

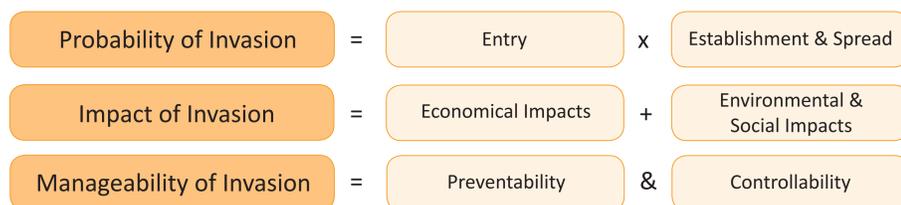
FinnPRIO - a model for ranking invasive plant pests based on risk

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FinnPRIO is a tool for carrying out quick, well-structured, semi-quantitative expert assessments. It uses consistent criteria and hence enables comparison of different pests.

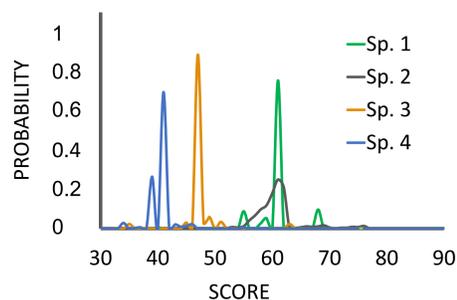
FinnPRIO follows the structure of a full pest risk assessment, i.e. the probability of entry, establishment (incl. spread), and the likely impacts are assessed separately. The model also includes a section for assessing manageability of a pest invasion.



FinnPRIO consists of multiple-choice questions with answer options yielding a different number of points.

Uncertainty is considered in each question, so that for each question the most likely, and the minimum and maximum answer options are chosen. These are used to define a PERT probability distribution that describes the uncertainty of the answer.

The scores for entry, establishment, impact and manageability are calculated from the probability distributions of the question scores using Monte Carlo simulation. The resulting probability distributions of the scores indicate the level of uncertainty of the assessment.



ENTRY is calculated as joint probability of entry via all assessed pathways

$Entry\ via\ pathway_i = global\ distribution \times transport\ potential \times volume\ of\ trade \times likelihood\ of\ transfer\ to\ a\ suitable\ habitat$

If host plants are present in Finland, and if climate and production conditions are suitable for the pest

ESTABLISHMENT = suitability of climate and production conditions + rate of spread + traits promoting establishment or spread

Else ESTABLISHMENT = 0

IMPACT = $w_1 \times economical\ impacts + w_2 \times environmental\ \&\ social\ impacts$

$w_1 = weighing\ coefficient\ of\ economical\ impacts$

$w_2 = weighing\ coefficient\ of\ environmental\ \&\ social\ impacts$

MANAGEABILITY = min (PREVENTABILITY, CONTROLLABILITY)

PREVENTABILITY =

max (natural spread potential, presence in the EU, detectability in inspections)

CONTROLLABILITY =

max (feasibility of surveillance, feasibility of eradication)

ENTRY

How wide is the current global distribution of the pest?

Can the pest spread via the considered pathway?

How large a volume of the considered commodity is traded into Finland annually?

Can the pest transfer to a suitable habitat after entering Finland via the pathway?

ESTABLISHMENT

Could the pest reproduce and overwinter in Finland taking into account the climate and production conditions?

In how large an area do the pest's host plants grow or are cultivated in Finland?

How quickly would the pest likely spread in Finland?

Does the pest have characteristics that could assist in its establishment or spread in new areas?

ECONOMICAL IMPACT

How significant are the direct economic losses that the pest would cause in Finland?

Would the pest cause the following indirect economic impacts in Finland?

- Would the pest impact foreign trade?
- Is the pest a vector for other pests?
- Would the pest have a significant impact on the profitability of some plant production sector?

ENVIRONMENTAL & SOCIAL IMPACT

How much direct impact would the pest have on the natural ecosystems in Finland?

Would the pest have the following environmental or social impacts in Finland?

- Cultural impacts
- Significant aesthetic impacts
- An impact on plants which have an important, recognized position in the Finnish culture

PREVENTABILITY

Can the pest spread naturally to Finland from its current range during the next ten years?

Is the pest present in the area of the European Union?

How difficult is it to detect the pest during inspections?

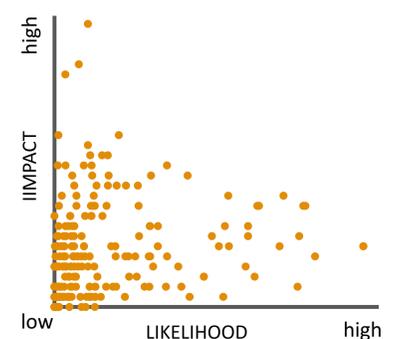
CONTROLLABILITY

How difficult would it be to eradicate the pest from Finland?

How difficult would it be to survey the pest's occurrence in Finland?

Ranking of the pests can be based on summary statistics, such as median, or upper or lower percentiles of the score distributions. Ranking that considers the entire probability distributions can be obtained using the concept of stochastic dominance.

Priority species can be selected by plotting the likelihood of invasion against the impact of invasion. Also the scores for preventability and controllability of invasions can be used when planning risk management measures.



FinnPRIO has been tested by simulation analysis and expert workshops. It has been used to rank over 240 pest species, and the assessments are used in risk management, e.g. when selecting priority pests for surveys.

FinnPRIO is described in detail in Heikkilä et al. 2016, *Biological Invasions* 18: 1827–1842. A guide for the interpretation of the questions and answer options is available as supplementary material.

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