
A suite of simple models to support quantitative assessment of spread and impact in pest risk analysis

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An assessment of the likelihood and extent of spread is an integral part of a pest risk analysis for quarantine measures. However, few tools - if any - are available to risk assessors to make an assessment of the spread as a dynamic process in space at the continental scale. Within the frame of the EU project PRATIQUE, we explored avenues for spread modelling and link models of spread to maps of host distribution, climate, and potential economic impacts.

Five models for spread were considered: (1) logistic temporal increase of the invaded area following a point introduction; (2) radial range expansion at a constant rate following a point introduction; (3) a combination of models 1 and 2 where the range expansion model sets the outer limit of the invaded area, and the logistic growth model specifies how this range is “filled in”; (4) logistic temporal increase of pest density following a blanket introduction of the invasive alien all across the area of potential establishment in Europe; (5) spatio-temporal population growth and dispersal

model constructed by combining local logistic population growth of model 4 with propagule dispersal according to a flexible spatial probability model.

These models are generic and simple, to enable rapid parameterization with limited data, enabling scenario analyses in the context of rapid appraisals of pest risk. We developed the models considering Europe as the PRA area. Different models enable alternative assumptions and points of view of the risk assessor to be entered into the assessment process. All models consider the fundamental niche of the invasive species, based on climate suitability and presence of hosts. None of the models is considered *a priori* better than alternatives. The suite of models provides a more complete picture of invasion consequences than any single model would do.

Case studies are provided to illustrate the parameterization process and highlight comparative strengths and weaknesses of the five models. A formal test of model performance against invasion data has not yet been conducted here, but is proposed as a valuable objective for future research. We engage with the community of pest risk assessors in Europe to help risk assessors develop familiarity with the new tools and collect user feedback for identifying future development needs.
