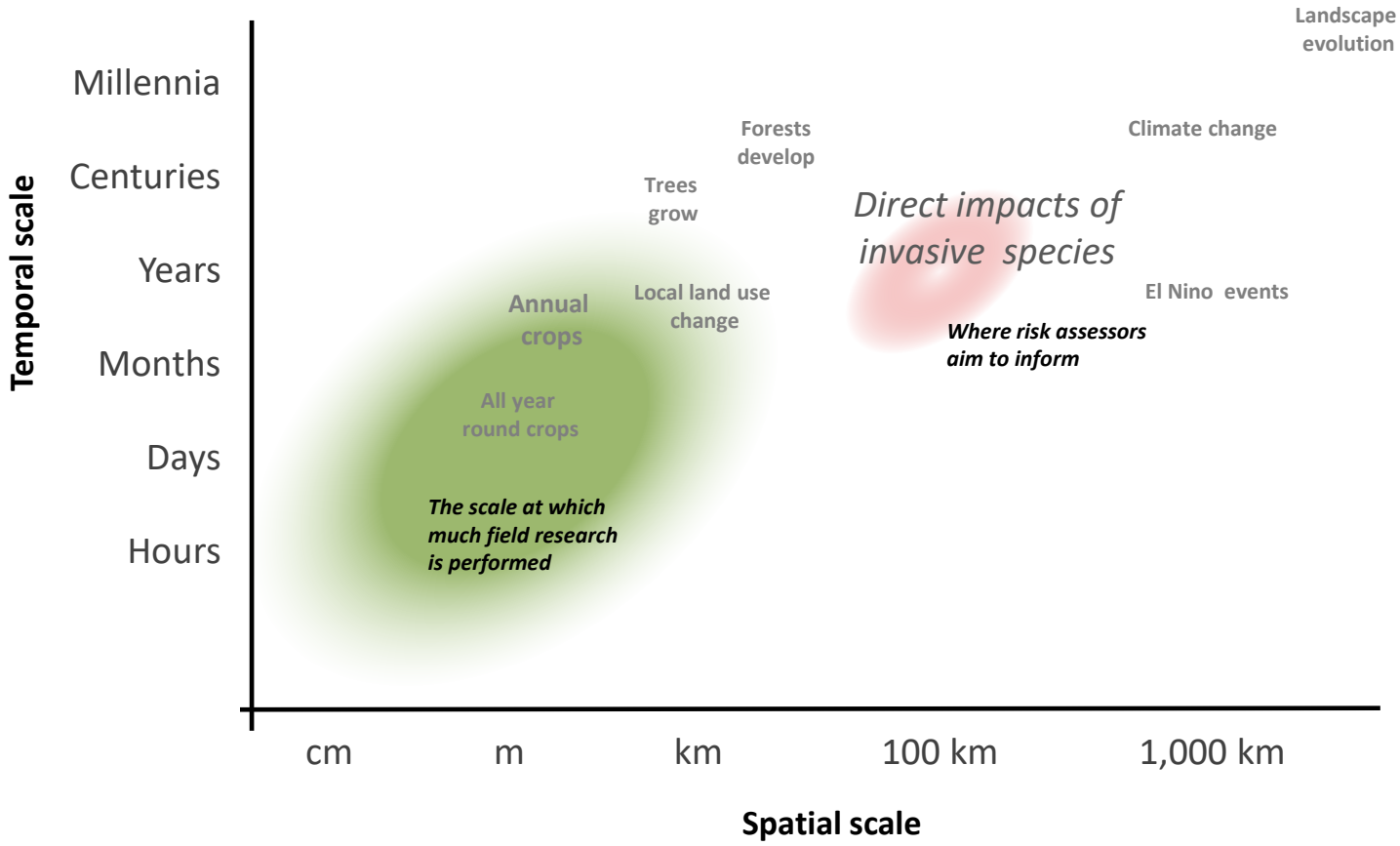

Adapted from Rodrigue *et al*. (2020) *The Geography of Transport Systems*, 5th Edn

# Looking into the future: time horizon

- Neither ISPM 2 or ISPM 11 specify a fixed validity period for a PRA
- ISPM 11 suggests PRA should be based on current and relevant data
- ISPMs note PRAs should be:
  - reviewed and updated when new information becomes available
  - reassessed if conditions change significantly  e.g. pest spreads in origin, trade patterns change, environmental conditions alter
- Validity of PRA depends on the stability of the assessed risk
  - Emergence of new data (e.g. pest interceptions; updated climate data)
- **Time horizon** “the maximum point in the future when assumptions, judgements and decisions made within the PRA remain valid”
- Beyond the time horizon uncertainties become significant enough such as to have a material impact on the conclusions of PRA

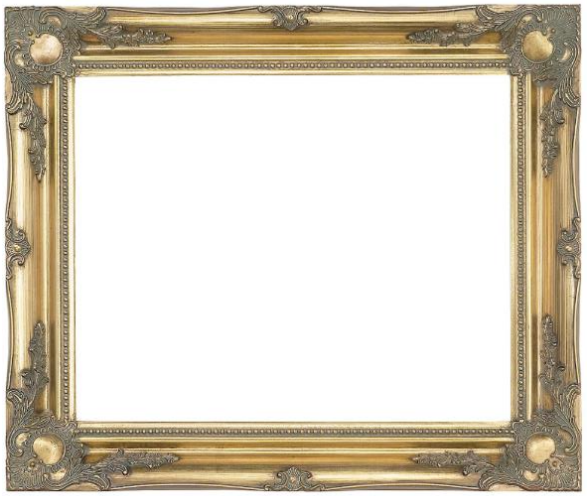
# Always some uncertainty

- Disconnect between where PRA aims to inform (red) and the scales at which field informing PRA is often conducted (green)




MacLeod & Lloyd (2020) *Emerging Topics in Life Sciences* **4** (5), 463–471.

# Time frame



- Frame: suggests boundaries / rigid
  - time limit how far back
  - time limit how far forward (time horizon)
- Place limit on literature searching
- But much basic biology and pest information can be available in old literature
- If use long time series import data potential for error in projections of future imports
- Need to be flexible regarding how far back assessors go to collect data
  - For transparency, should specify if limits were used when searching for data

# On climate change

- Q. Does a PRA that shows unacceptable pest risk under a future climate change scenario justify imposing phytosanitary measures under current climate conditions?
  - Future climate models and pest behavior predictions carry uncertainty
  - Acting on uncertain futures may lead to unnecessary trade restrictions
- Action to prevent unacceptable impact under future climate would be precautionary
- Acting on very uncertain assessment may create unnecessary trade barriers, goes against IPPC principles
- If climate change is considered in PRA and reveals unacceptable risk:
  - do not immediately impose phytosanitary measures
  - do consider more proportionate actions, e.g. enhance surveillance; develop contingency plans to improve preparedness;
  - do review PRA in N years (time horizon) to reassess

Kriticos et al. (2024) *EPPO Bulletin,* **54,** S1, *https://onlinelibrary.wiley.com/toc/13652338/2024/54/S1*

# Conclusions

- Pest Risk Analysis is an essential tool to protect plant health, esp. in relation to international trade
- When conducting PRA, aspects of time are relevant to many elements of risk
- Consider how far back into the past to go to collect and use data it; will influence future projections
- Be transparent about time horizon

# Thank you