# **Emerging and invasive** forest pests and diseases

M. Branco, E. Sousa, A. Ortiz, J. Casado, A. Cantero, J. Diez, E. Mauri, C. Orazio, H. Jactel











# Context

- **Exponential increase** in the number of exotic, invasive pests and diseases that get established in Europe
- As a result of global change (climate, trade, urbanization)
- **Rising threat to European forests**, particularly to planted forests of southwestern Europe

# **Rationale for emergency plans**

- The next invader might be unknown as a pest, or even undescribed
- > Need for generic plans

- The introduced species is likely invasive
- > Need for transboundary cooperation

- Better prevent than cure
- > A priority to early detection

# Tentative framework for <u>early warning detection</u> of invasive forest pests (and diseases)

- Sequential framework, following the steps of introduction
  - ✓ Origin of the pest
  - ✓ Transport
  - Entry = Arrival and Establishment
- Asking the same questions
  - ✓ How?
  - ✓ Where ?
  - ✓ By whom ?

# Step 1. Monitoring scientific and technical literature

- EPPO alert bulletins, studies, PRAs
- EPPO website
- Can be checked by anyone



- Scientific papers or presentations
- Web of Science, SCOPUS, international conferences (IUFRO)
- Contact with scientists

### 7.03.12 - ALIEN INVASIVE SPECIES AND INTERNATIONAL TRADE

Coordinator:	
René Eschen,	Switzerland

Deputies: <u>Hugh F. Evans</u>, United Kingdom <u>Kenji Fukuda</u>, Japan <u>Sankaran Kavileveettil</u>, India

### Unit 7.03.12

- > Activities and events
- > Publications and references
- > Expertise offered by Unit
- > Toolbox
- > Unit Noticeboard

# Step 2. Install sentinel plantings in areas of origin

- Planting of important European tree species in potential origin areas of introduced species
- In main countries exporting goods and products to Europe and sharing congeneric tree species: Asia!
- In cooperation with scientists and colleagues from exporting countries



Fig 5. Comparative colonization of the different species of European trees planted at two sites in China and the frequency of the colonization events. No. spp > 5 events means that these insect species were observed on more than 5 seedlings during two different years (pooled over both sites). Note that an individual insect species can be observed on more than a single tree species.

doi:10.1371/journal.pone.0120864.g005

# Step 3. Surveillance of forests at risk of invasion

- Identification and surveillance of forests threatened by insects or diseases on alert list, through aerial and/or field surveys
- In main areas of presence of threatened tree species
- By forest health managers with help of forest inventory people







NFI

## Step 4. Use of arboreta as sentinels for detection

- Network of arboreta & botanical gardens with native and exotic trees species, to serve as "trap trees" of introduced exotic species
- Through the region at risk, close to entry points (ports, roads)
- By forest scientists, forest health agents, forest managers



# Step 5. Use of multi-pheromone traps

- Installation of multi-pheromone (generic) traps, for the interception of alien species
- In seaports and airports
- By forest health managers, custom agents, with the help of taxonomists

Journal of Pest Science https://doi.org/10.1007/s10340-018-0997-6

**ORIGINAL PAPER** 

Multi-component blends for trapping native and exotic longhorn beetles at potential points-of-entry and in forests

Jian-ting Fan<sup>1,2</sup> · Olivier Denux<sup>1</sup> · Claudine Courtin<sup>1</sup> · Alexis Bernard<sup>1</sup> · Marion Javal<sup>1</sup> · Jocelyn G. Millar<sup>3,4</sup> · Lawrence M. Hanks<sup>5</sup> · Alain Roques<sup>1</sup>





# Step 6. DNA bar coding for the identification of intercepted alien species

- Development of generic pipelines using NGS data as genetic markers (e.g. SNPs) to identify introduced species, and track their origin
- In research labs and biosecurity agencies
- By scientists and staff members of biosecurity labs

Biol Invasions (2015) 17:1199–1213 DOI 10.1007/s10530-014-0788-9

ORIGINAL PAPER

Worldwide invasion routes of the pinewood nematode: What can we infer from population genetics analyses?

Sophie Mallez · Chantal Castagnone · Margarida Espada · Paulo Vieira · Jonathan D. Eisenback · Mark Harrell · Manuel Mota · Takuya Aikawa · Mitsuteru Akiba · Hajime Kosaka · Philippe Castagnone-Sereno · Thomas Guillemaud



the populations of

Portugal/Madeira seem to be closer to the American populations than to the Japanese populations,

# Step 7. Citizen science for multiplying the sources of information on emerging sanitary problems

- Development of smartphone application to take pictures of damages or symptoms on trees and detect anomalies
- Everywhere but focus on urban and peri urban areas
- By trained forest (health) managers, then citizens. Curation and identification by trained people, then artificial intelligence

Type of habitats for the first interception of 126 alien forest pest species in Europe (PLURIFOR study)



# Step 7. Citizen science for multiplying the sources of information on emerging sanitary problems

- Development of smartphone application to take pictures of damages or symptoms on trees and detect anomalies
- Everywhere but focus on urban and peri urban areas
- Curation and identification by trained people, at EFI Planted Forests Facility

## SILVALERT<sup>®</sup> Developed by EFI in the PLURIFOR project



# **Step 8. Remote sensing of forest damage**

- Time series of satellite images over large forest areas to detect new infestations foci and their spatial extension
- Forest areas at risk, regional level
- Forest health departments, biosecurity agencies



Satellite image of Mountain Pine Beetle damage (NASA)



Healthy pine trees (green) and trees infested by mountain pine beetle (red); the delineating polygons used for computerized classification procedures

# Step 9. Permanent monitoring unit: "war room"

- Gathering and analysis of information Updating methods and tools for monitoring and detection purposes Sending alerts
- At regional level at European level (e.g. EFI)
- Cooperation btw scientists + forest health agencies + forest managers



## **Decision tree**



# More to come...

Addition of Neodiprion abietis to the EPPO Alert List



From www.eppo.int - June 2, 2017 4:59 PM Neodiprion abietis is a North American defoliator of Abies spp. and other conifers.

## Corythucha arcuata found for the first time in France



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#### From agriculture.gouv.fr - September 28, 2017 4:35 PM

Neonectria neomacrospora: added to the EPPO Alert List



#### From www.eppo.int - June 29, 2017 5:04 PM

Since 2008, a new and severe canker disease caused by Neonectria neomacrospora (anamorph Cylindrocarpon cylindroides) has been observed on firs (Abies spp.) in Norway. In 2011, the same disease was also found in Denmark causing damage on fir trees. In 2015, the fungus was detected in Southern Sweden. The Panel on Quarantine Pests for Forestry recommended that N. neomacrospora is added to the EPPO Alert List

## Xylella fastidiosa detected on almond in Alicante (ES)

#### From www.agroinformacion.com - July 3, 2017 2:17 PM

" La detección por primera vez en la península de la bacteria Xylella fastidiosa en una plantación de almendros del municipio de Guadalest, en la comarca alicantina de la Marina Baixa, ha desatado la alarma y la necesidad de que se tomen medidas urgentes para evitar que se pueda propagar a otros cultivos, especialmente el olivar. ..."

### Anne-Sophie Roy's insight:

Xylella fastidiosa has recently been detected in an almond orchard in the municipality of Guadalest (Marina Baixa, Alicante). This is the first record of the bacterium on mainland Spain.

## Addition of Xylosandrus compactus to the EPPO Alert List



From www.eppo.int - March 10, 2017 10:27 AM A new Asian ambrosia beetle found in Europe

Anne-Sophie Roy's insight:

Xylosandrus compactus is an ambrosia beetle of Asian origin which has recently been found in Italy and Southern France. In Italy, damage has been observed in maquis plants (Lazio).