WEBINAR 1 DECEMBER 2020
15:00 – 16:00 GMT+1

Pest surveys following an outbreak: delimiting and buffer zone surveys

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INTERNATIONAL YEAR OF PLANT HEALTH 2020

Webinar guide for attendees

- This webinar is being recorded!
- The webinar is in English and questions should be submitted in English through the platform
- To communicate with us use the chat boxes

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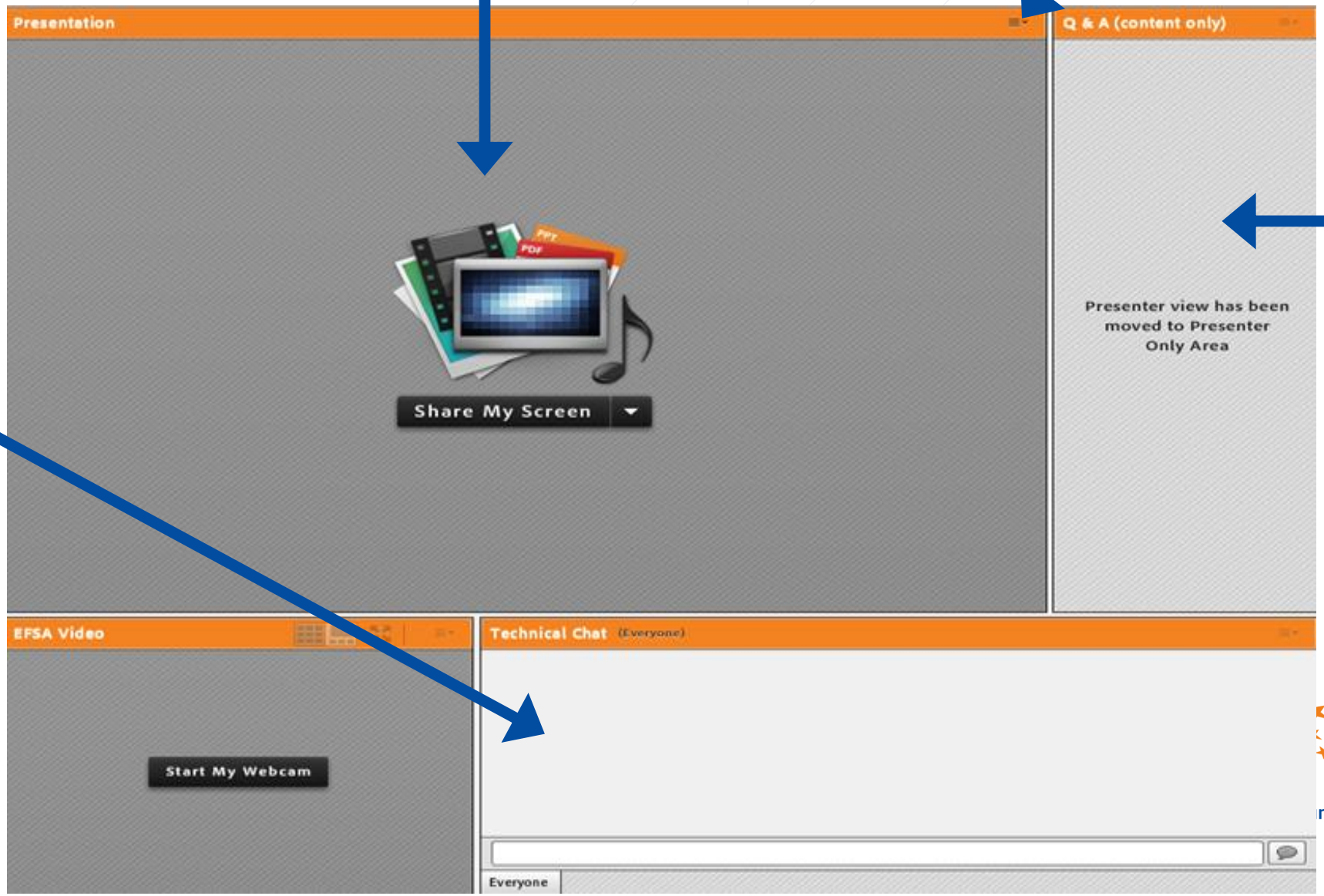
Presentation window

Full screen



Technical box: **technical issues only**

Q&A box: any question **related to the topic**

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Plant pests and diseases

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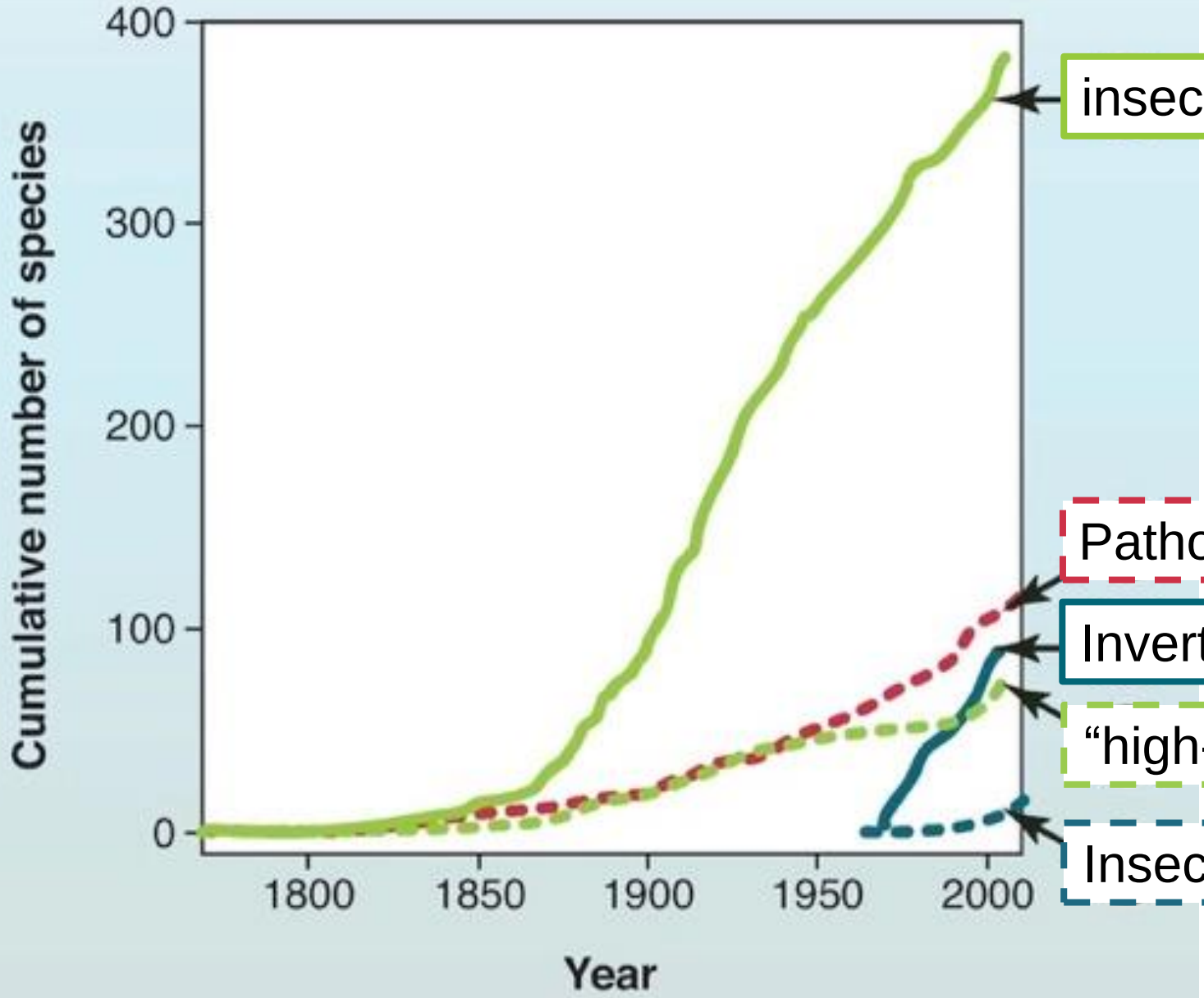
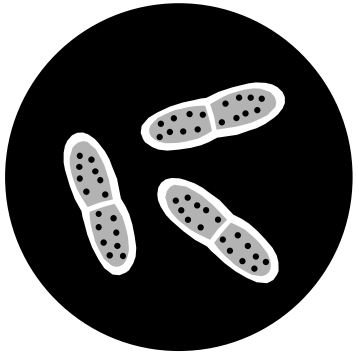
Invasive species



insects (US)



Pathogens (Europe)

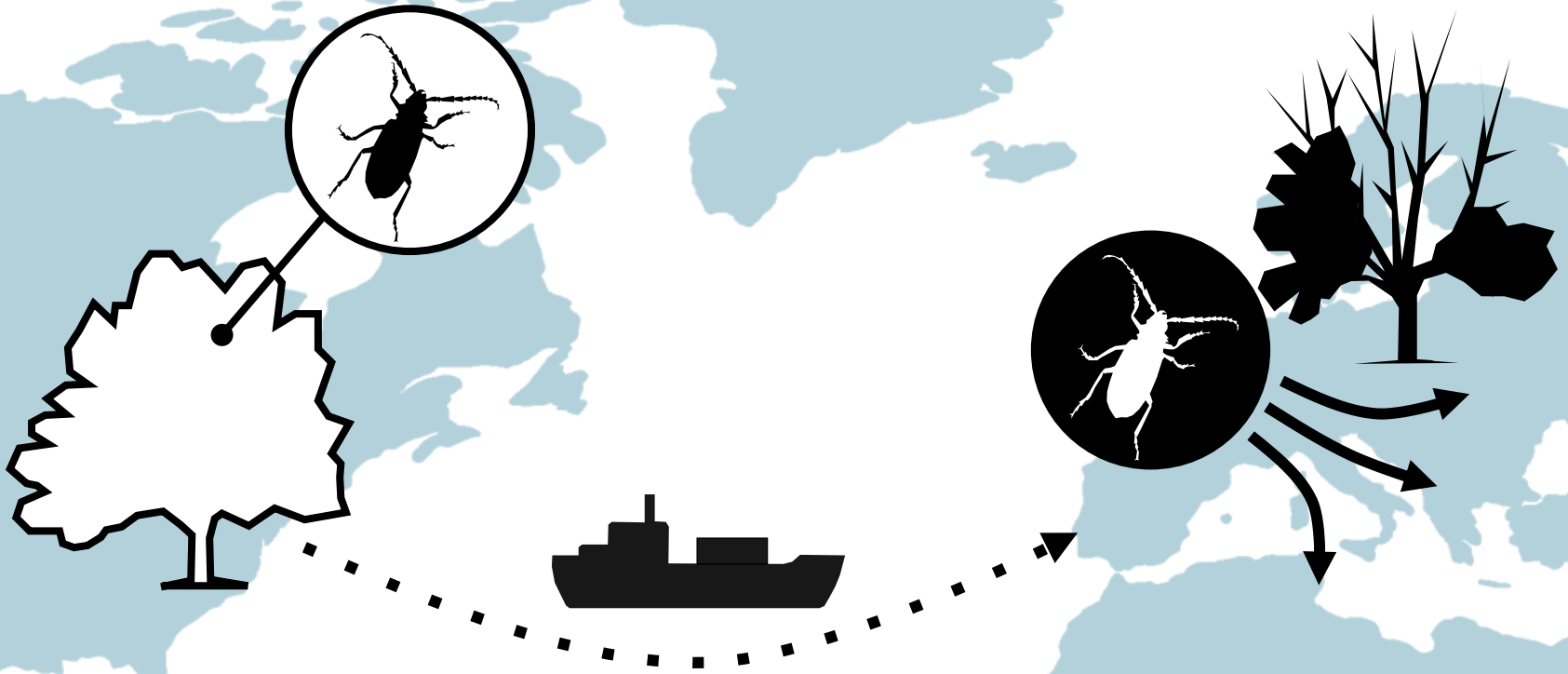
Invertebrates (UK)

“high-impact” insects and path. (US)

Insect and pathogens (UK)

Boyd et al. 2013, Seebens et al. 2017

Invasive species



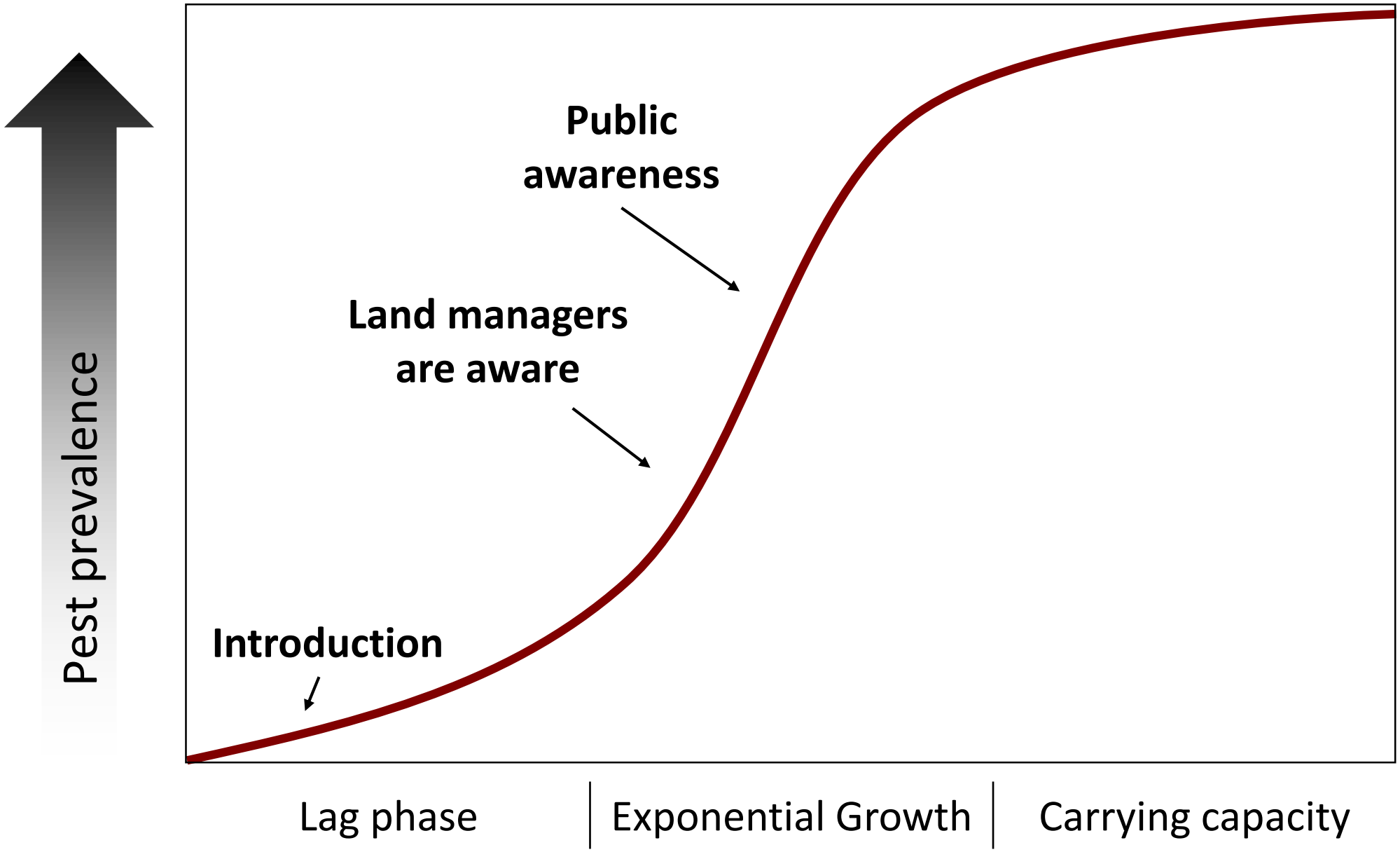
Entry

Establishment

Spread

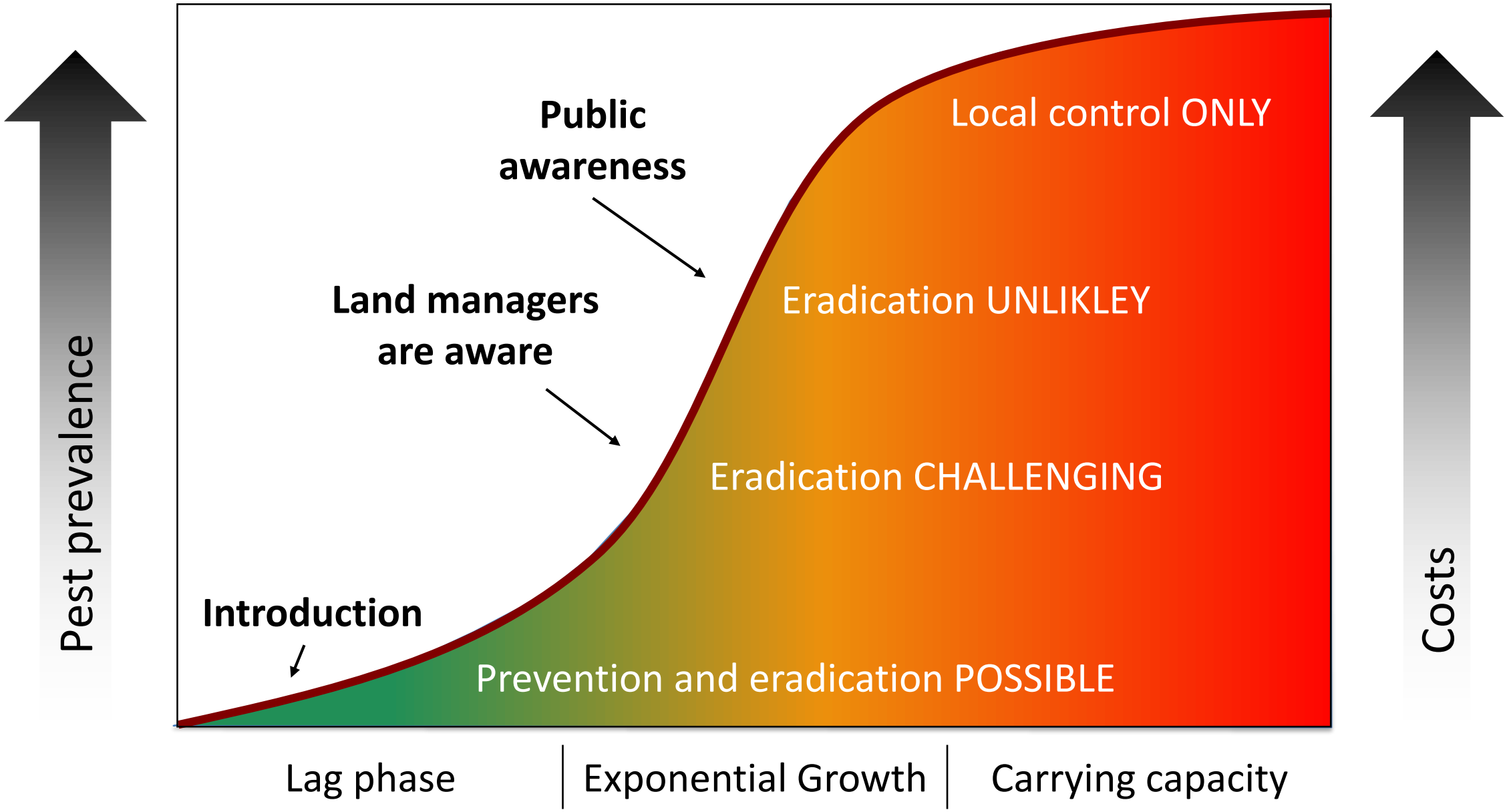
Impact

Invasive species



From: California Department of Fish and Wildlife (wildlife.ca.gov)

Invasive species



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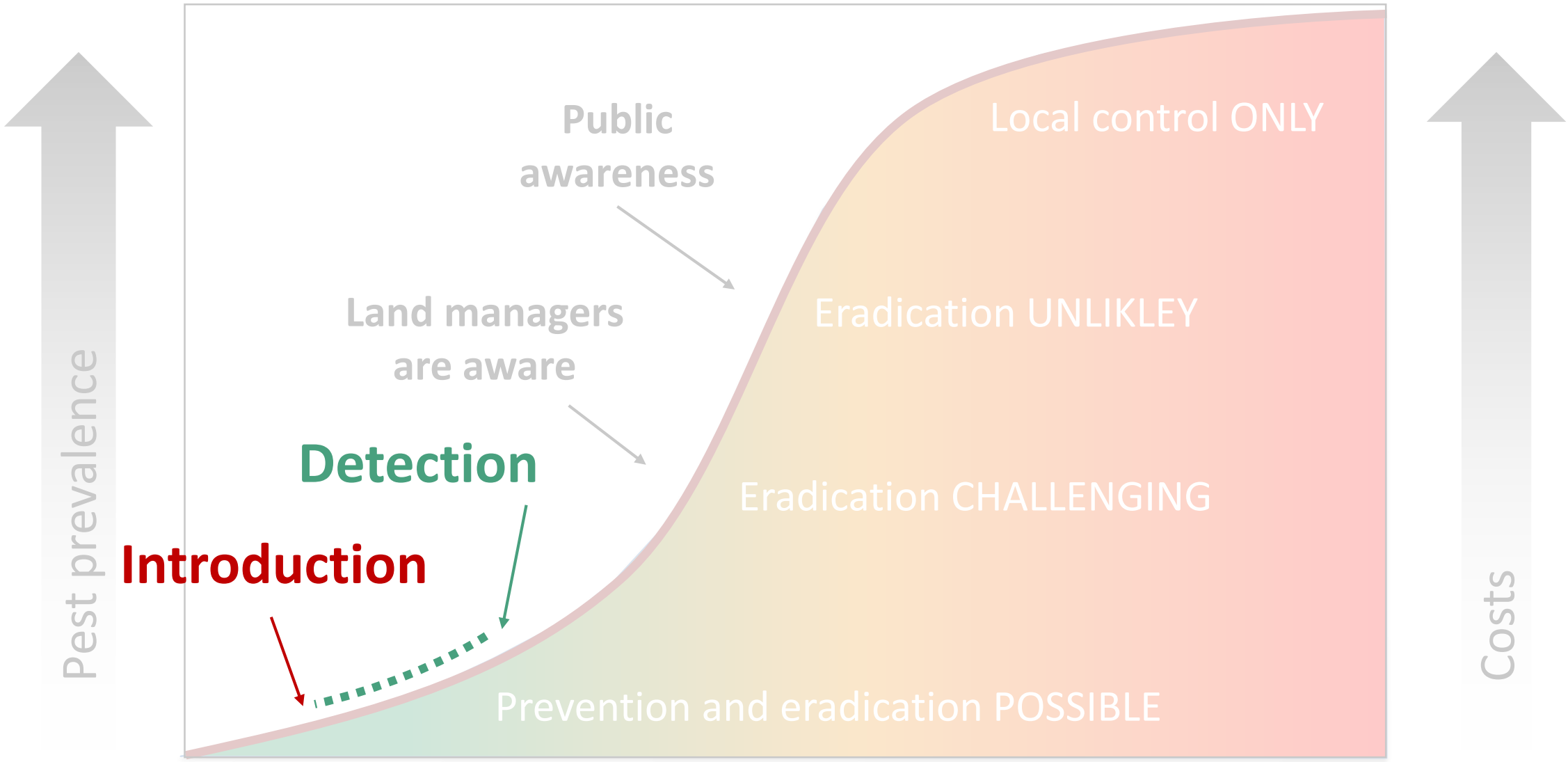
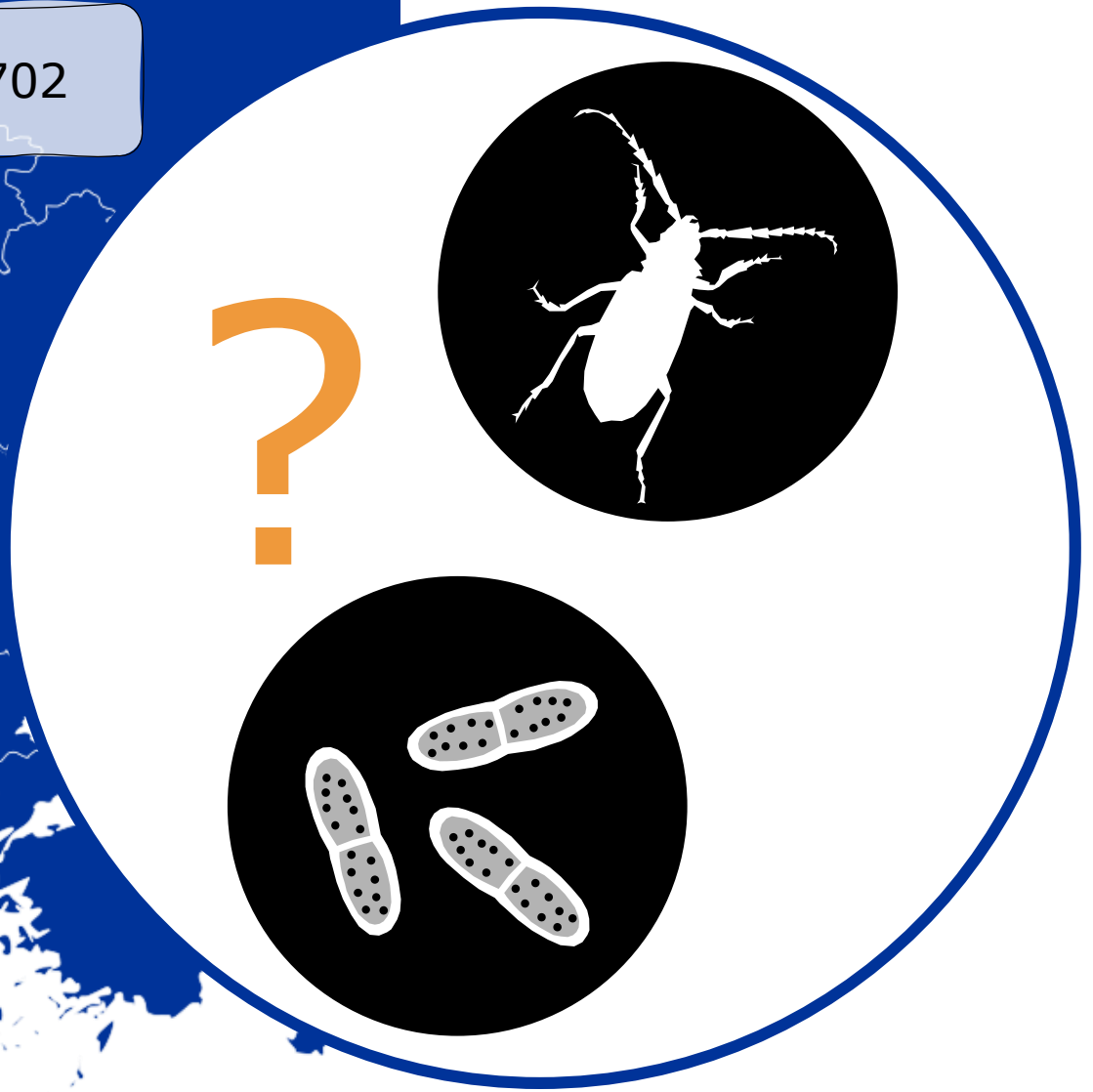
Invasive species



Aukema et al. 2010, Bebber et al. 2013, Bradshaw et al. 2016

Surveillance (IPPC ISPM 5)

EU/2016/2031 - EU/2019/2072 - EU/2019/1702

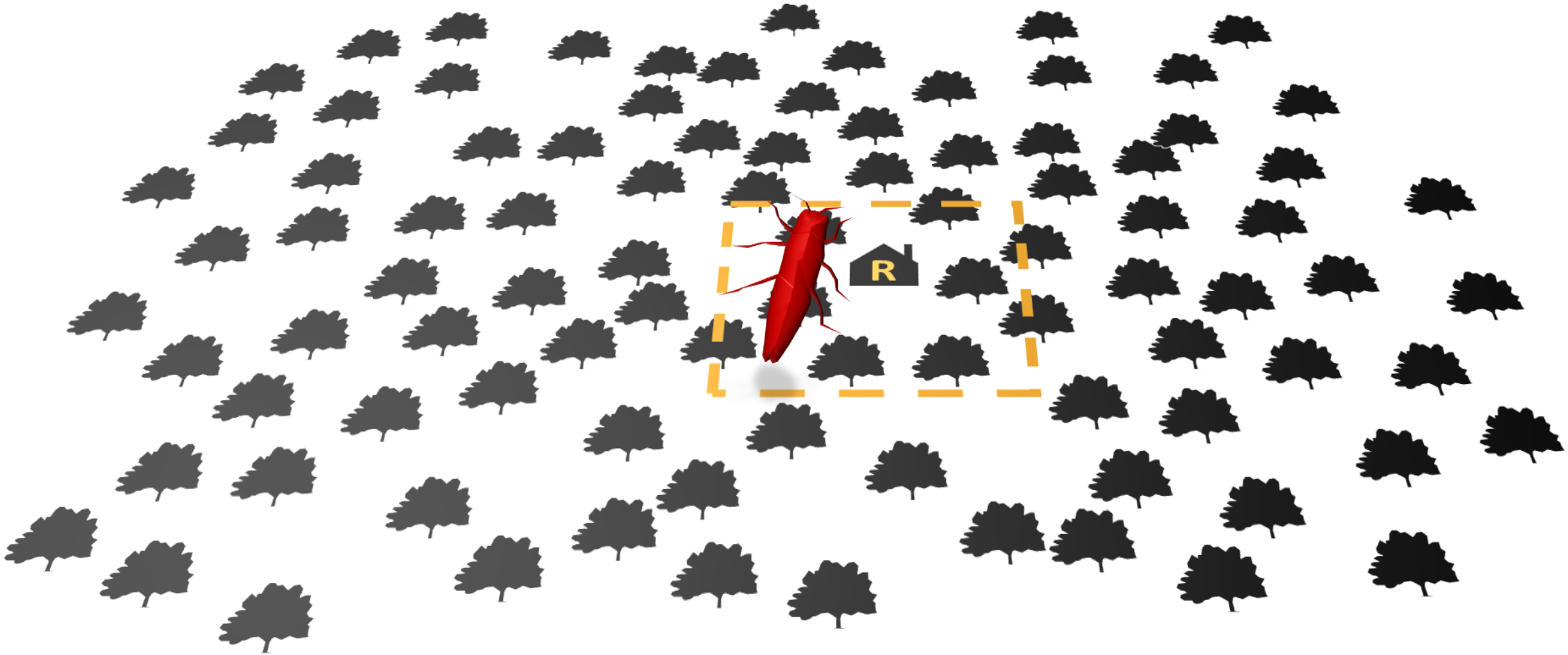


Types of surveys – Why?

Detection

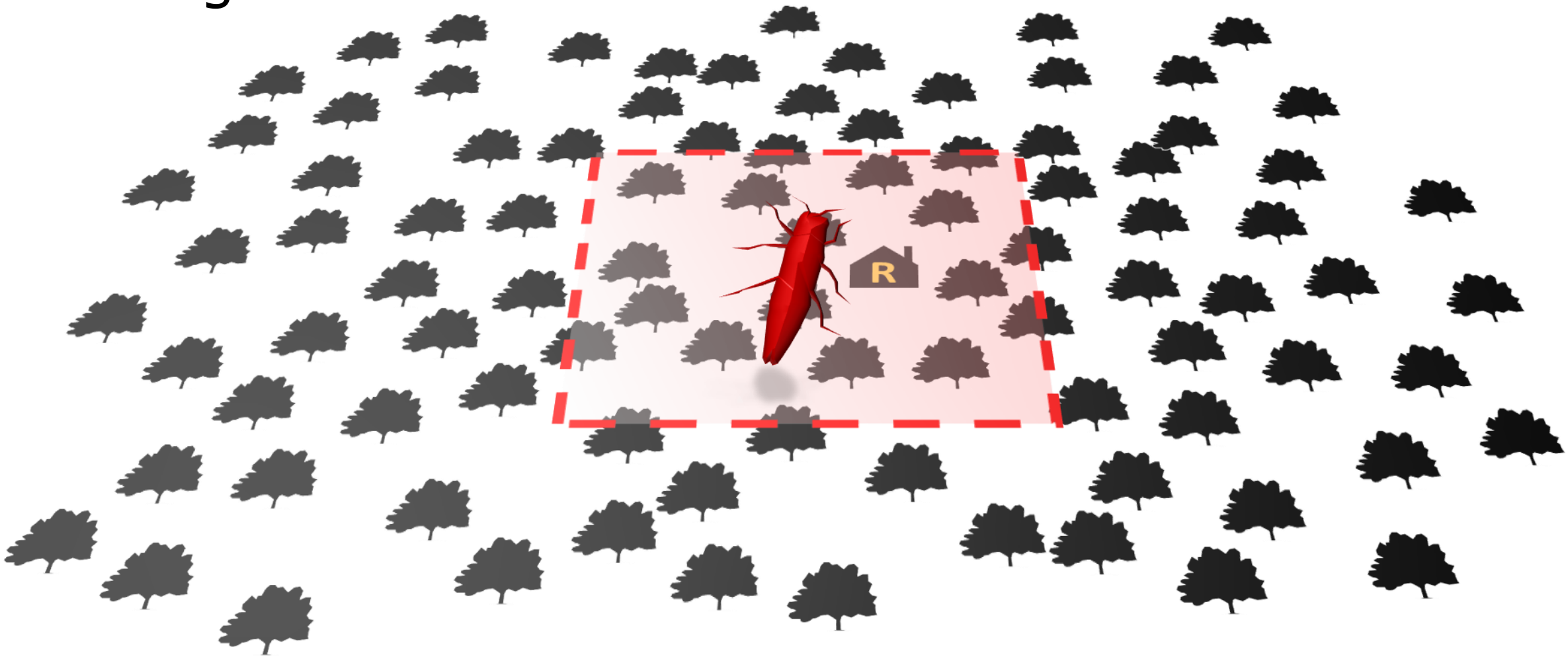
Types of surveys – Why?

Detection



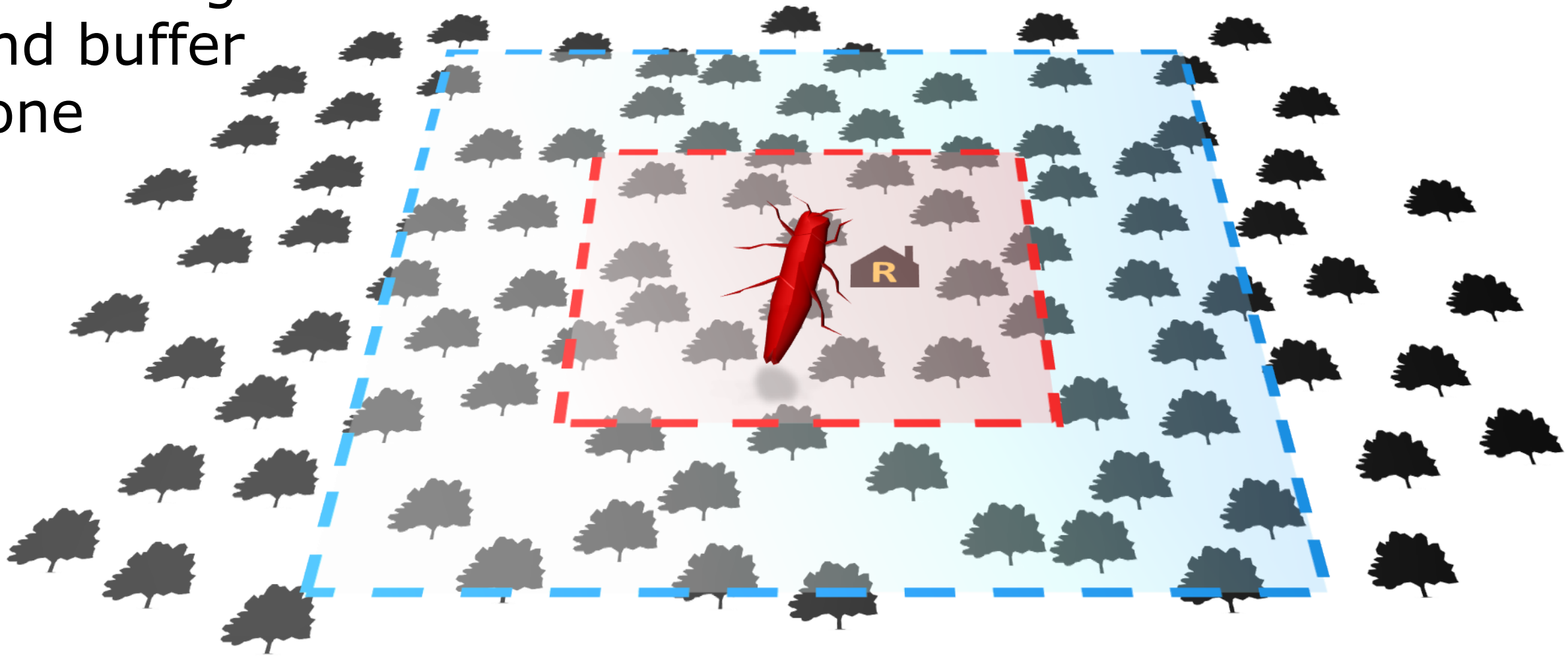
Types of surveys – Why?

Delimiting

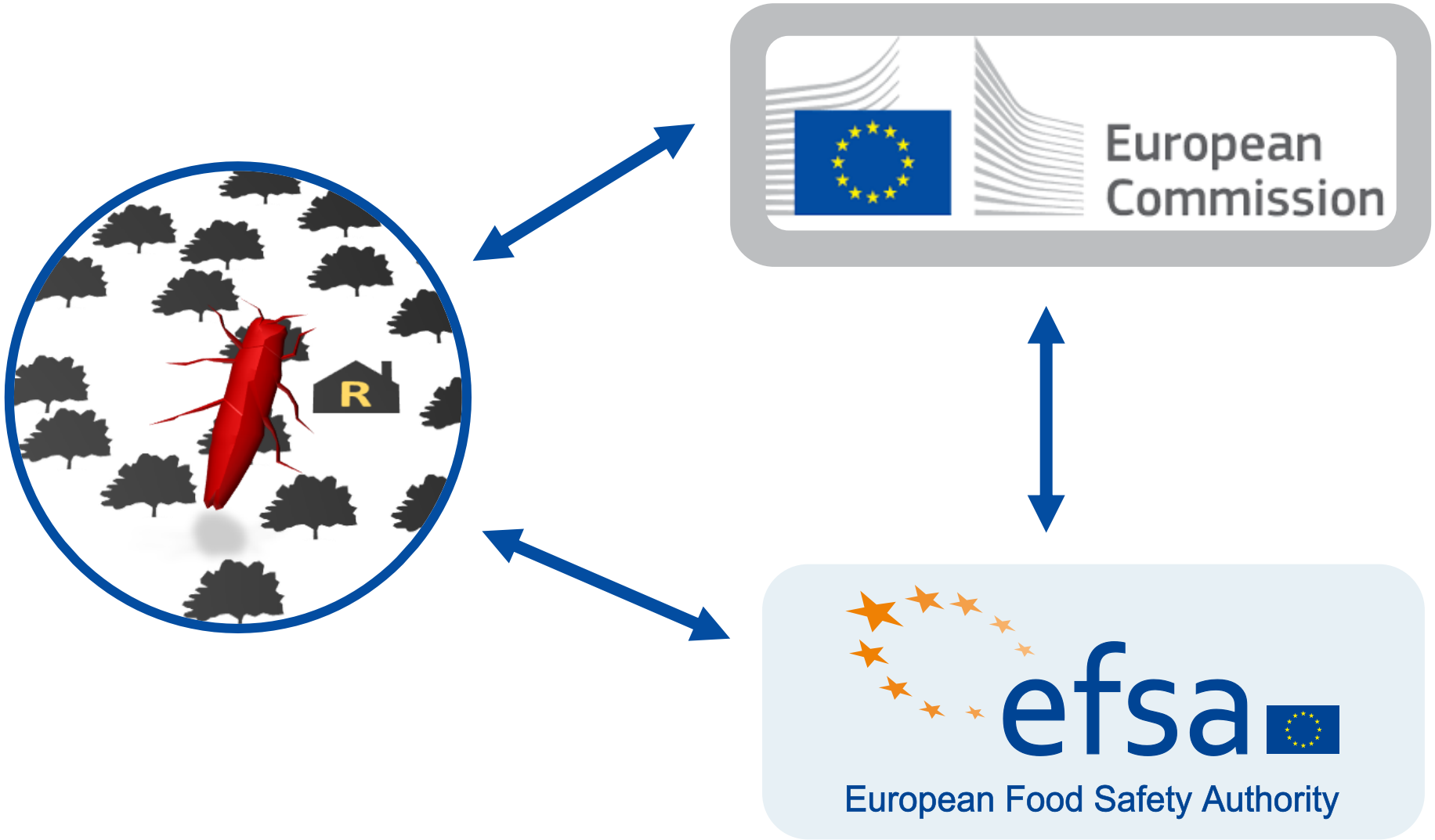


Types of surveys – Why?

Delimiting and buffer zone



EFSA mandate on pest surveys



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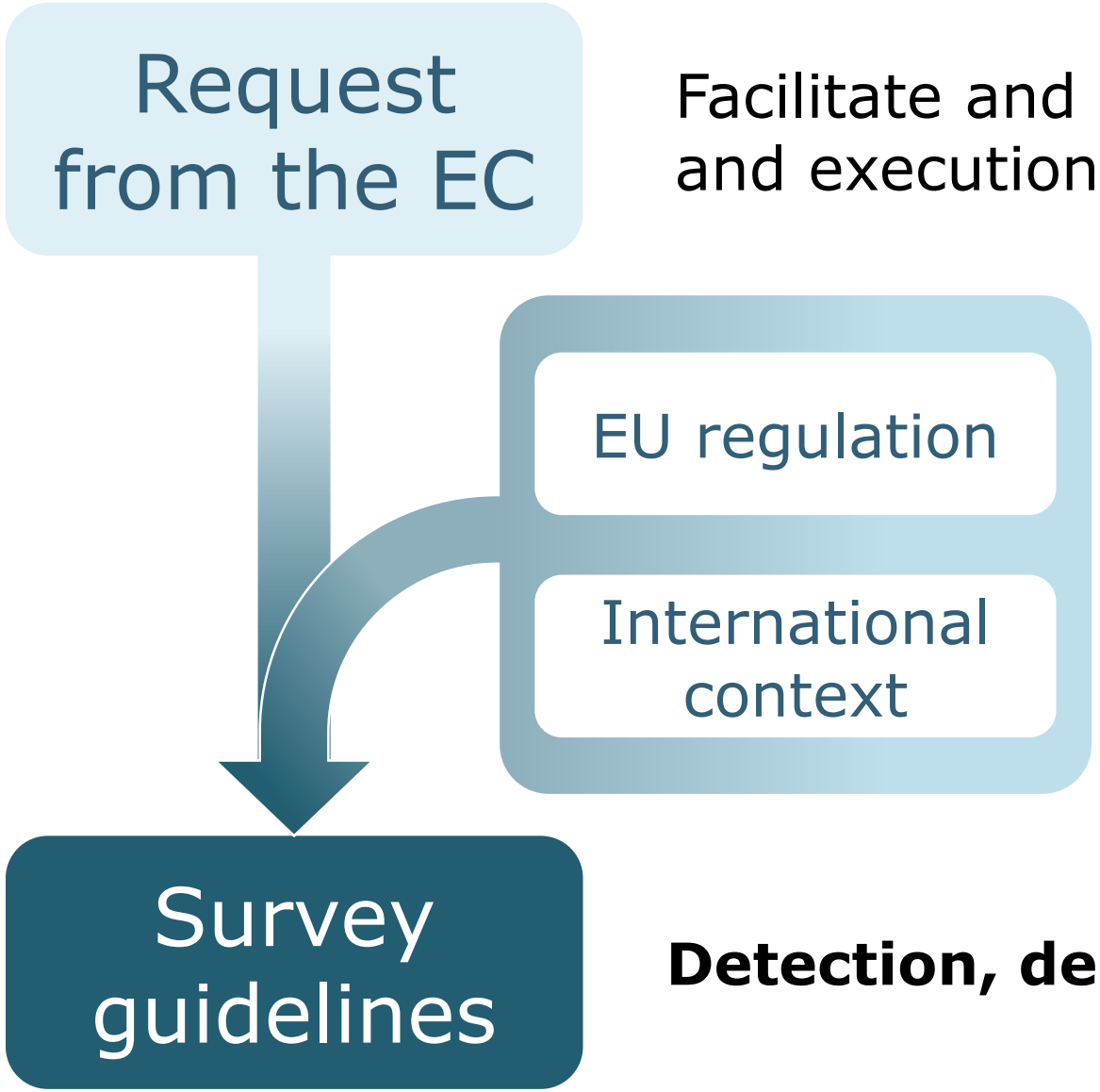


Facilitate and support the MSs in the planning and execution of survey activities

More prevention, risk-targeting and statistics (EU/2016/2031-EU/2019/2072-EU/2019/1702-EU/652/2014)

Instructions: IPPC ISPM 6 & ISPM 31
Procedures/protocols: ISPMs 1,4,8,9,10,17,22,26,27,32

Detection, delimiting (and monitoring) **surveys**

Surveillance toolkit

PREPARE THE SURVEY

DESIGN THE SURVEY

- WHAT
- WHERE
- WHEN
- HOW
- HOW MUCH

Survey preparation

Pest Surveillance Toolkit

PEST SURVEY CARD

efsa European Food Safety Authority
Supporting Publications

APPROVED: 20 October 2020

doi:10.2903/sp.efsa.2020.EN-1945

Pest survey card on *Agrilus planipennis*

European Food Safety Authority (EFSA),
Jan Schans, Gritta Schrader, Alice Delbianco, Ignazio Graziosi, Sybren Vos

ArcGIS StoryMaps

Detection method & target population

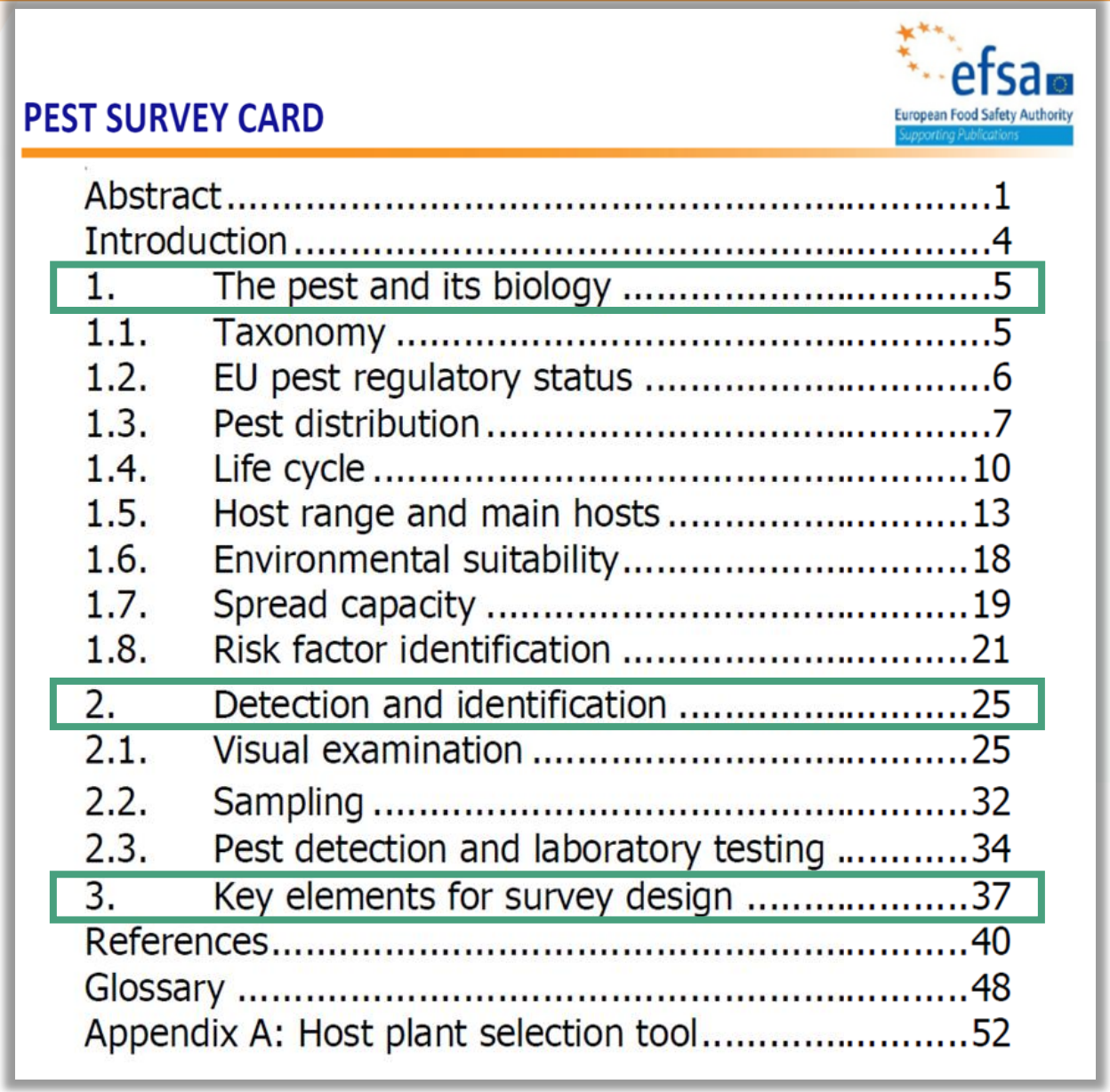
WHAT

WHERE

WHEN

HOW

Pest survey card



PEST SURVEY CARD

European Food Safety Authority
Supporting Publications

WHAT

WHERE

WHEN

HOW

Pest survey card

EAB

Trapping method	Effectiveness at low EAB densities	References
Dark green multifunnel traps with (3Z)-hexenol	87.5±12.5%	Francese et al., 2013; USDA APHIS PPQ, 2018; Poland et al., 2019
Double-decker traps with (3Z)-hexenol and manuka oil	100%	Poland and McCullough, 2014; McCullough and Poland, 2017
Green prism traps with (3Z)-hexenol and (3Z)-lactone	75–98%	Ryall et al., 2013; McCullough and Poland, 2017; Parker et al., 2020
Double-decker traps with manuka oil	56–95%	Marshall et al., 2010a, 2010b; McCullough et al., 2011
Green or purple prism	37–82%	Ryall et al., 2013; Crook et al., 2014; Poland and McCullough,

Detection method

Target population

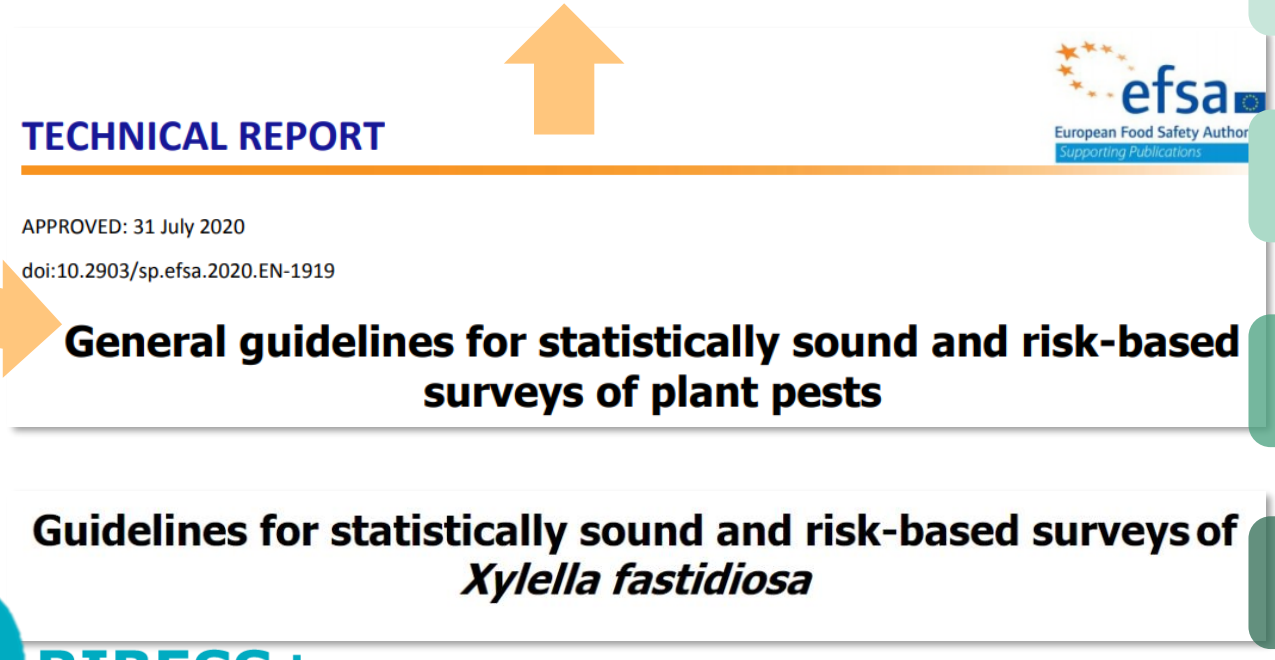
CBS

	Definition
Target population	Citrus plants growing in orchards, backyards and gardens in each Member State
Epidemiological unit	A single homogeneous area that contains at least one individual host plant (e.g. citrus orchard, backyard or garden)
Inspection unit	A host plant with mature fruits

Surveillance guidelines

Sample size
&
allocate samples
to survey area

Pest Surveillance Toolkit



RIBESS+

WHAT

WHERE

WHEN

HOW

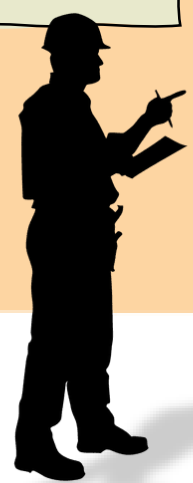
HOW MUCH

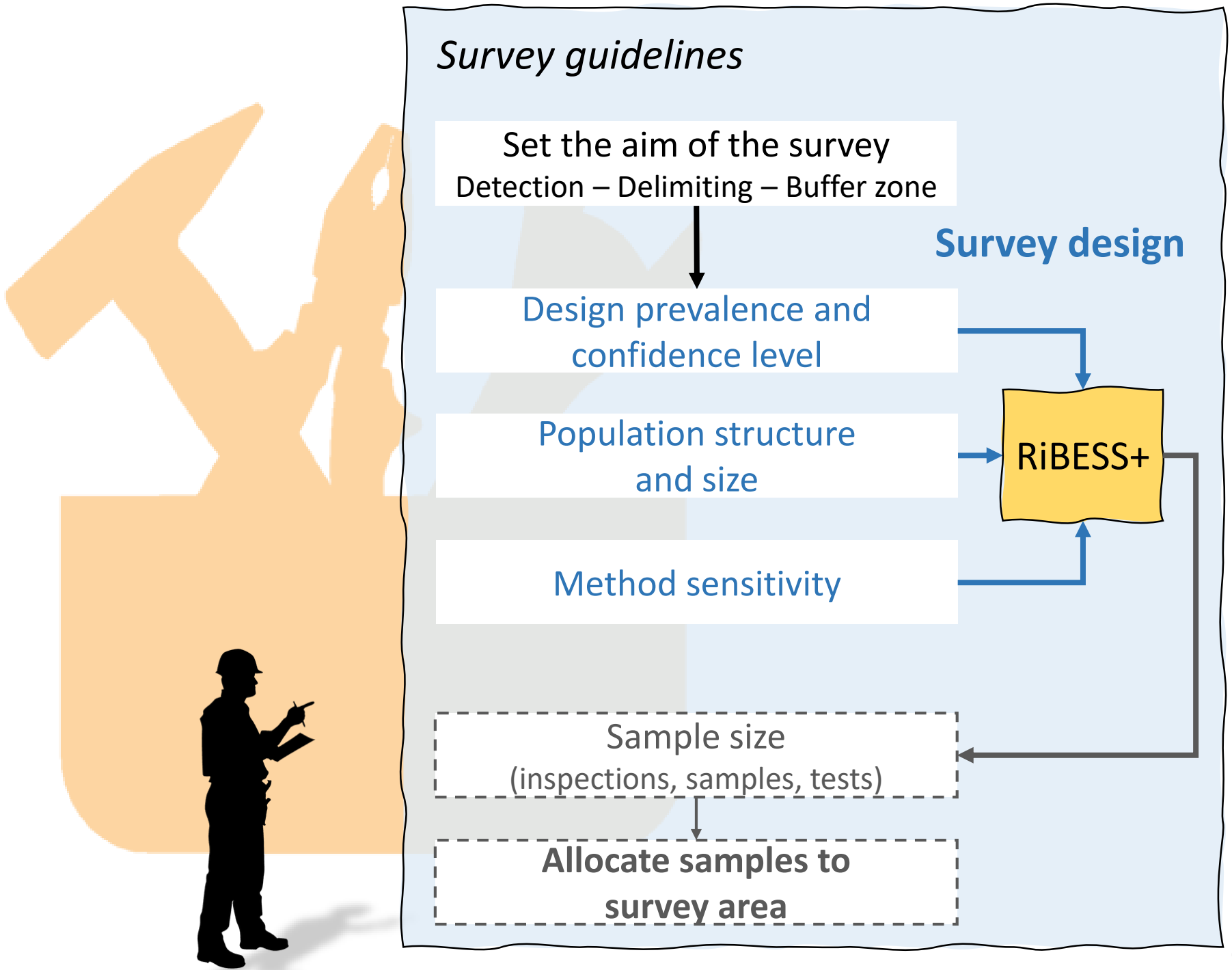
Pest survey card & story map

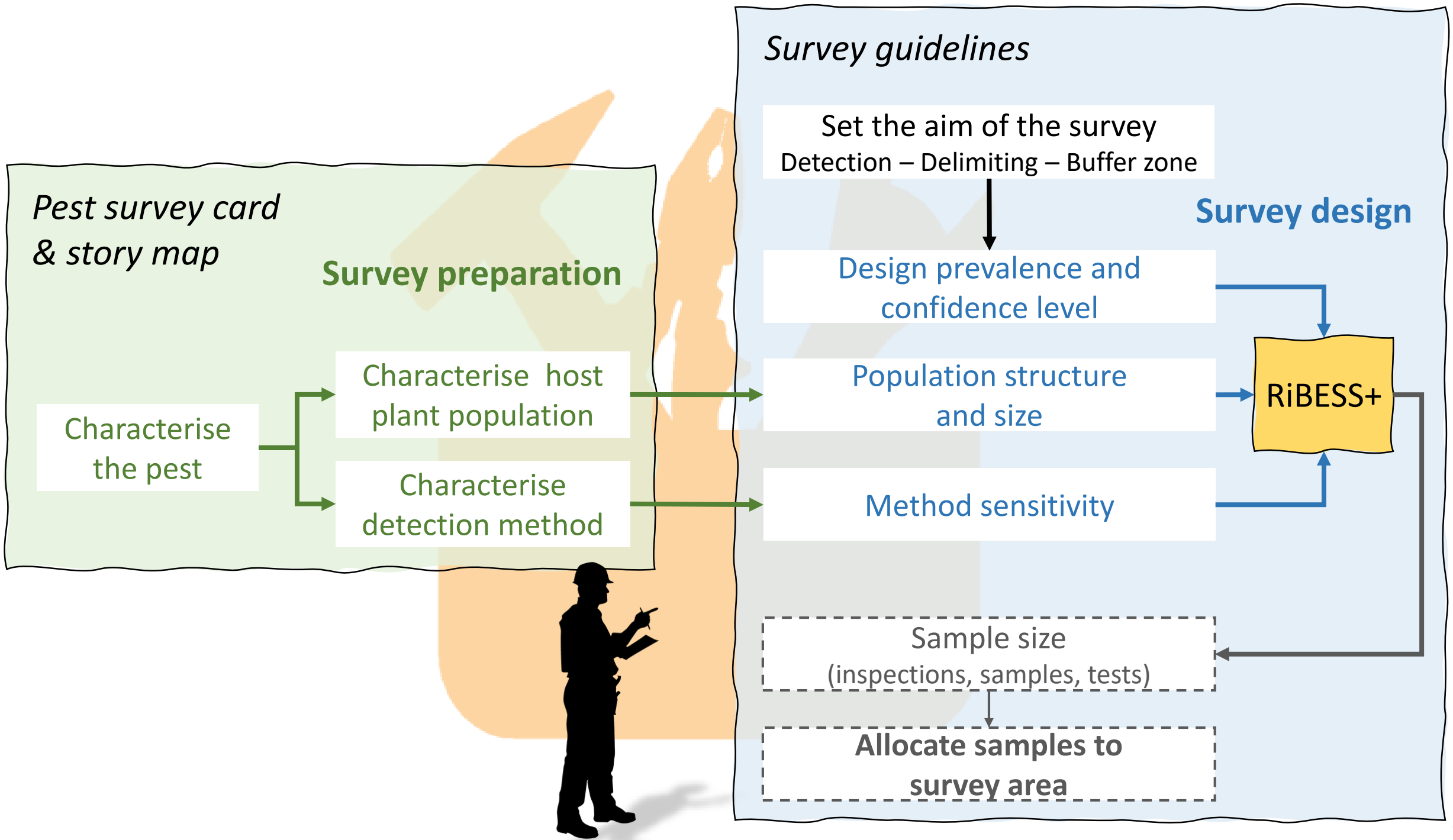
Survey preparation

Characterise the pest

- Characterise host plant population
- Characterise detection method




Survey guidelines
Set the aim of the survey
Detection – Delimiting – Buffer zone
Survey design
Design prevalence and confidence level
Population structure and size
Method sensitivity
RiBESS+
Sample size
(inspections, samples, tests)
Allocate samples to survey area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Pest survey card & story map
Survey preparation
Characterise the pest
Characterise host plant population
Characterise detection method

Survey cards available…

44 cards

…64 pests

EFSA journal virtual issue
https://efsa.onlinelibrary.wiley.com/doi/toc/10.1002/(ISSN)1831-4732.toolkit-plant-pest-surveillance

- **Pilot organisms**
- Citrus pests
- Forest pests
- Potato pests
- Miscellaneous pests

… and ESRI story maps

28 maps

Last update

Online & mobile

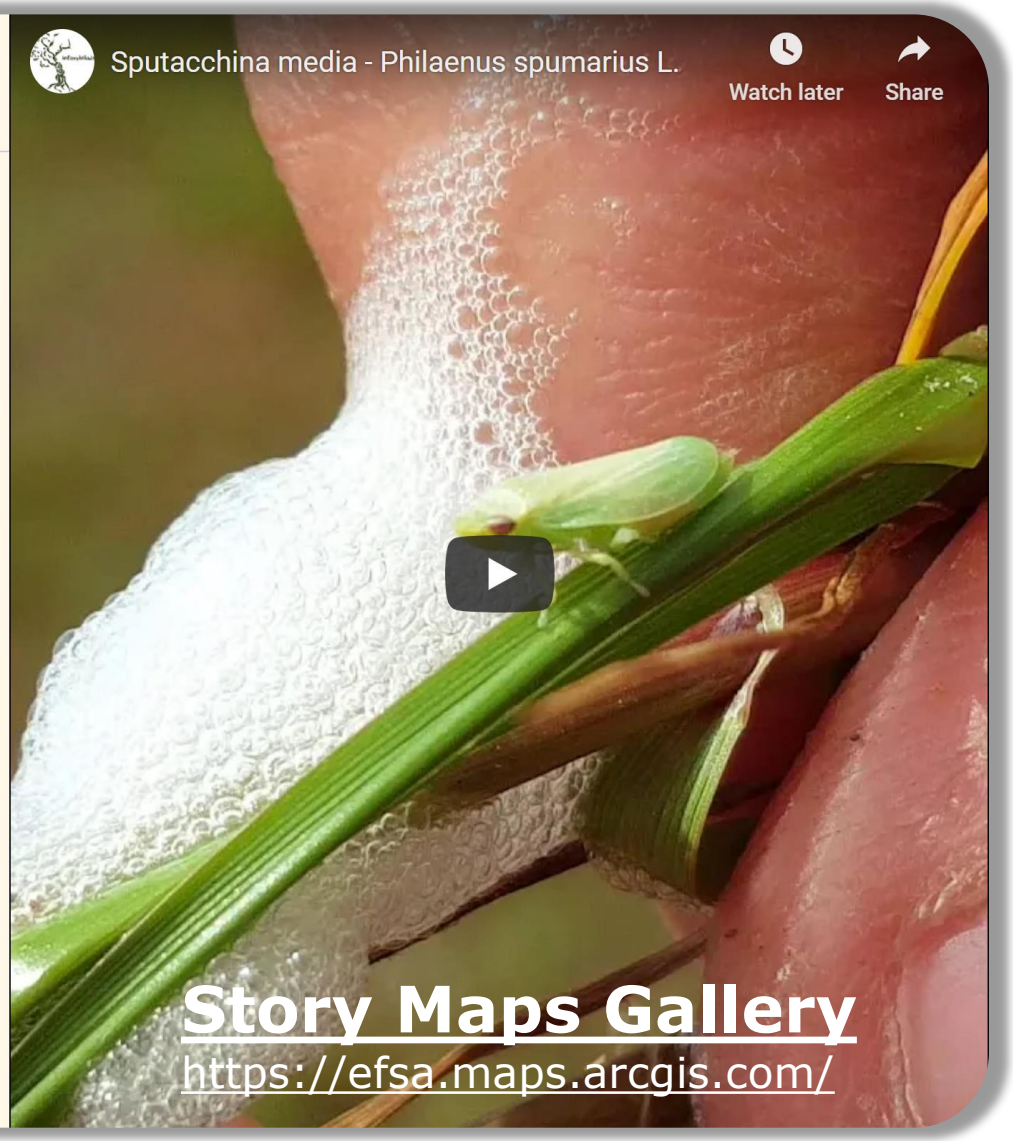
ArcGIS StoryMaps

Plant Pests Story Maps Gallery

Story map for survey of *Xylella fastidiosa*

All Cicadoidea (cicadas) and Cercopoidea - such as the Aphrophoridae family, known as **froghoppers and spittlebugs** - are considered as xylem fluid feeders. Within the superfamily Membracoidea, only the insects belonging to the **subfamily Cicadellinae** (known as sharpshooters) are **xylem fluid feeders. Only these insects have been shown to be vectors of *X. fastidiosa*** (EFSA PLH Panel, 2015, 2018, 2019a).

Nymphs and spittle of *Philaenus spumarius*. Source: Tomasz Klejdysz, shutterstock.com



Q&A

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Delimiting & buffer zone surveys

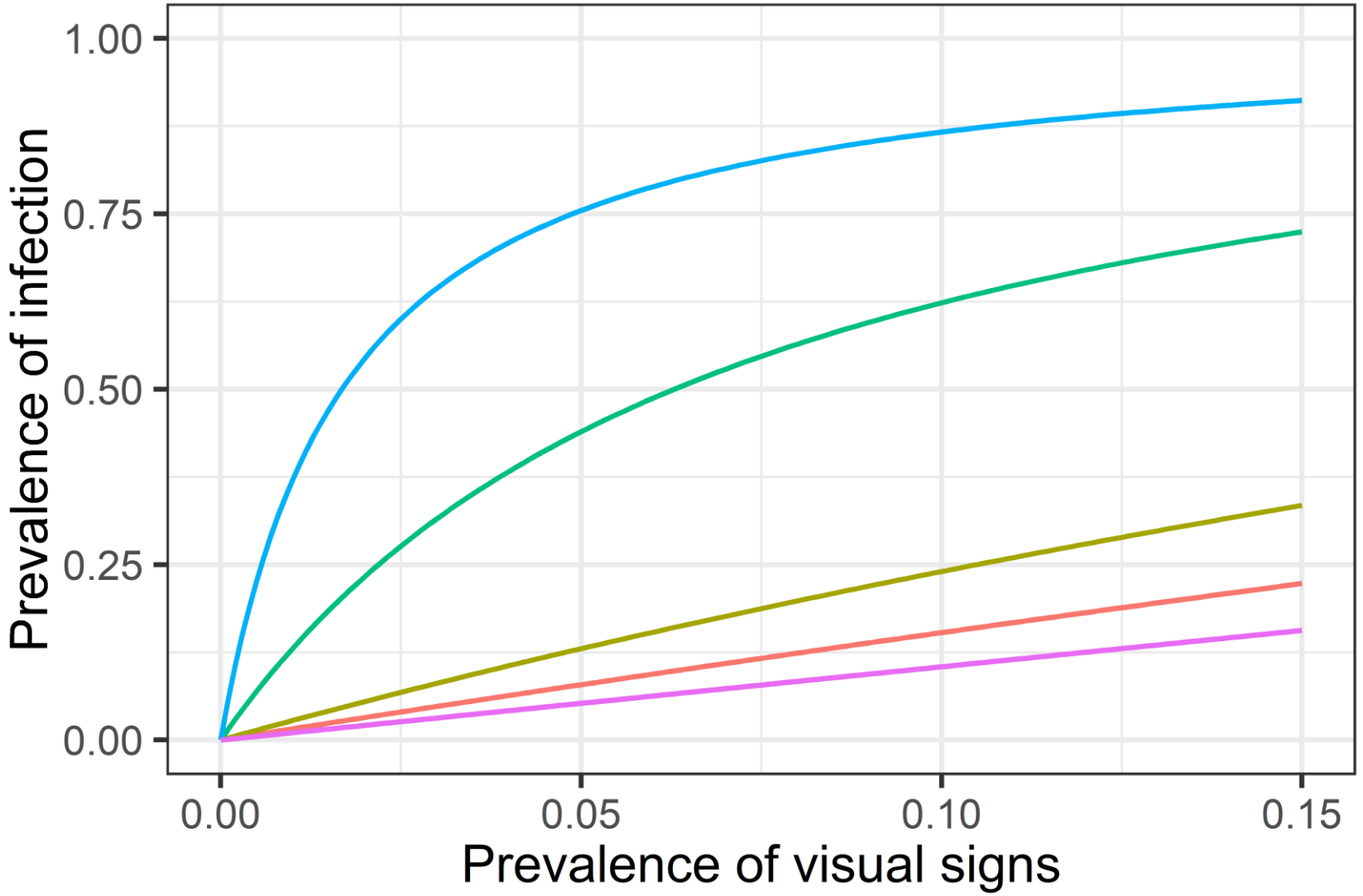
Photo: University of Kentucky

Delimiting & buffer zone surveys

- **Key concepts for survey design**
- **Delimiting surveys**
- **Buffer zone surveys**

Photo: University of Kentucky

Detection method is key



Olive quick decline
(*Xylella fastidiosa*)

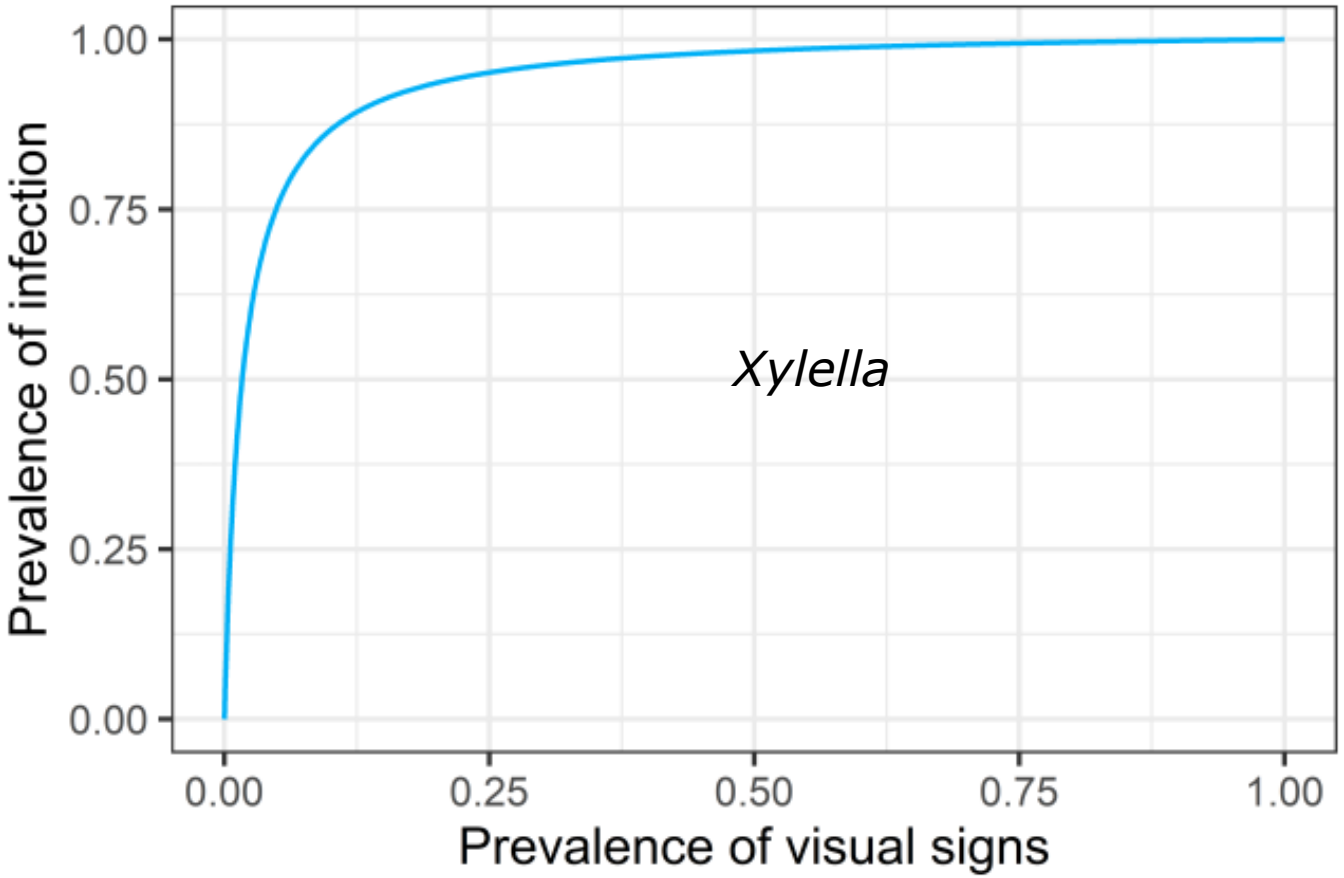
Huanglongbing
(*Ca*. Liberibacter asiaticus)

Citrus canker
(*Xanthomonas axonopodis*)

Ash dieback
(*Hymenoscyphus fraxineus*)

Sudden oak death
(*Phytophtora ramorum*)

Method sensitivity



By the time a visual inspection survey first finds symptoms, the prevalence of infection can already be very high

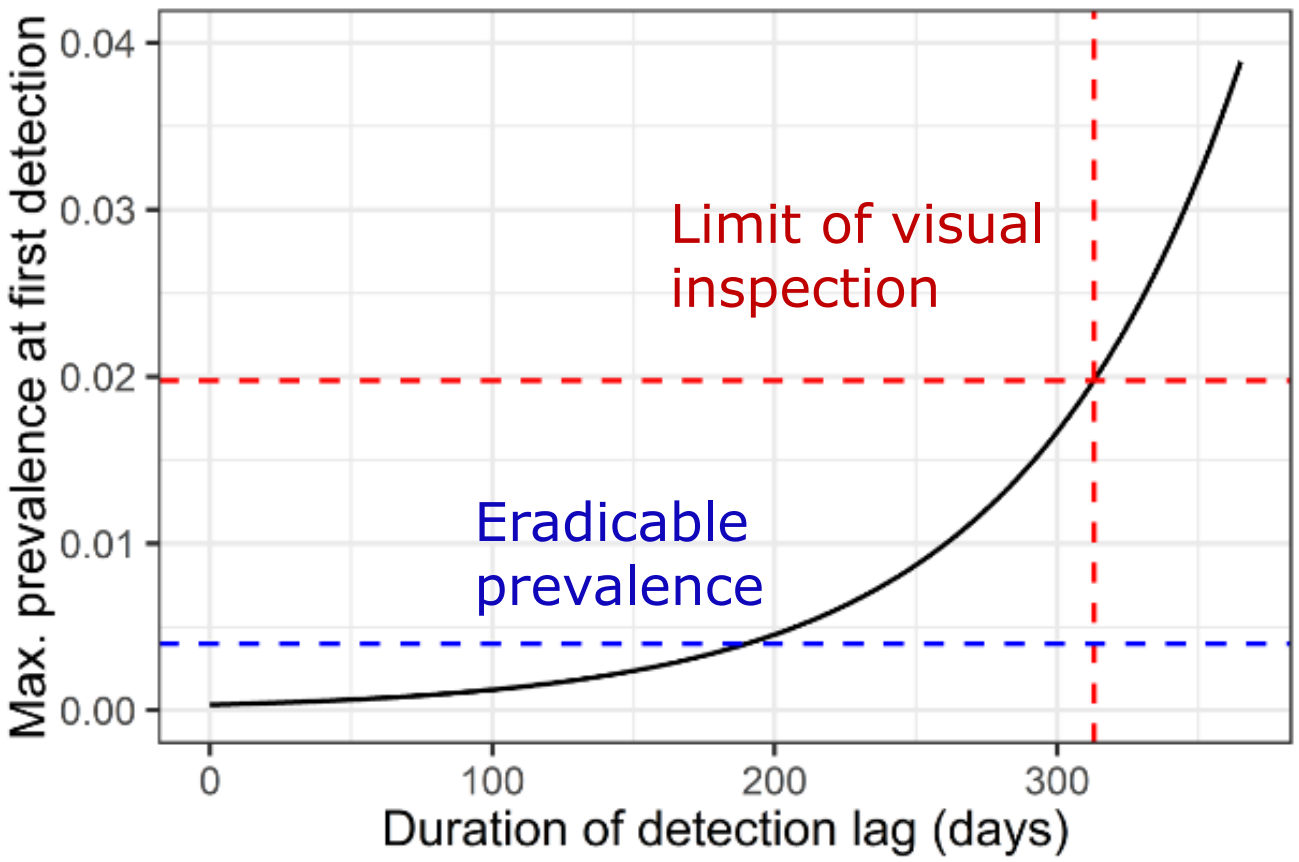
- **Method sensitivity**

(efficacy of detection, ISPM 31)

- The probability to detect the pest in an individual inspection unit if it is present
- Sampling effectiveness × diagnostic sensitivity

- **Sampling effectiveness** → depends on the ability of the **inspector** to successfully choose the infected parts from a host plant.
- **Diagnostic sensitivity** → the probability that a sample tests positive when the sample is truly positive. (The lab method).

Method sensitivity



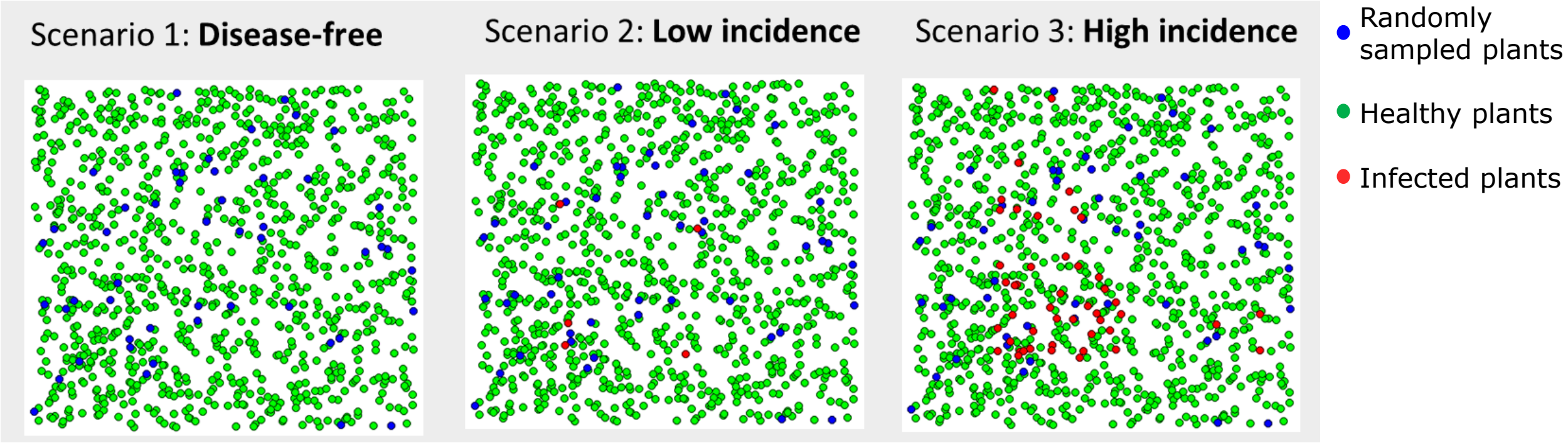
©CNR Bari

Consequently, the prevalence a visual inspection survey can detect *Xylella* (red line) is much higher than that which is considered "eradicable" (blue line)

Confidence level and design prevalence

What is the evidence for pest freedom?

Suppose you conduct a survey and find no pest, what does that mean? Is there really nothing there? How sure can we be?



It is impossible to say with 100% certainty that the pest is not present.

So, what can we say?

We found no pest. We can say with **90% confidence[1]** that if the pest is present its **prevalence[2] is below 1%**

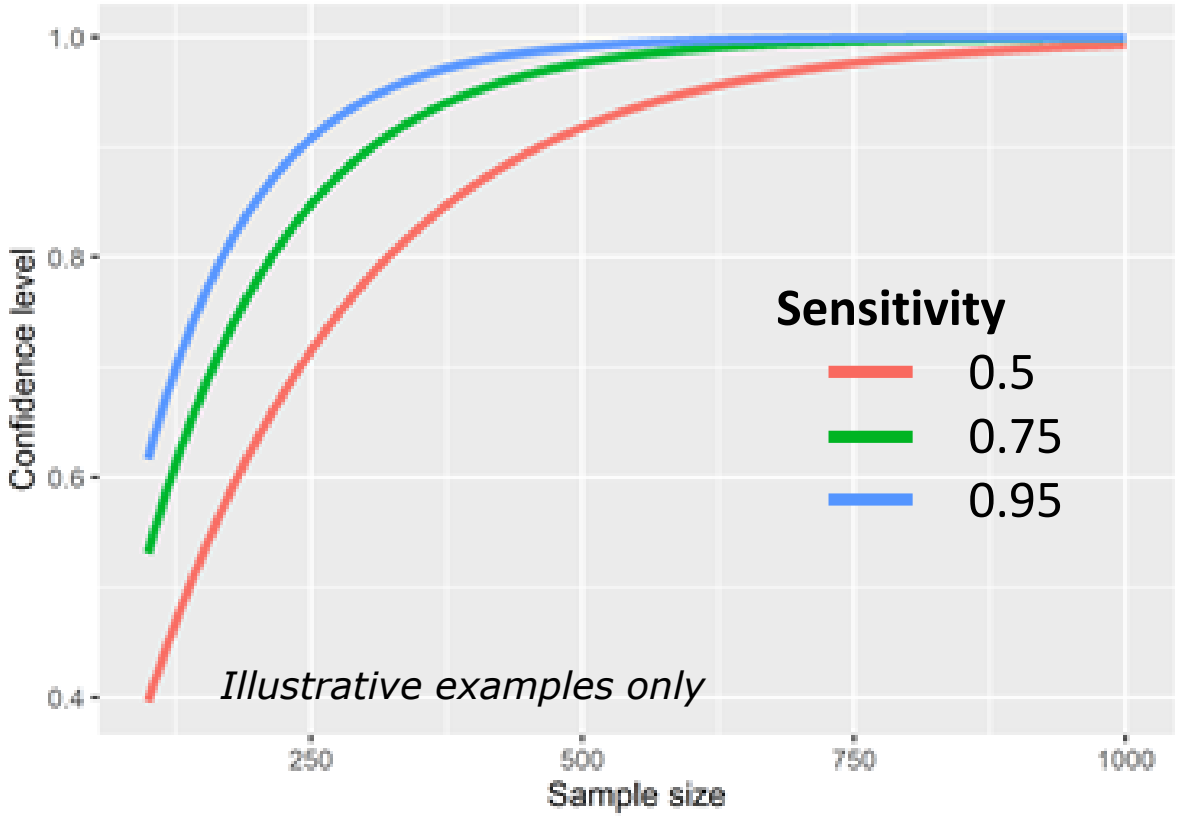
[1]The **Confidence level CL** is the amount of confidence in finding the pest

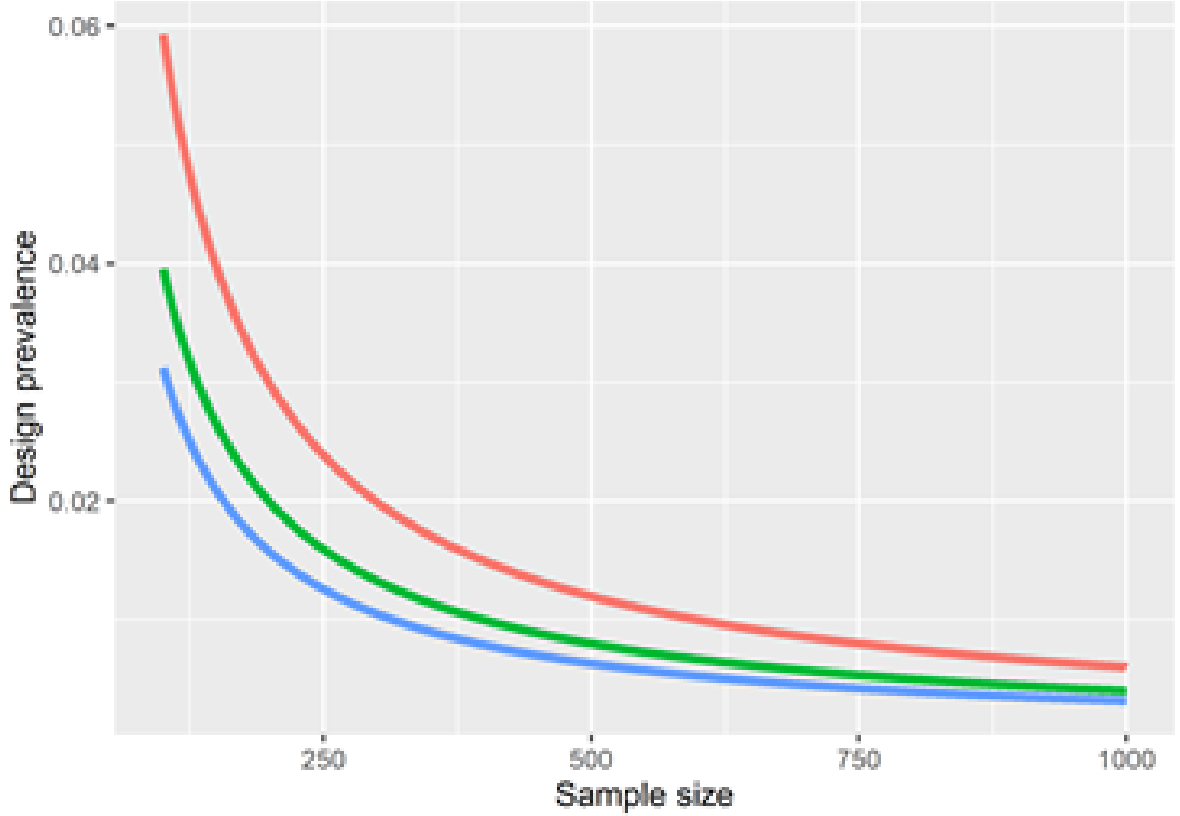
[2]The **Design prevalence DP** (defined in ISPM 31) is the "maximum prevalence" of the pest allowed by the survey

- CL and DP depend on the aim of the survey: detection surveys and delimiting survey will have different CL and DP values
- CL and DP are set by risk managers: is a compromise between available resources and the level of risk acceptable for that specific pest

Interrelation of survey parameters

The lower the design prevalence and the higher the confidence level, the stronger the evidence for pest freedom.





Within an epidemiological unit the more inspection units that are sampled (sample size) and the higher the method sensitivity, the lower will be the design prevalence and the higher the confidence level.

RiBESS+: the statistical tool

A video tutorial is available via the EFSA YouTube Channel and will be played now.

Video

Delimiting & buffer zone surveys

- Key concepts for survey design
- **Delimiting surveys**
- **Buffer zone surveys**

Photo: University of Kentucky

Survey design steps

I. Set survey parameters. They depend on:
   - Aims of the survey
   - Target population
   - Pest identification methods

II. Estimate the number of host plants (sample size) to be sampled (**RiBESS+**)

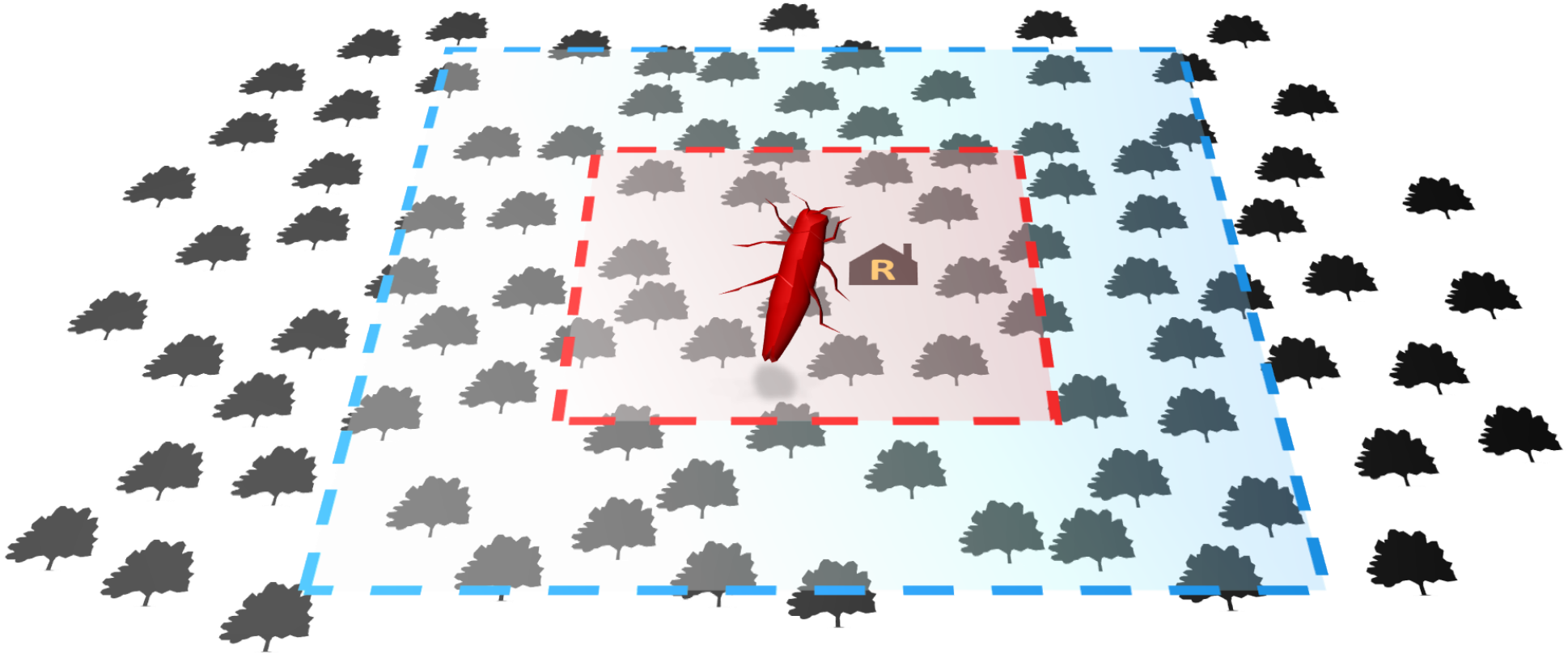
III. Allocate the number of host plants to be sampled in the survey area

I. Quantify survey parameters

- Aims of the survey → **Confidence level** (CL) and **Design prevalence** (DP)
  - Detection surveys: pest freedom
  - Delimiting surveys: **infested zone boundaries**
  - Buffer zone surveys: **detection at low prevalence level**
- Host plant population → **Population size** and **Risk factors**
- Pest identification methods → **Method sensitivity** (MeSe)

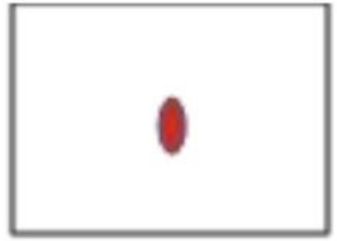
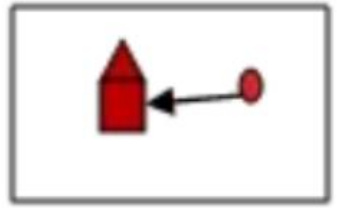
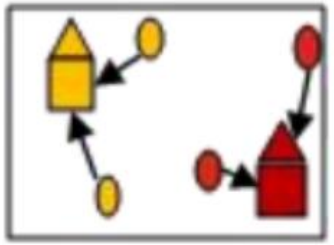
Delimiting and buffer zone surveys

The demarcated area should consist of an **infested zone** and **a buffer zone** (Regulation (EU) 2016/2031, Article 18)



Delimiting surveys: a stepwise approach

- **Step 1:** Identifying the source of the **infestation** or **infection**
- **Step 2:** Construction of the potentially infested zone
- **Step 3:** Delimit the boundaries of the infested zone

One infected host was found; no source locally identified. The infected host becomes the source of the infection.	
One infected host was found and a source identified.	
More than one infected host was found; no sources locally identified. All infected hosts are considered as sources.	
More than one source of infection was identified.	

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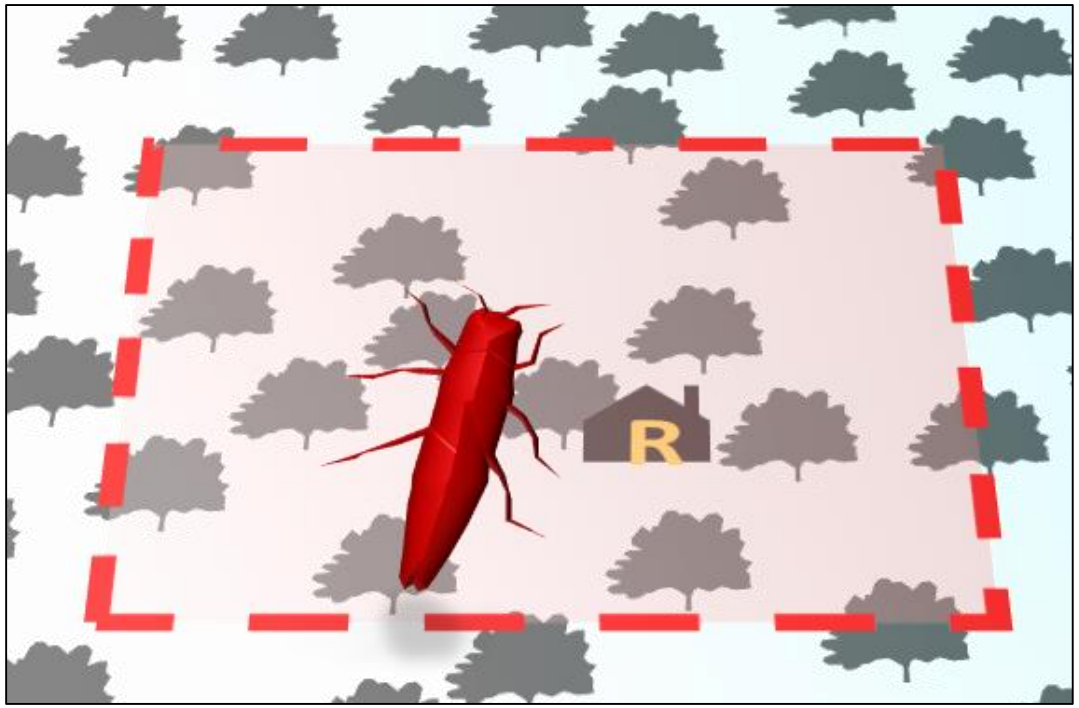
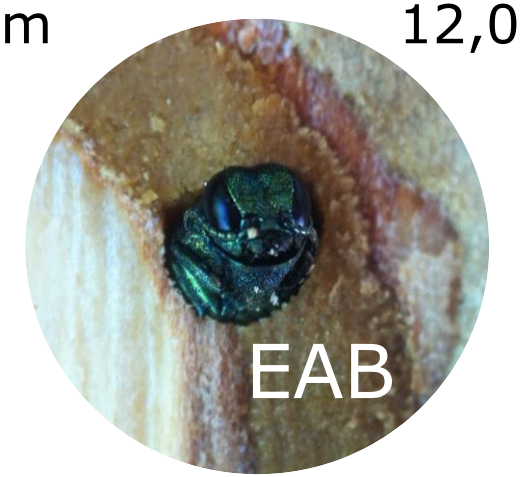


Pest spread and survey design

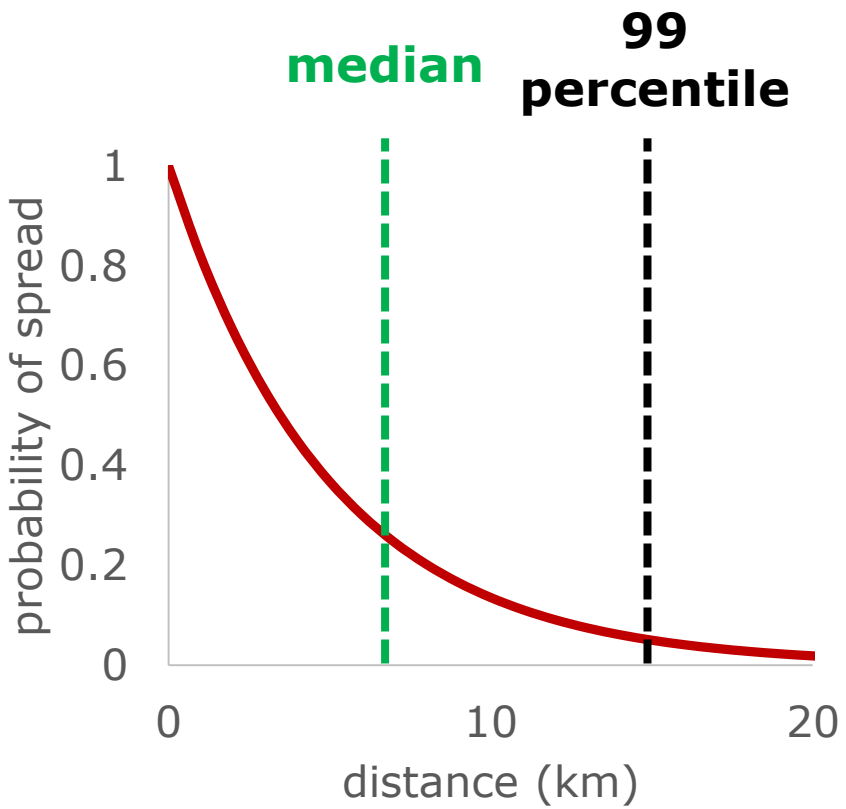
Spread rates (m/yr) (99 percentile)

5000m

12,000m

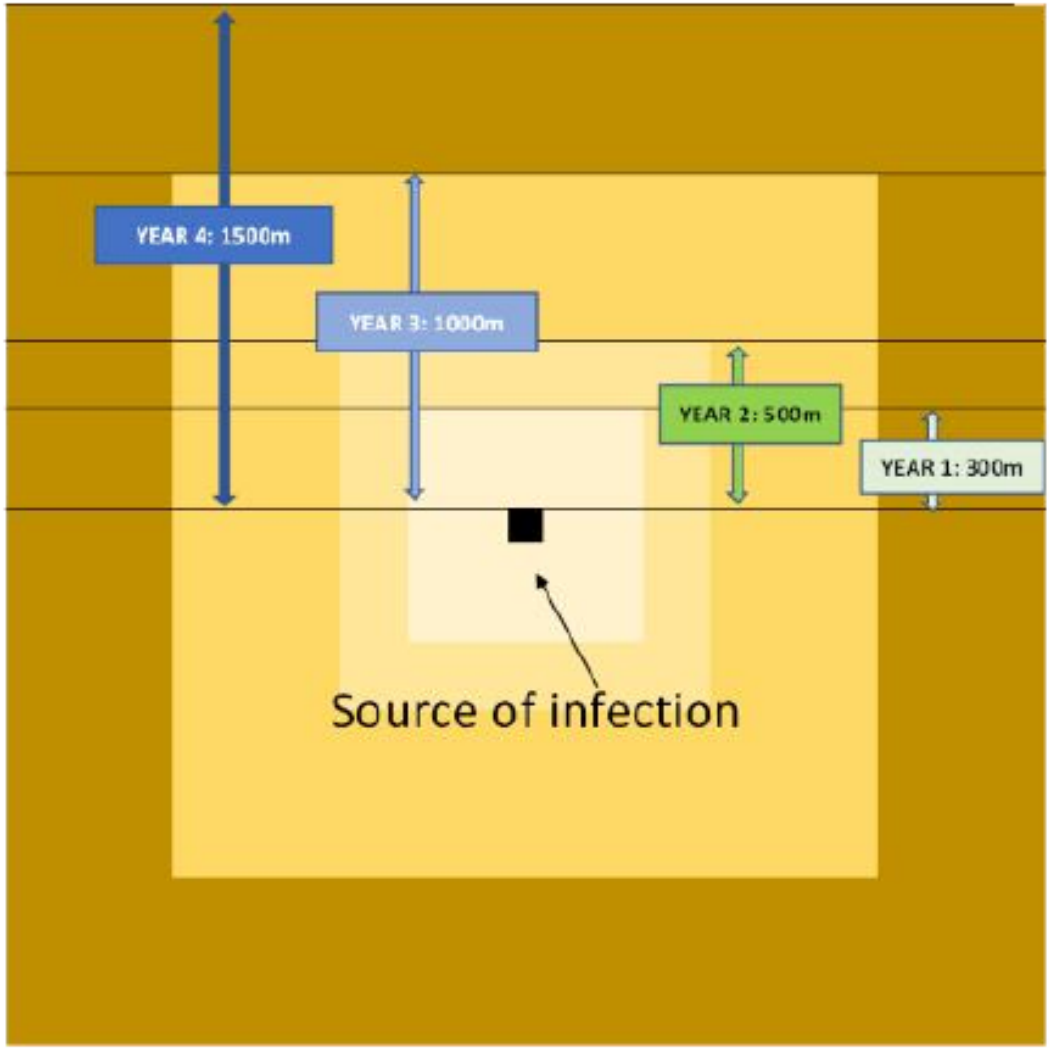


10,000m



Delimiting surveys: a stepwise approach

Step 2: Construction of the potentially infested zone

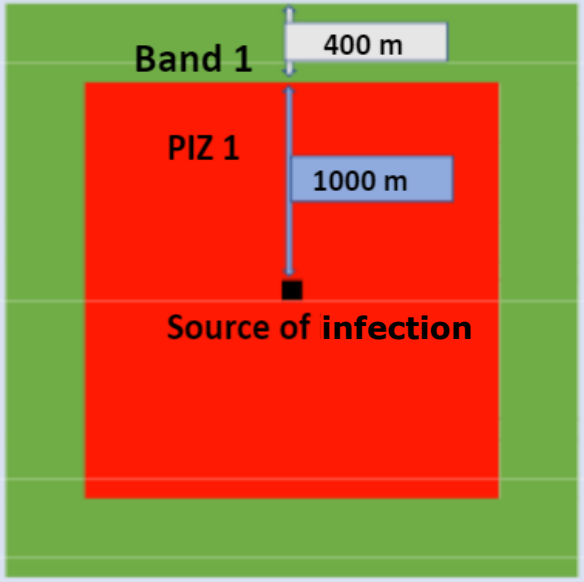


Years since last detection survey of the site	Estimated spread distance around the source of infection [a]
1	300 m [b]
2	500 m [c]
3 [d]	**1000 m** [c]
4	1500 m [c]

(a) The potential spread distance, from its introduction until the pest is n found, in the worse case corresponds to the years elapsed since the last detection survey was performed.
(b) Yearly median of short-distance dispersal 151 m (fitted to the spread rate in Apulia) (EFSA PLH Panel, 2019).
(c) Based on short-range spread model of the disease caused by *Xylella fastidiosa* (EFSA PLH Panel, 2019).
(d) This is the scenario chosen for the simulations.

Delimiting surveys: a stepwise approach

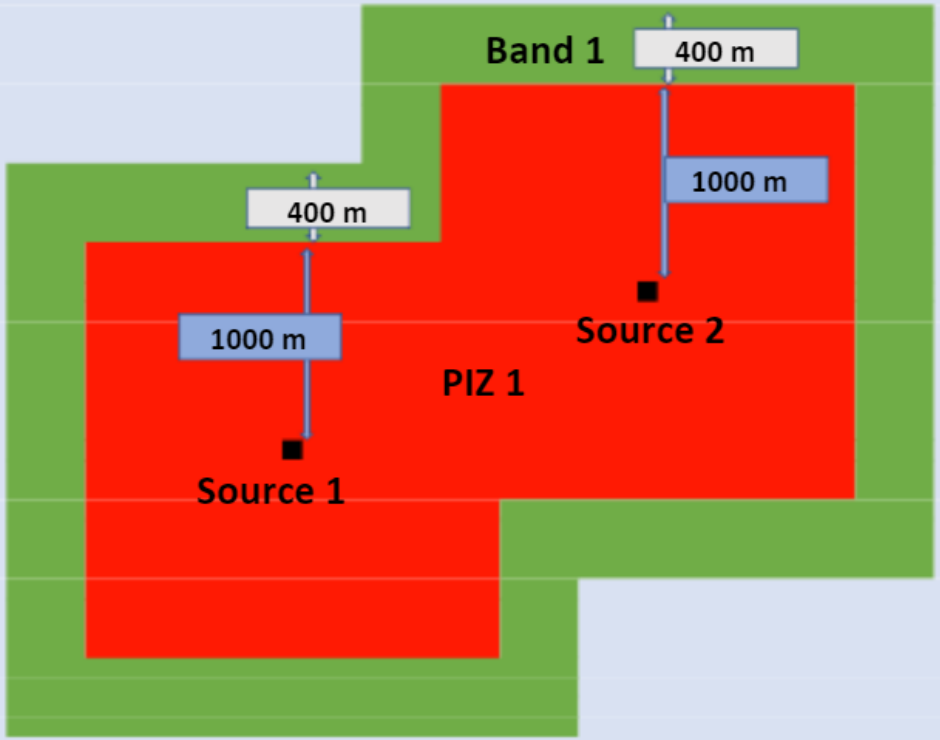
Single infection source



Source of infection
PIZ 1 : Potenally infested zone 1
Band 1 : Survey band 1

Provisional demarcated area

Multiple infection sources



Source of infection
PIZ 1 : Potenally infested zone 1
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Provisional demarcated area

Delimiting surveys: a stepwise approach

- **Step 1:** Identifying the source of the **infestation** or **infection**
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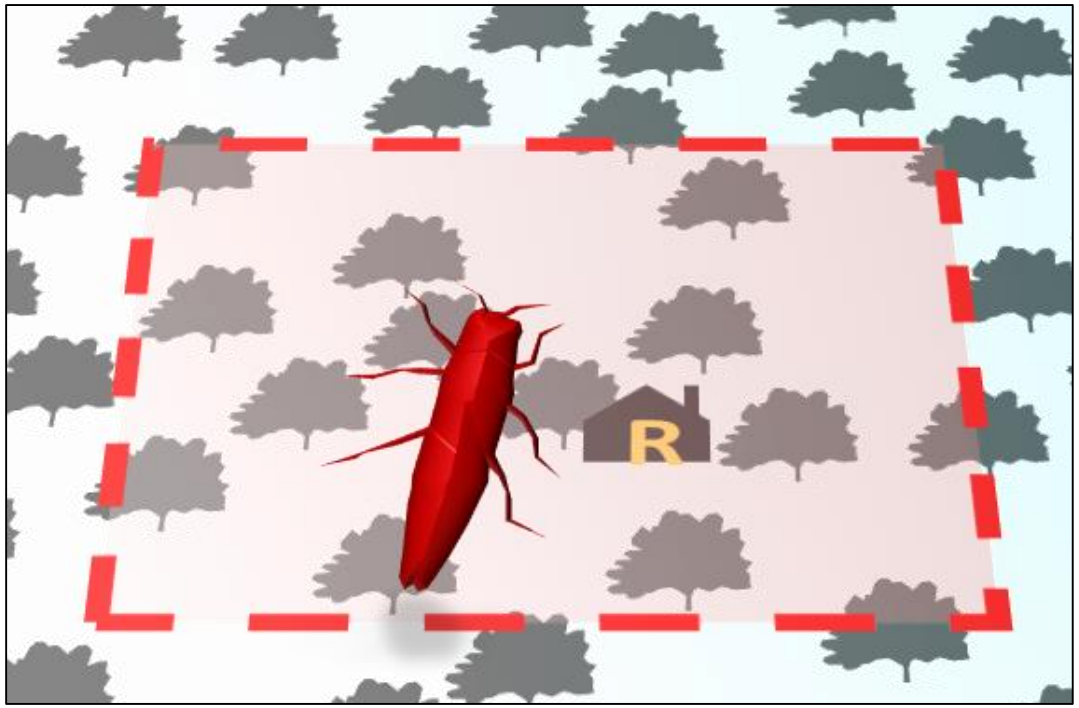
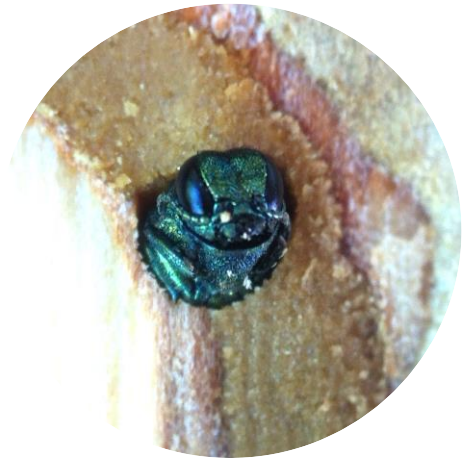


Narrowing down the provisional infested zone



Provisional demarcated area

Band 1

1,500 m

3,000 m

PIZ 1

Band 1 cleared

Band 2

1,500 m

PIZ 2

Band 2 cleared

1,500 m

Band 3

- Source of infestation
- Provisional infested zone = PIZ
- Survey band

Band 2 is infested

Band 3 is infested

Band 3 is cleared

Demarcated area

Buffer zone

10,000 m

IZ

3,000 m

*

*

*

10,000 m

IZ

**

1,500 m

10,000 m

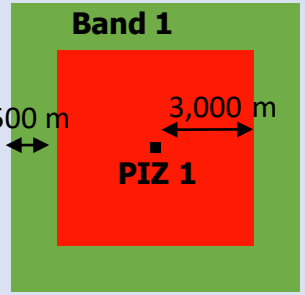
Infested location

- Infested zone IZ
- * New findings

Boundaries of the infested zone confirmed and area demarcated

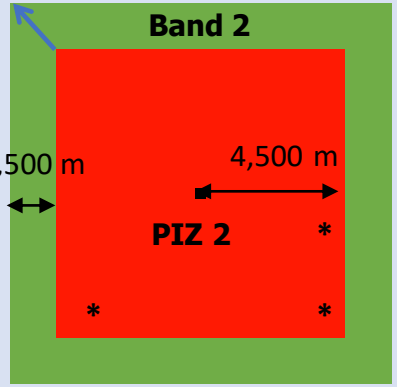
Enlarging the provisional infested zone

Provisional demarcated area



Source of infestation
Provisional infested zone = PIZ
Survey band

Band 1 infested



* New findings

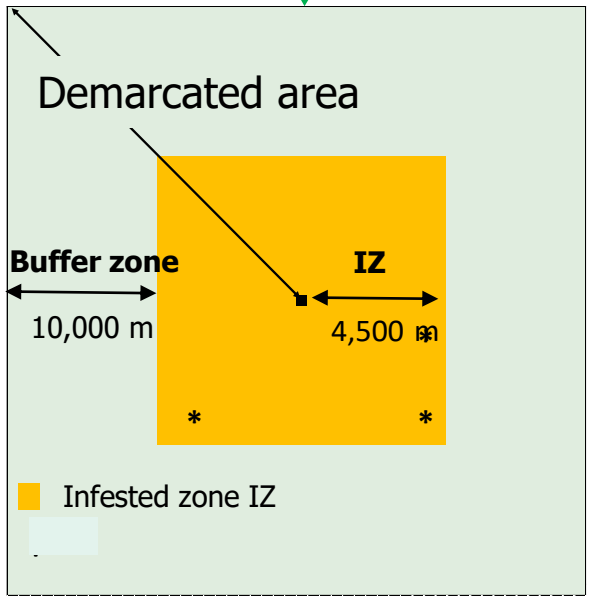
Band 2 infested

Iterative process following positive findings in the newly defined survey bands

Band 1 cleared

Narrowing down of the PIZ 1 following the process described in Step 3a

Band 2 cleared

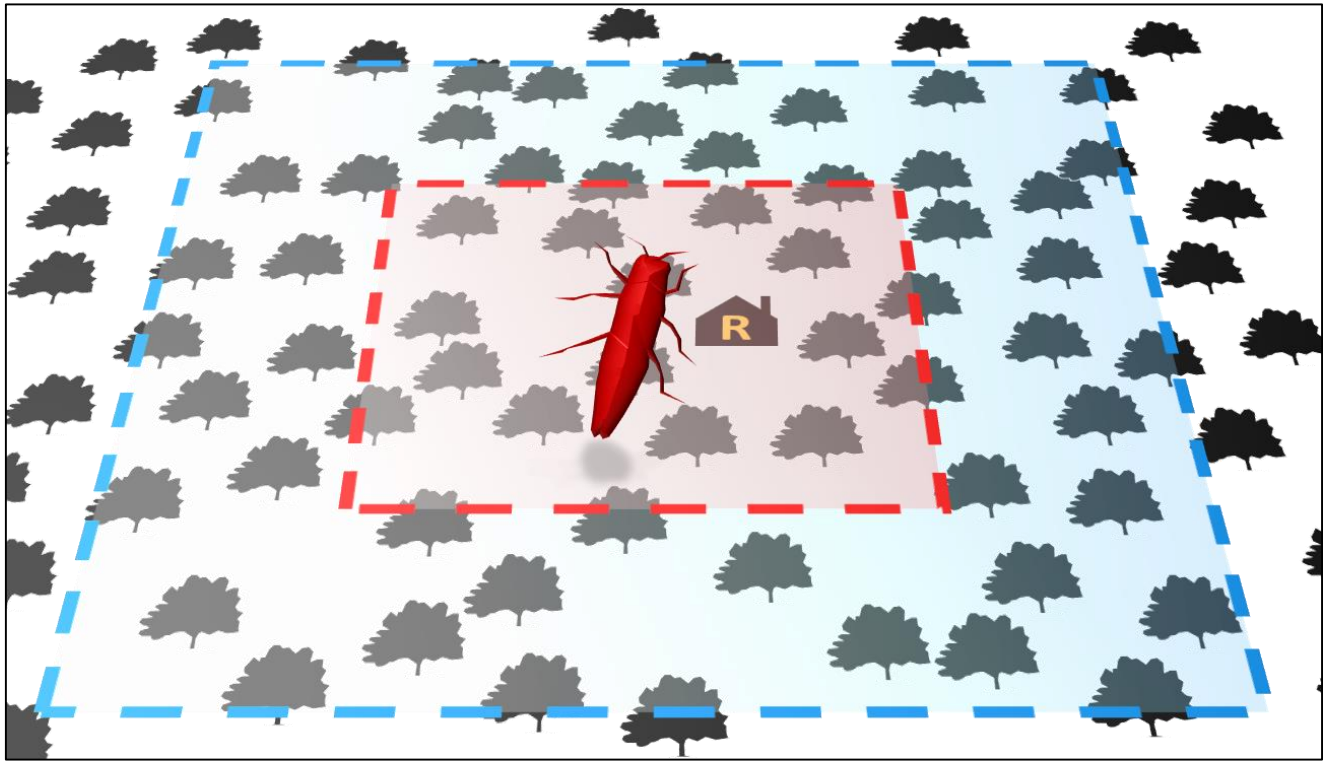


Boundaries of the infested zone confirmed and area demarcated

Buffer zone surveys

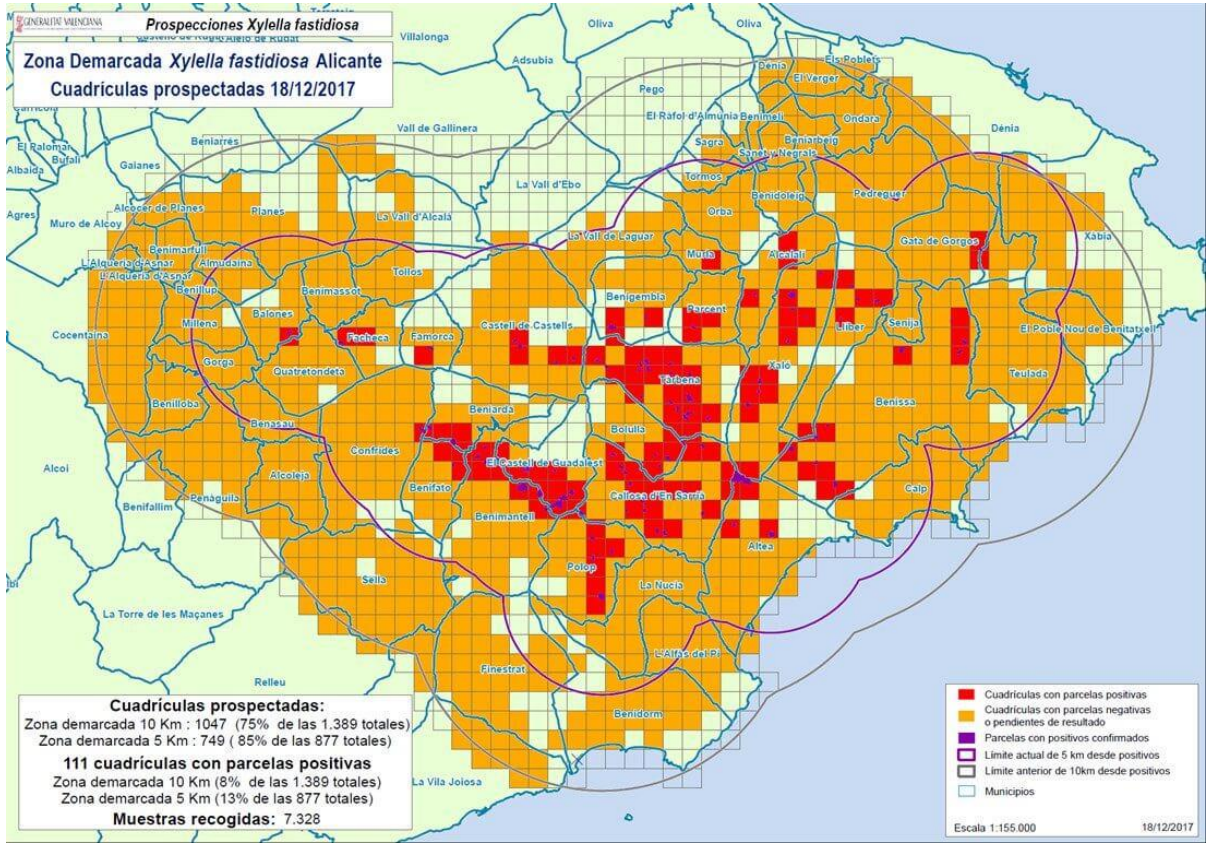
A buffer zone is "*an area surrounding or adjacent to an area officially delimited for phytosanitary purposes in order to minimize the probability of spread of the target pest into or out of the delimited area, and subject to phytosanitary or other control measures, if appropriate*"

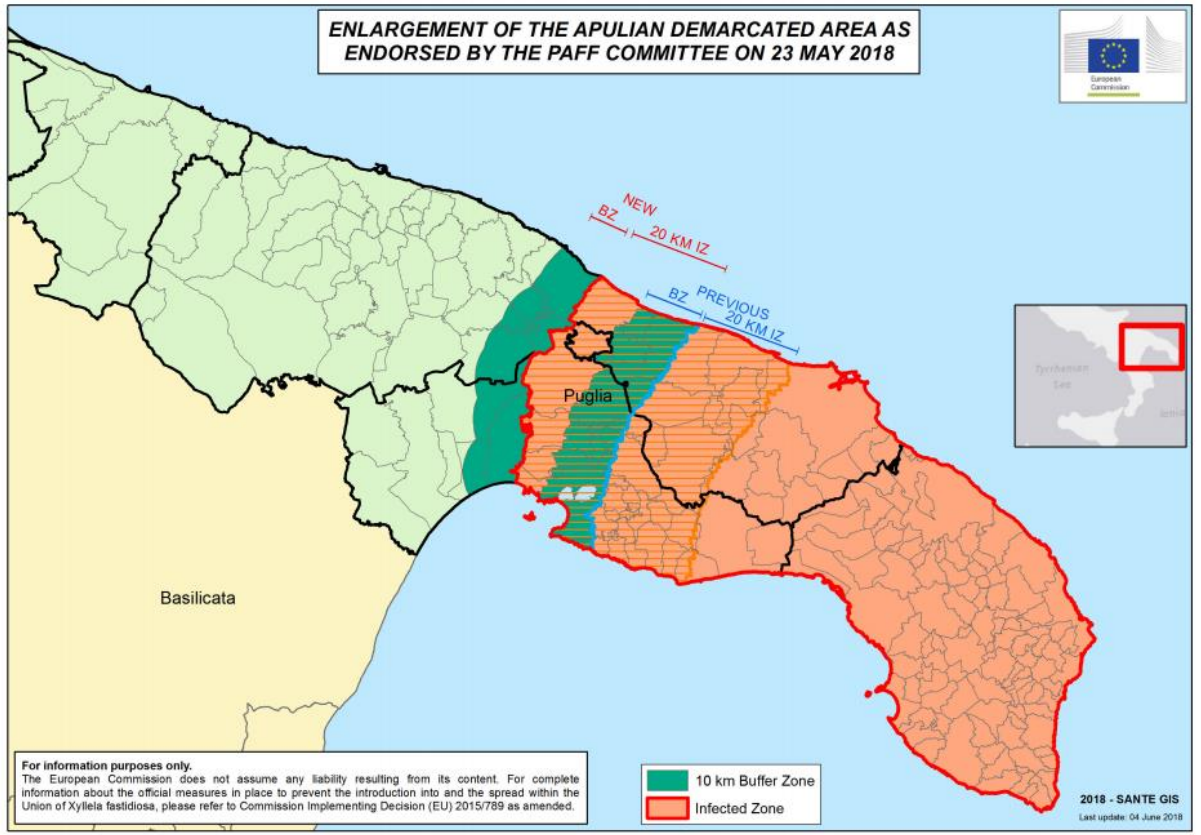
ISPM 5 (FAO, 2019)



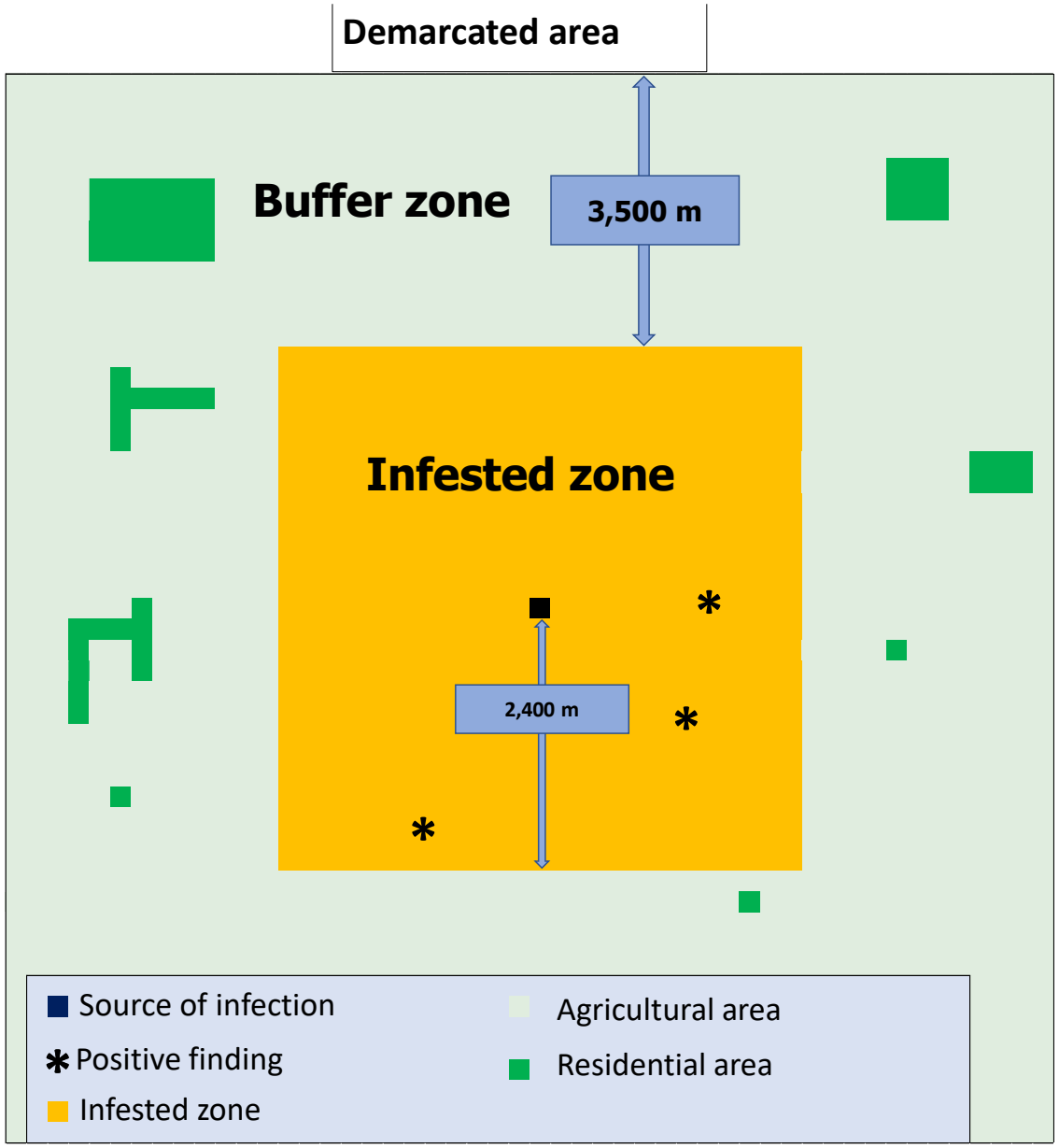
Buffer zone surveys

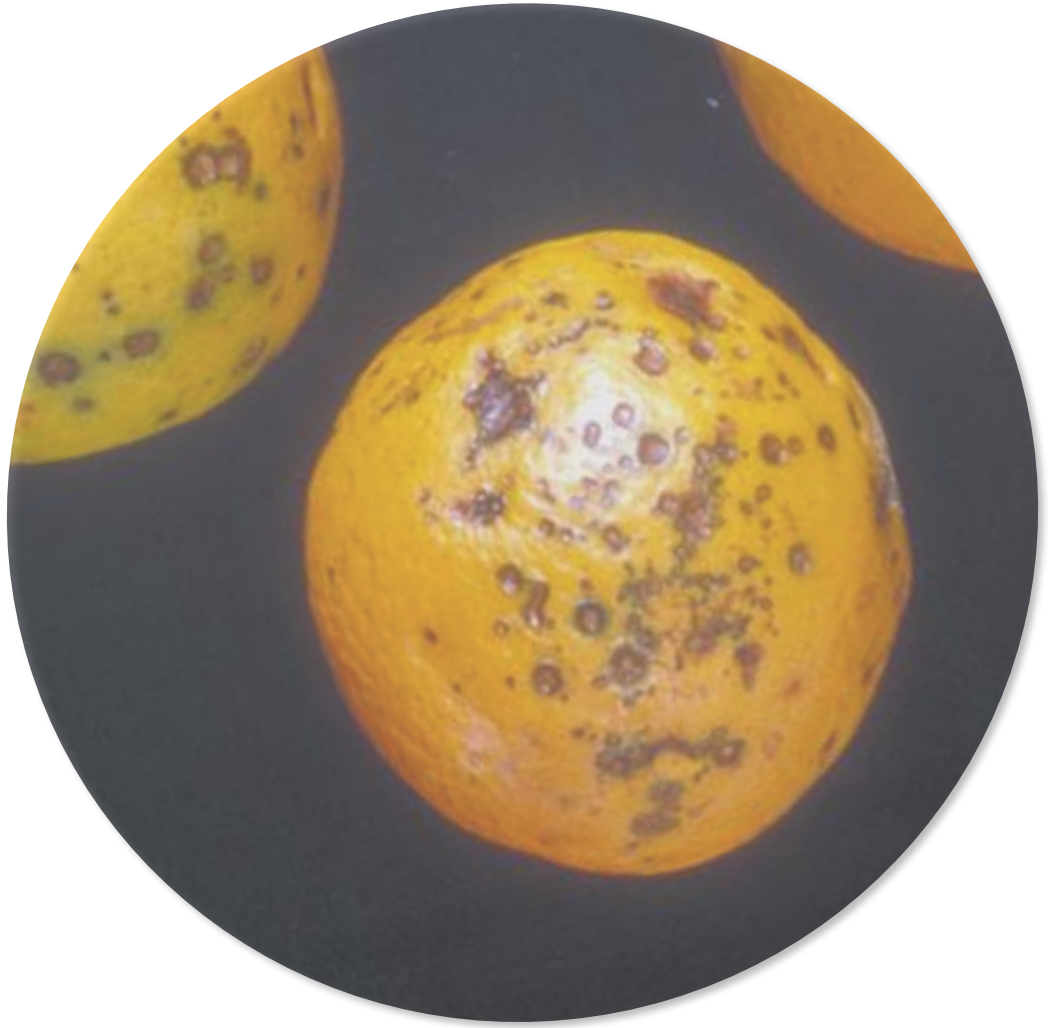
Examples of buffer zones as shown for *Xylella* for Valencia and Apulia



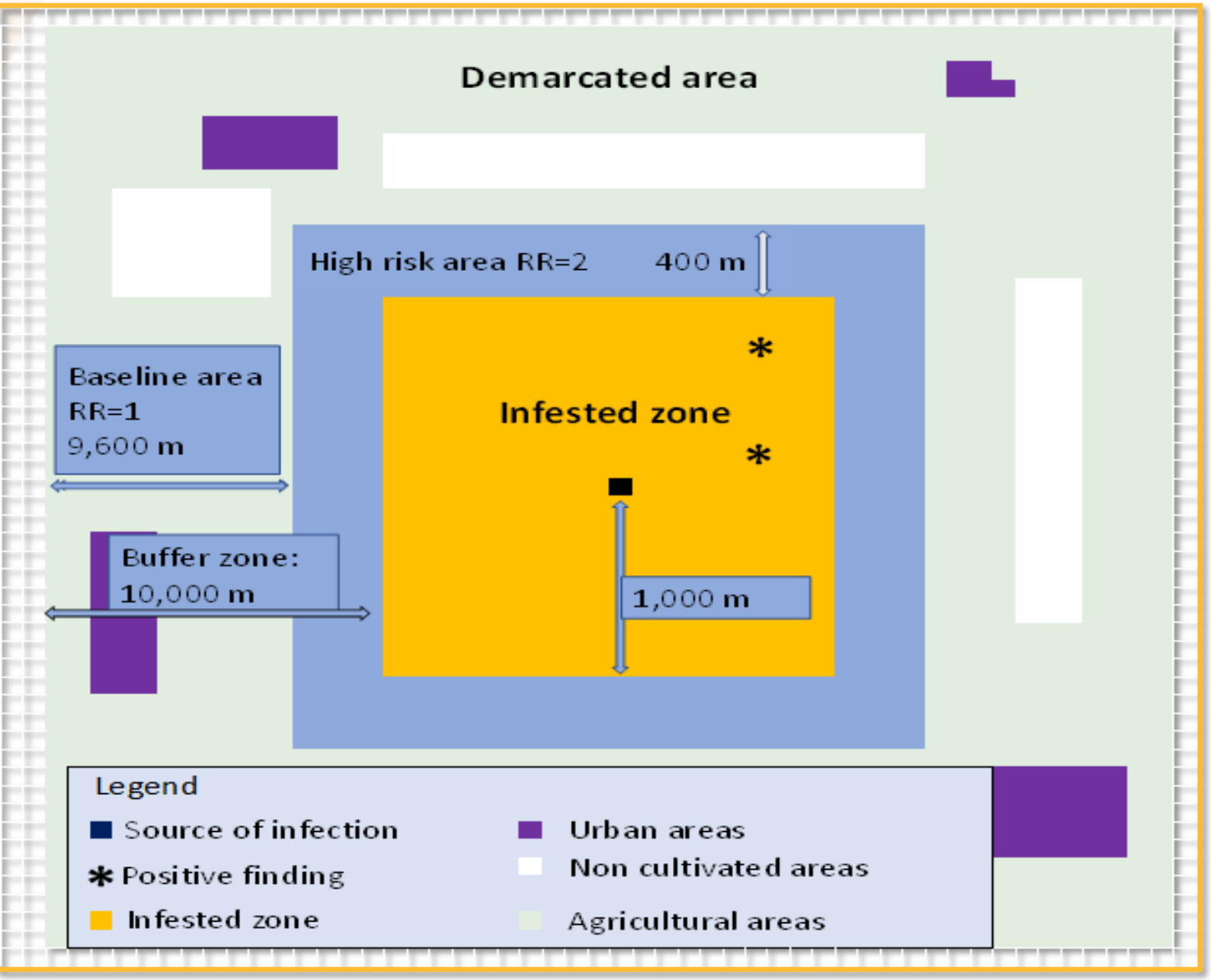


Citrus black spot





Xylella fastidiosa



Example: calculation

SURVEY PARAMETERS			AGRI AREAS	URBAN AREAS
Goal of the survey	**Confidence level (CL)**		**0.78**	0.78
	Design prevalence (DP)		**0.04%**	0.1%
Target population	**Host plants**		***Prunus* sp.** ***Vitis* sp.**	*Lavandula* sp.
	Size		**7.5 million host plants**	1.2 million host plants
	Extent		**25,000 ha**	12,000 ha
	Epidemiological units		**Whole extent**	Whole extent
	Risk factor	**High risk (24,600 ha) RR=2**	**120,000 host plants (0.016)**	-
		Baseline (400 ha) RR=1	**7,380,000 host plants (0.984)**	-
Identification methods	**Method Sensitivity (MeSe)**		**0.55**	0.55

Result: N of samples needed

LAND USE	DESIGN PREVALENCE (%)	CONFIDENCE LEVEL (%)	RISK LEVEL	RR	CONVENIENCE SAMPLING	SAMPLES
Agri area	0.04	78	High risk	2	2	**2,784**
			Baseline	1	1	**1,392**
Urban area	**0.04**	**45**	N/A	N/A	N/A	**2,751**
	UNIQUE DP	**OCL = $1-(1-CL_{AA}).(1-CL_{UA})$**				
Total	**0.04**	**1-(1-0.78).(1-0.45) = 0.8799 → 87.99%**				**6,927**

In conclusion

Photo: University of Kentucky

Q&A

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What is next…

Survey cards for >200 pests in 6yr

- Quarantine, protected zone, and emerging pests
- From pest-based to crop-based survey
- Plant health specific stats tool

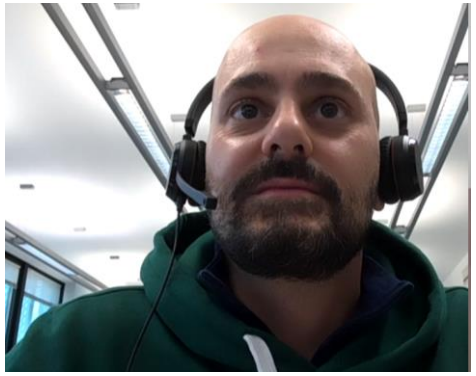
- **6, 21 October and today's webinar available online**

Check for:

- **New survey cards and guidelines in the EFSA journal**
- **New story maps in the gallery**

Thanks for attending!



EFSA surveillance

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- **Experts:** Elena Lazaro, Antonio Vicent Civera, Stephen Parnell
- **Partners:** Netherlands Food and Consumer Product Safety (NVWA); Julius Kühn-Institut Federal Research Centre for Cultivated Plants (JKI); HORT@: Maria Chiara Rosace (story maps)
- **Thanks** to NPPOs of MSs for suggestions in the development of survey cards and guidelines

We also thank Alzbeta Mikulova, Sara Tramontini, the EFSA Plant Health team, and EFSA Comms

Thanks for attending!

Please feel free to reach out at:

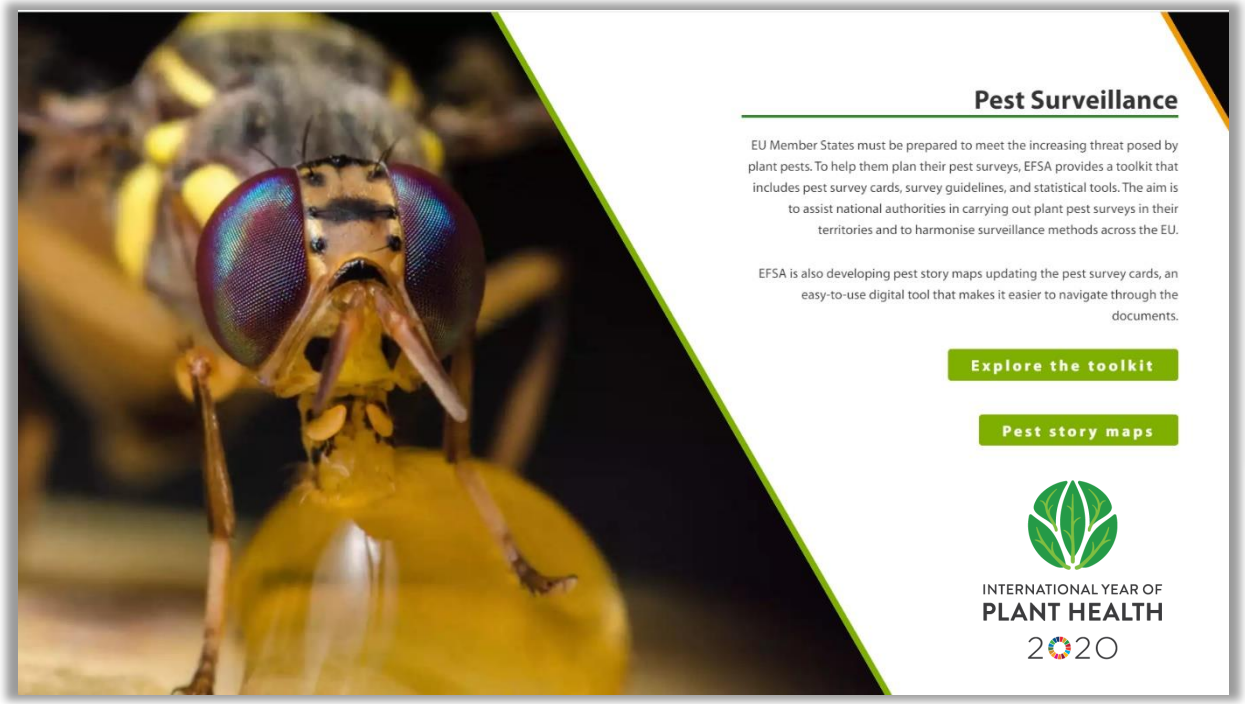
alpha@efsa.europa.eu

Please take 5 more minutes to fill out the evaluation form that you will receive shortly. Your feedback will help us improve our work!

Thanks for attending!

efsa
European Food Safety Authority

New PLH website
https://bit.ly/3dtyypm



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