The EFSA quantitative approach to pest risk assessment - Methodological aspects and case studies

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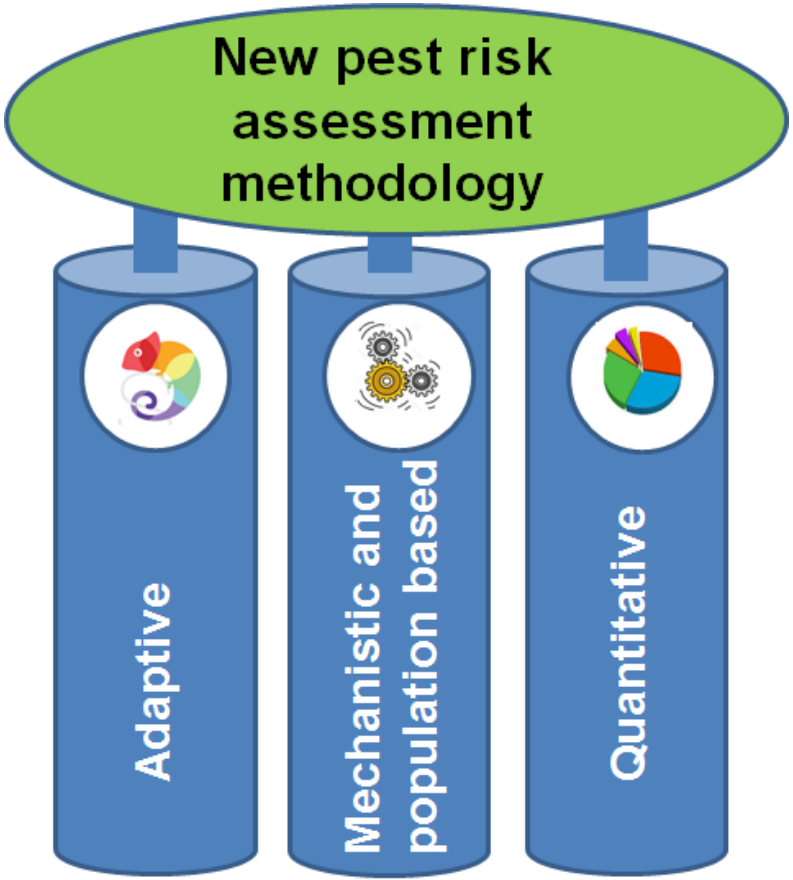
JOINT EFSA-EPPO WORKSHOP
Modelling in Plant Health: How can models support risk assessment of plant pests and decision making?

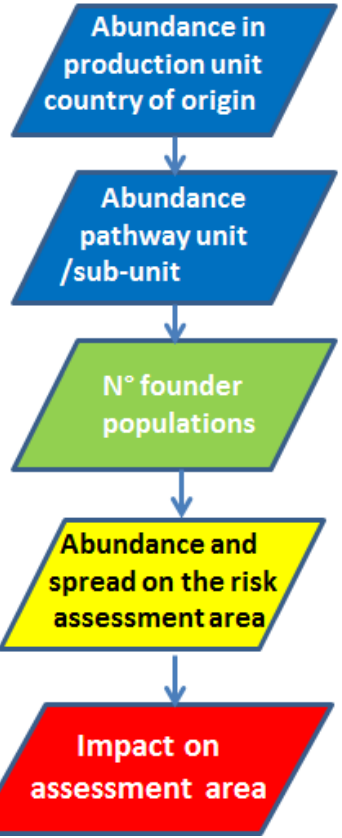
THREE PILLARS



MECHANISTIC-POPULATION BASED APPROACH (1)

Mechanistic-based PRA

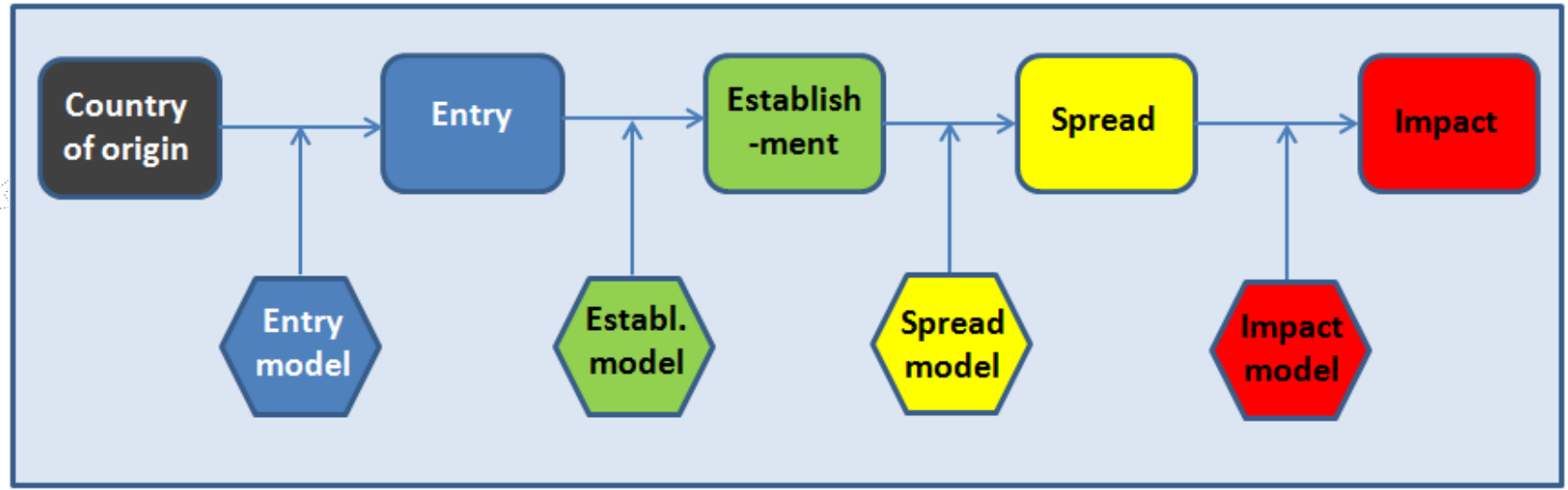
- Invasion process is seen as a flow of events and processes
- Represented (measured) in terms of change in pest population abundance
- Reasoning is based on biological relevance
- All steps and sub-steps are connected
- Integration of RROs into the Risk Assessment (quantification of the effects)



MECHANISTIC-POPULATION BASED APPROACH (2)

Steps and their integration

- In the PRA procedure the process of invasion is conveniently sub-divided into a series of steps
- Mechanistically-based integration of steps in the assessment by the use of step-specific models (possibly process-based models)



A GENERAL MODEL FOR PRA (1)

According to the population-based approach, the spatial and temporal variability of the pest can be used to predict the spatial and temporal variability of the impact on the cultivated plants and the environment

Impact *j*

(at time *T* and in the point *Y*)

$=$ f

Population abundance *j*

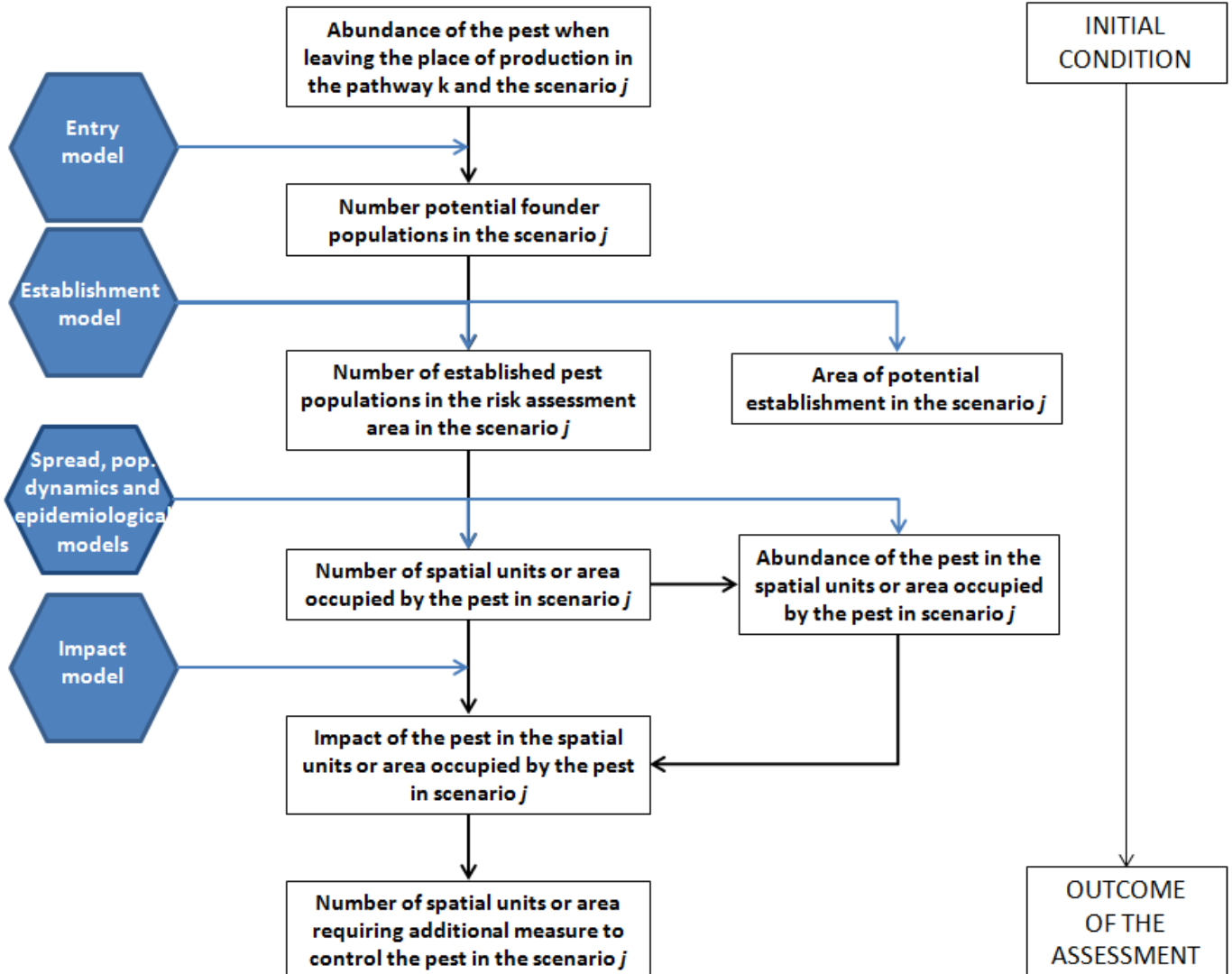
(at time *T* and in the point *Y*)

A GENERAL MODEL FOR PRA (2)

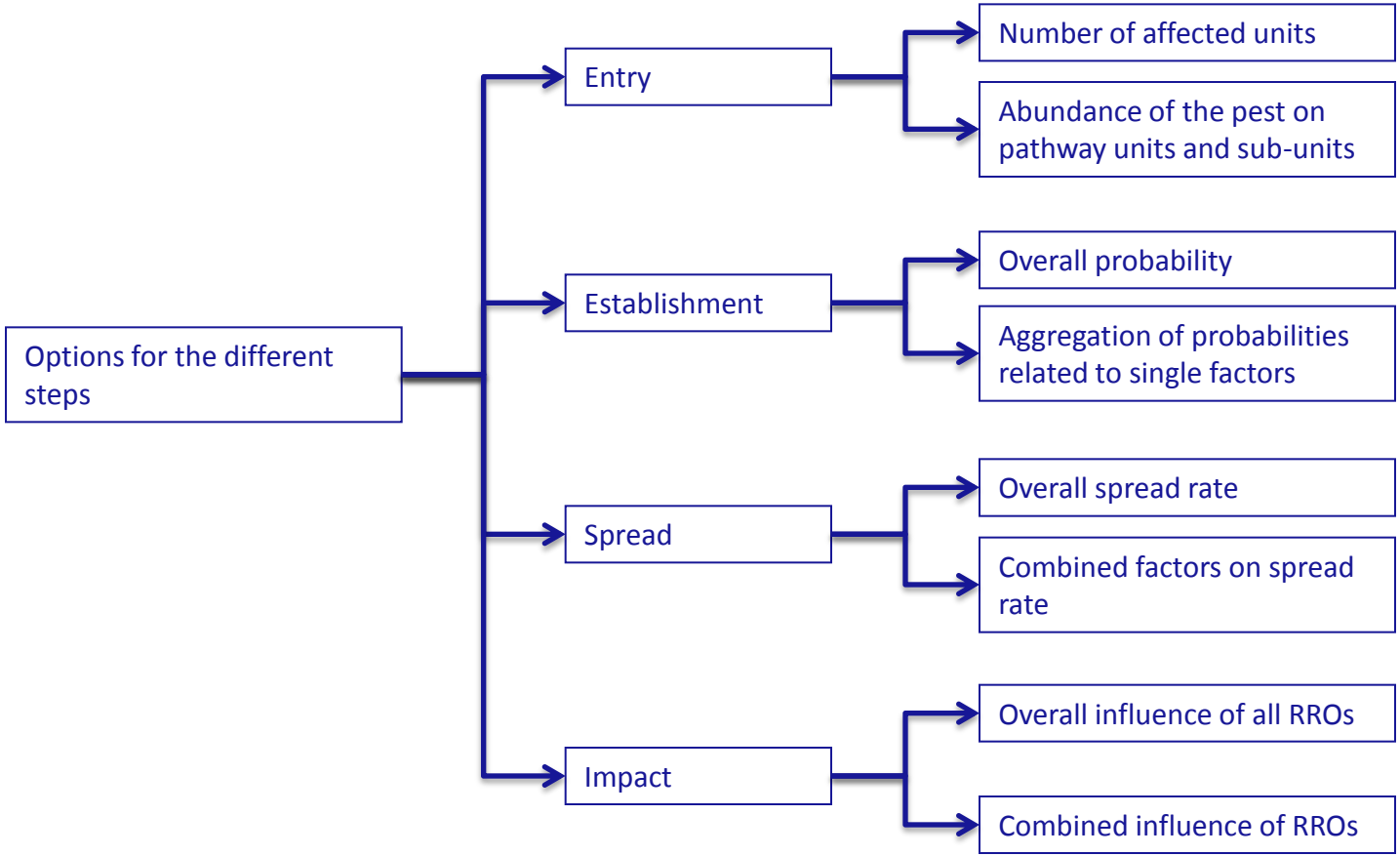
The purpose of the PRA can be described in general terms of a set of models

- Deriving the pest population abundance in the assessment area from the initial conditions (usually the abundance of the pest when leaving the place of production)
- For the conditions described in a specific scenario
- Linking the population abundance to the impact on cultivated plants

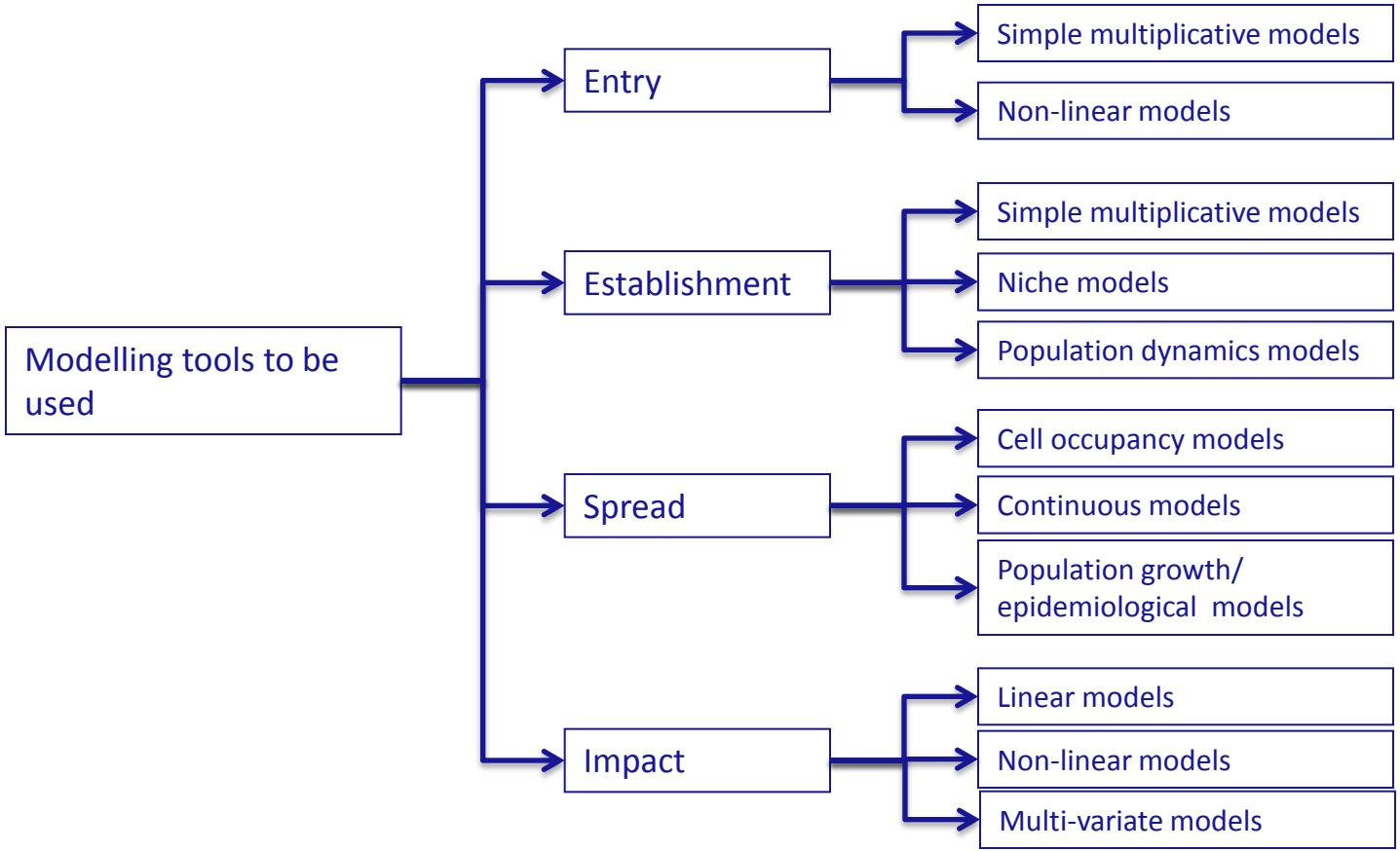
GENERAL MODEL FOR PRA (3)



DEFINITION OF THE ASSESSMENT METHODOLOGY (1)



DEFINITION OF THE ASSESSMENT METHODOLOGY (2)



WHAT IS NEEDED TO PLAN THE RISK ASSESSMENT?

- ToR: What does the Commission ask for?
- Current regulation of the pest
- Definitions specific to the risk assessment/scenario components
  - pathways → what are the relevant ones?
  - mechanisms of spread
  - unit definitions
  - definition of abundance of the pest
  - definitions relevant to the RROs
  - ecological factors and conditions
- Temporal and spatial scales
  - temporal horizon and resolution
  - spatial extent and resolution

SCENARIOS

- All scenarios, scenario components and specific definitions defined in line with terms of reference (ToR) for the risk assessment at the beginning of the process
- risk assessment is carried out for the selected scenarios
- scenario A0 reflects the baseline scenario:
  - current situation: all open pathways, applied regulations, RROs
  - after a certain time horizon (current situation prolonged for a certain time)
- has to be included in the assessment
- changes in the pathways or RROs etc. (scenarios A_1 to A_n) can be evaluated against this baseline scenario

CASE STUDIES

Already done:

Ceratocystis platani
Cryphonectria parasitica
Ditylenchus destructor
Flavescence dorée

Under work:

Atropellis spp.
Diaporthe vaccinii
Eotetranychus lewisi
Radopholus similis

CASE STUDIES: *CRYPHONECTRIA PARASITICA*

- **Scenario A0**: current situation in non-PZs
- **Scenario A1:** situation in the EU without measures
- **Scenario A2:** current situation in PZs with additional RROs

- number new introductions of *C. parasitica* into the EU reduced by approx. factor 5000 in A2 compared to A0
- **A0: 2 NUTS1** regions in the **next 10 years**
- **A1: 3.5 NUTS1** regions in the **next 10 years**
- **A2: 0.5 NUTS1** regions in the **next 10 years**
- impact on **ecosystem services**, due to introduction and spread into the EU of new, virulent strains, **higher for A1 than for A0 and A2**
- current EU requirements (**A0**) and additional RROs (**A2**) **effective in reducing the risk of introduction and spread** of *C. parasitica*, thus **preserving PZ status** in some parts of EU

OUTPUT CATEGORY

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Risk assessment and reduction options for *Cryphonectria parasitica* in the EU

EFSA Plant Health (PLH) Panel; Michael Jeger, Claude Bragard, Elisavet Chatzivassiliou, Katharina Dehnen-Schmutz, Gianni Gilioli, Josep Anton Jaques Miret, Alan MacLeod, Maria Navajas Navarro, Björn Niere, Stephen Parnell, Roel Potting, Trond Rafoss, Gregor Urek, Ariena Van Bruggen, Wopke Van der Werf, Jonathan West, Stephan Winter, Giorgio Maresi, Simone Prospero, Anna Maria Vettraino, Irene Vloutoglou, Marco Pautasso and Vittorio Rossi

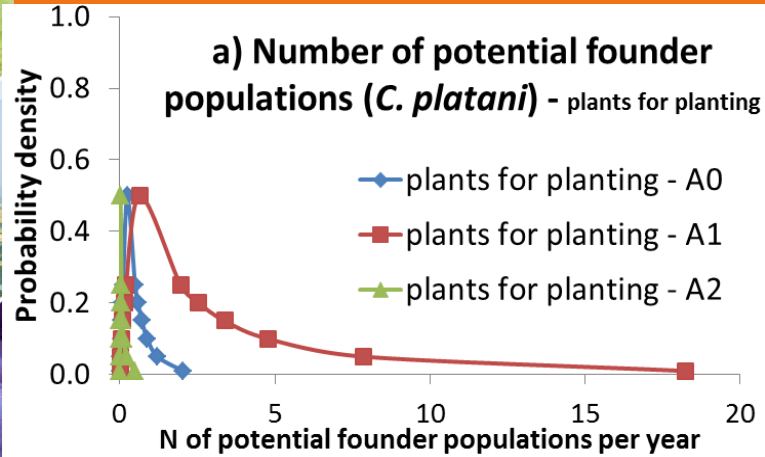
Abstract

Following a request from the European Commission, the EFSA Plant Health (PLH) Panel performed a quantitative risk assessment for *Cryphonectria parasitica* in the EU with the aim to assess the current EU phytosanitary requirements and identify the risk reduction options, which would preserve the protected zone (PZ) status in some parts of the EU, where the pathogen is not known to occur. *C. parasitica*, a bark-inhabiting fungus causing blight of chestnut trees (*Castanea* spp.), has a wide distribution in the EU (non-PZs). Three regulatory scenarios were considered for the whole RA area: the current situation in non-PZs (scenario A0), the situation in the EU without measures (A1), and the current situation in PZs with additional RROs (A2). The Panel considered both the risk of potential spread to PZs of *C. parasitica* strains currently present in the non-PZs and the risk of introduction from Third Countries and spread in non-PZs of new, virulent strains that would be able to jeopardize the currently effective hypovirulence and cause severe impact. The number of new introductions of *C. parasitica* into the EU is reduced by approximately a factor 5000 (median values) in the scenario A2 compared to scenario A0. Under the A0, A1 and A2 scenarios, 2, 3.5 and 0.5 (median values) NUTS1 regions, respectively, are expected to be affected in the next 10 years due to spread of *C. parasitica* strains. The estimated relative impact on ecosystem services, due to the introduction and spread in the EU of new, virulent strains, is higher for scenario A1 compared to scenarios A0 and A2. The current EU requirements and the additional RROs considered in scenario A2 were assessed to be effective in reducing the risk of introduction and spread of *C. parasitica*, thus preserving the PZ status in some parts of the EU.

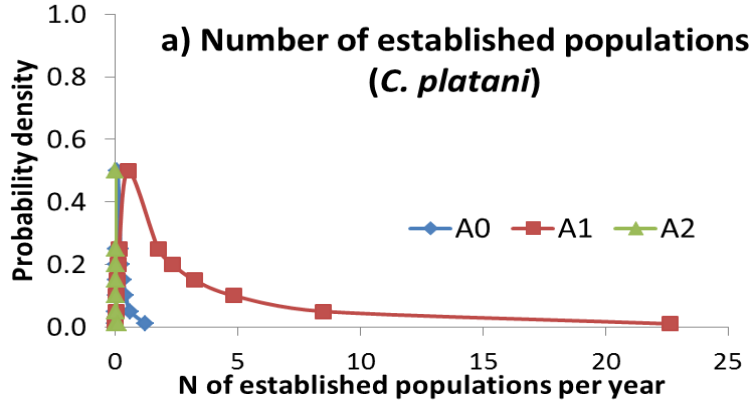
Keywords: *Castanea sativa*, chestnut blight, forest pathology, hypovirulence, phytosanitary, plants for planting, wood trade

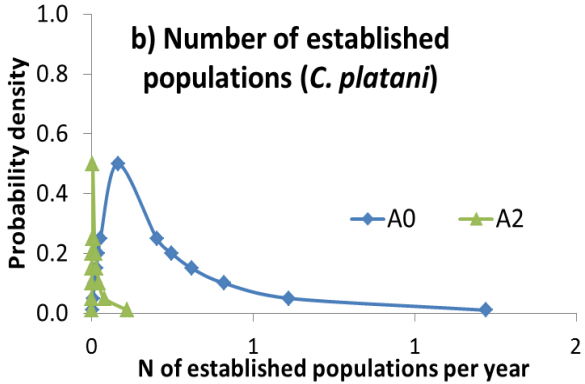
Requestor: European Commission
Question number: EFSA-Q-2015-00266
Correspondence: alpha@efsa.europa.eu

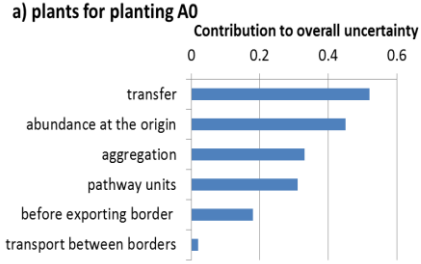
CASE STUDIES: *CERATOCYSTIS PLATANI* – ENTRY AND ESTABLISHMENT

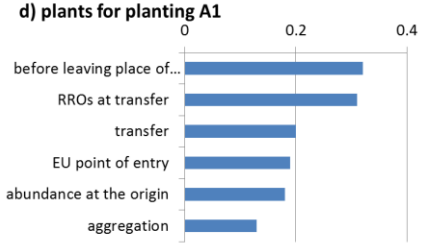


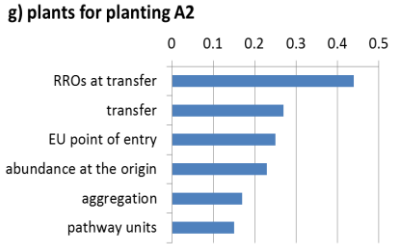
Differences between the scenarios are easily visible



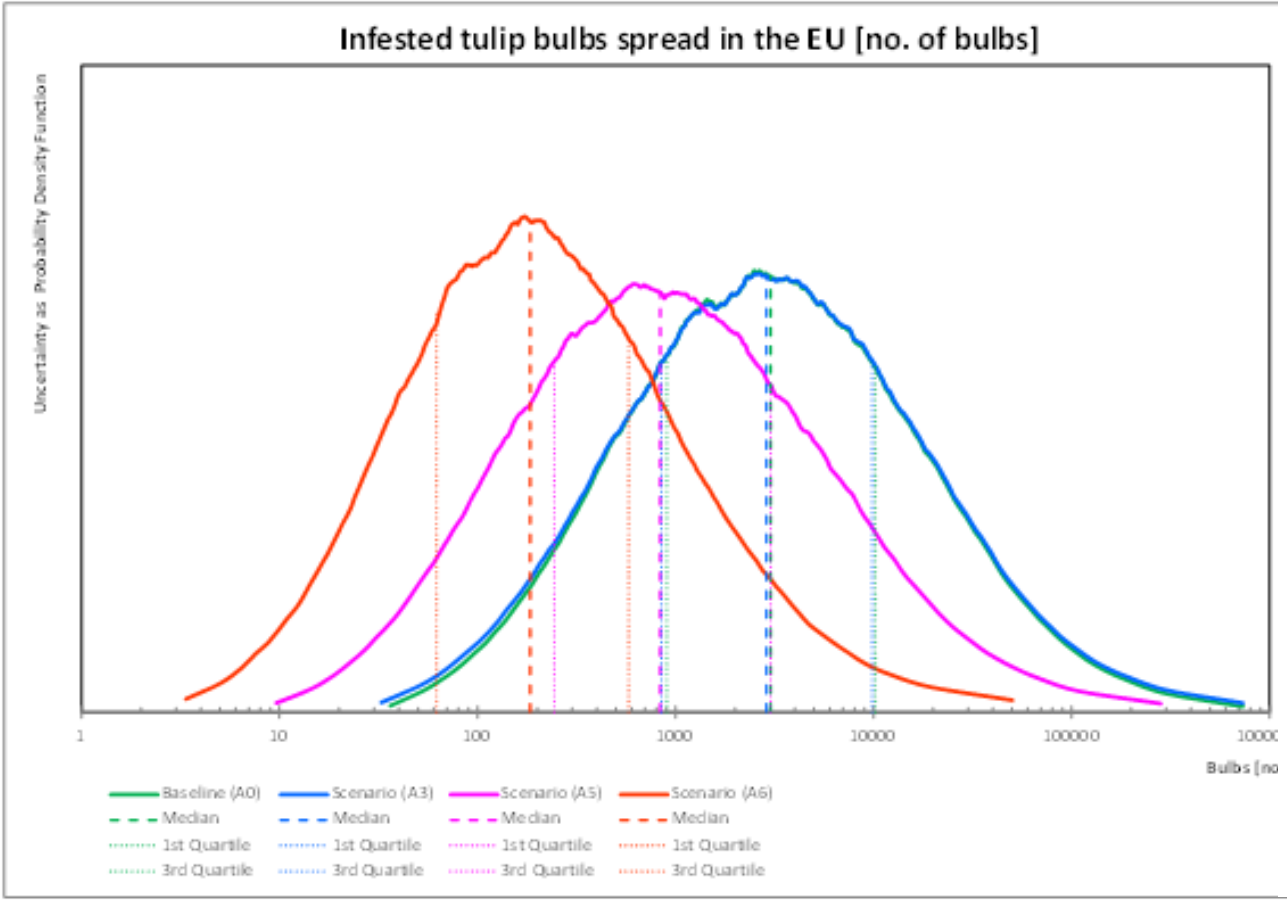








CASE STUDIES: *DITYLENCHUS DESTRUCTOR* – SPREAD



Median number of infested bulbs planted each year around 2,900 (50% uncertainty interval 870-9,800 infested bulbs)

- **A0 (green line):** baseline
- **A1 (not shown):** without regulations identical to A0
- **A3 (blue line):** production of bulbs in pest free places of production in 3rd countries
- **A5 (pink line):** production of bulbs in pest free areas
- **A6 (orange line):** hot water treatment before planting

CASE STUDIES: *FLAVESCENCE DOREE* – IMPACT

Scenario A0: current measures

Scenario A1: current measures + hot water treatment in all nurseries in infested areas

Scenario A2: current measures + strengthening of containment and eradication programs and improvement of surveillance

Under both **A1** and **A2**, FDp impact on wine and table grapes production is predicted to be **reduced by approximately one third (A1)** and **by two thirds (A2)** as **compared to A0**. The uncertainties associated with these evaluations are however large, as indicated by 50% uncertainty intervals spanning roughly two orders of magnitude

THANK YOU!

Ditylenchus destructor