POLICYBRIEF

Action on invasive alien species should better anticipate climate change effects on biological invasions in Europe

Main findings

Due to changing climatic conditions, the rate of change in distribution and overall range, the risk of alien species becoming naturalised, and their potential impacts may increase.

BiodivERsA-funded research has quantified how climate change determines these important components of the invasion process for contrasting organisms in Europe: the African clawed frog, an alder tree pathogen, and a variety of ornamental garden plants.

The research findings highlight the need for horizon scanning to detect species that might become invasive under future climates – whose introduction could be prevented.

Key policy recommendations

Changes in climatic conditions will increase the risk of new invasive alien species in Europe in the near future. In response to this emerging risk, BiodivERsA-funded projects propose that Invasive Alien Species policy implementation by Member States and the European Commission should:

- Include climate-distribution modelling under different IPCC climate scenarios in **horizon scanning to identify alien species** that have the potential to be invasive in the future due to climate change, and to screen out species with a low risk of invasion.
- Include an assessment of the likely species range change in Europe in response to climate change in the **risk assessment of invasive alien species** identified as high priority in the EU.
- Introduce an EU-wide **early detection and rapid response system** for alien garden plants in Europe to anticipate potential invaders under future climate scenarios.

Context

Invasive alien species (IAS) are species that are introduced intentionally or accidentally to Europe, where they are one of the biggest threats to biodiversity and ecosystem services, and damage agriculture, forestry, infrastructures and human health, as demonstrated by Vilà and coworkers (2010). The economic costs of IAS in Europe are at least €12.5 billion a year, and their number is rising with increased travel and trade. Risks posed by IAS may intensify due to climate change.

The European Union's 2014 regulation on Invasive Alien Species outlines key actions to prevent, eradicate, and manage IAS. The regulation focuses on IAS of Union concern.

The priority species are identified through risk assessments carried out by the European Commission and Member States. Risk assessments to identify priority IAS need to assess how foreseeable climate-change conditions might influence the risks of IAS introduction, establishment and spread, compared to current conditions. A delegated regulation to be published soon will define minimum standards for risk assessments, including climate change impact assessment.

Member States must set up IAS-surveillance systems and official controls to aid early detection and rapid eradication systems by early 2018. This will require horizon scanning for possible new IAS and ways to prevent their introduction. Although some Member States, such as Sweden, are already doing this, the IAS regulation requires action by all Member States in the EU.

This brief reports how the results of three BiodivERsA-funded projects (INVAXEN, RESIPATH, and WhoIsNext) have quantified the effects of climate change on the risk of spread of various types of IAS. Results from European Commission-funded research were also considered (ALARM, DAISIE).

Key results

Climate change could increase invasion risk of predatory frogs, which requires priority setting and better anticipation of future invasions

African clawed frogs (*Xenopus laevis*) are commonly used in labs and kept as pets. They disperse rapidly via water systems and also over land. Using species distribution models (SDMs), Ihlow and co-workers (2016) assessed the global invasion potential of this species. Occurrence probabilities were calculated for 2070 following four IPCC climate scenarios.

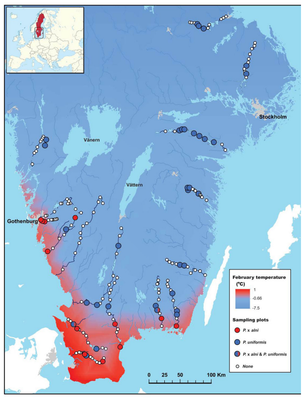
They predicted an overall decrease in the global population but an **increase in potential suitable range size towards more northern areas**. Areas in France and the UK are particularly vulnerable to invasion because of their increasing suitability as a habitat with warming temperatures. The Mediterranean area is already suitable as it is very close to the climatic conditions of the species native range but populations there will benefit from increasing precipitation.

Measey and co-workers (2015) reviewed the literature on frog diet while recording the habitat, the number of other frog species with overlapping distribution, and the invasiveness of the species. They found that invasive frog species pose a higher predation risk to other amphibians than native frog species. Therefore more native frogs will be at risk from predation if the range size of the African clawed frog increases with warmer temperatures.

To prevent escapes of the African clawed frog, Ihlow and co-workers (2016) stressed the importance of biosecurity at breeding facilities. They suggest that eradication efforts should focus on small and scattered populations that are likely to expand with climate change. SDMs contribute to prevention, surveillance and rapid eradication planning, by helping to identify possible priority regions to anticipate and fight invasions.

Milder winter climate conditions favour aggressive invasive pathogens that damage forests

Due to increased international trade, the number of forest pathogen invasions has been rising. Redondo and co-workers (2015) studied the distribution of two subspecies of *Phytophthora* (*Phytophthora alni* subspp. *alni* and *P. alni* subspp. *uniformis*) in Southern Sweden which are killing black alder (*Alnus glutinosa*). The results showed that the subspecies *uniformis* is present across Southern Sweden whereas the more aggressive subspecies *alni* is currently restricted to areas with milder winter conditions (i.e. higher temperatures and short frost periods). Low temperatures in Northern Europe are thus preventing the spread of the aggressive subspecies *alni* but **higher winter temperatures will likely enable higher invasion rates** of this pathogen and therefore increase damage to alder trees across a wider range.



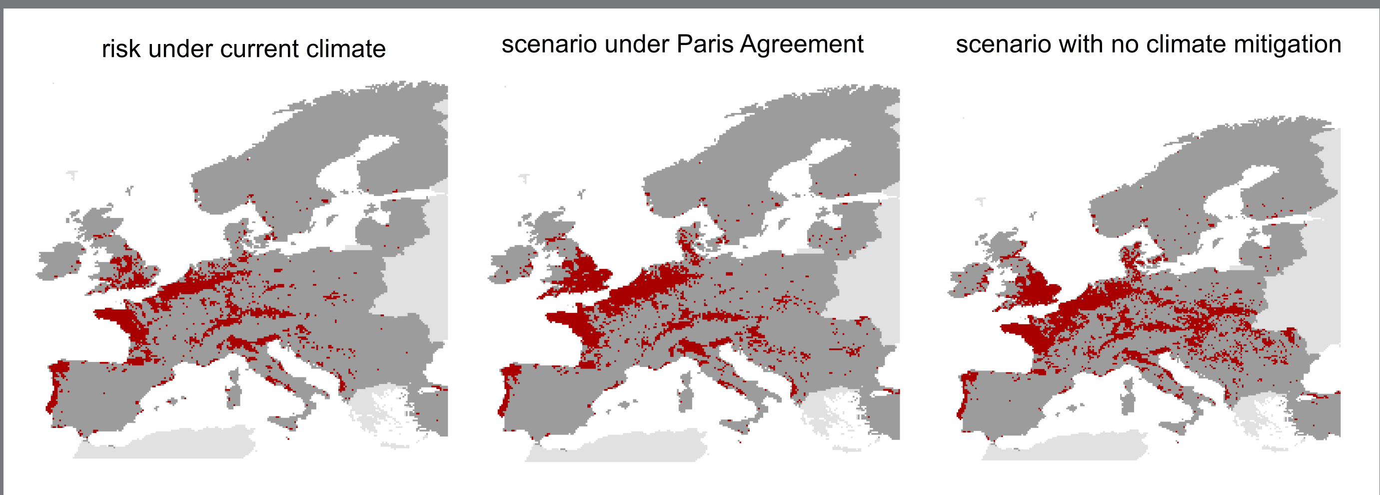
The map shows that *P. alni* subspp. *alni* (red) is currently restricted by colder winter temperatures. The subspecies *uniformis* (blue) is distributed across southern Sweden. The map also shows the systematic sampling of sites.

Climate change will increase the naturalisation risk of non-native garden plants in Europe, calling for networking of actors in the horticultural sector

The major pathway of introduction of non-native vascular plants into Europe is via the ornamental plant trade, as shown by Hulme and co-workers (2008). Thousands of non-native plant species are sold and cultivated in Europe, and only a small proportion of them are currently invasive. To start determining the future risk of invasion, Dullinger and co-workers (2017) evaluated the risk of naturalisation of a pool of 783 currently cultivated garden plant species not native to Europe, and how this risk may change under an expected changed climate in Europe. The species have all become naturalised elsewhere in the world, indicating that they are a potential risk in Europe.

Their results showed that the naturalisation risk of garden plant species will increase with warmer temperatures and changes in precipitation.

Although around 58% of these species already find suitable conditions in Europe, **the potential range of many species will increase by 28-68%** depending on how much emission reduction takes place. The most suitable areas are currently found on the coasts of Portugal, France, Spain and the UK, but they are expected to expand to the north and east with increasing temperatures. This study represents a first step in horizon scanning for possible future invasive species. These species could then be prioritized in the implementation of a surveillance and rapid response system. The authors point to the importance of raising awareness and of networking actors in the horticultural trade.



The maps show the areas of high naturalisation risk of non-native European ornamental plants under current and two possible future climate scenarios. The percentages of land area at risk will increase by 28 percent under a Paris Agreement scenario and up to 68 percent under a scenario with no climate mitigation.

Policy recommendations

The EU Invasive Alien Species regulation requires EU countries to set up IAS surveillance systems, official controls, early detection and rapid eradication systems, and action plans that address the priority pathways through which IAS are unintentionally introduced and spread.

The regulation emphasises **prevention as the best method of tackling IAS** as it is more cost-effective and better for the environment than managing or eradicating established species. But this requires proper identification of species with the highest invasion risk.

Climate change is increasing the risk of future alien species invasions. Countries need to implement rapid assessments of the risk of possible future alien species invasions under likely climate change scenarios so that they can plan prevention and management.

BiodivERsA-funded projects have shown how possible changes in climatic conditions will increase the risk of the introduction, establishment, and spread of different types of invasive alien species in Europe in the near future.

The research findings highlight the **need for horizon scanning to detect species that might become invasive under future climates** – whose introduction could then be prevented.

Member States can improve their assessment of the risk of new IAS introductions if they:

- **Use species distribution modelling tools under different climate scenarios to inform IAS risk assessment.** This could be used to screen out species with a low invasion risk and prioritize those with a high risk of invasion for surveillance and rapid response planning.
- **Use all available ecological knowledge** on species to elucidate ecological risks, as well as assessing socio-economic impacts.
- **Support the introduction of an EU-wide early detection and rapid response system for alien garden plants** involving horticulturalists, botanical institutions, and the plant trade sector. A network of research institutes and stakeholders regularly carrying out field and lab experiments may provide information on potentially invasive alien plant traits (e.g. competitiveness and dispersal ability).

Such measures should be introduced quickly in order to prevent the introduction and establishment of as many new IAS as possible.

Links to sources

WhoIsNext project website

INVAXEN project website

RESIPATH project website

Scientific publications used in this policy brief can be found in the Information Sheet of this briefing, downloadable from www.biodiversa.org/policybriefs.

About this Policy Brief

This Policy Brief is part of a series aiming to inform policy-makers on the key results of the biodiversity research projects funded by BiodivERsA and provide recommendations to policy-makers based on research results. Two EC-funded projects were also considered (ALARM, DAISIE).

The series of BiodivERsA Policy Briefs can be found at www.biodiversa.org/policybriefs.

This publication was commissioned and supervised by BiodivERsA, and produced by the Institute for European Environmental Policy (IEEP).

The key research results presented here were validated by researchers from the RESIPATH, INVAXEN and WhoIsNext research projects.

The policy recommendations made do not necessarily reflect the views of all BiodivERsA partners.

The BiodivERsA project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642420

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MIX Paper from responsible sources FSC® C019064

Produced in December 2017.