

Science for Environment Policy

Invasive alien species in Europe: new framework shows scale and impact is increasing

Invasive alien species pose a threat to biodiversity, human health and the economy. This study describes six alien species indicators for Europe, showing that the scale and impact of biological invasions are increasing across all indicators. The societal response has also increased in recent years. The researchers say their framework could serve as a basis for monitoring the efficacy of recent EU legislation.

Throughout history, humans have introduced species into regions where they are not native. The introduction of some species poses a threat to biodiversity. These are known as invasive alien species (IAS). The most recent global analysis of the [IUCN Red List](#) shows that IAS are the third most severe threat to birds and mammals, and the second most severe threat to freshwater fish. Furthermore, the spread of IAS is increasing due to a combination of increasing trade and [climate change](#).

To mitigate spread and impact, the EU adopted dedicated legislation on the issue¹. Indicators are a crucial part of evaluating such policy. Alien species indicators are useful for policymakers because they provide information on the trends, current situation and likely future development of IAS, as well as their drivers and impacts.

Recent years have seen considerable progress in the development of alien species indicators. In 2010, the [Global Biodiversity Outlook 3](#) introduced an indicator based on the cumulative number of alien species, used to measure progress towards 2010 biodiversity targets. The [Biodiversity Indicators Partnership](#) developed further IAS indicators to monitor progress towards the more recent [Aichi Targets of the Convention on Biological Diversity \(CBD\)](#).

Building on a [set of biodiversity indicators](#) developed in 2010, this study developed and applied six IAS indicators:

1) A combined index of invasion trends

This indicator provides information on rates of accumulation of alien species in Europe, using records for mammals, marine metazoans (multicellular marine animals), terrestrial arthropods (insects and their relatives, such as spiders, scorpions and mites), vascular (seed-bearing) plants and bryophytes (non-vascular plants). The researchers calculated relative increases in species numbers from 1900 to 2010.

Results showed that the number of alien species in Europe has increased linearly over the past 100 years, leading to a fourfold increase in numbers since 1900. Relative rates of alien species accumulation over time are similarly increasing for all taxonomic groups, with marine metazoans increasing exponentially. The magnitude of increase differed widely: numbers of vascular plants increased by 1.4, whereas the numbers of alien marine metazoa increased by 33.1.

2) Pathways of invasions

Invasion pathways can change over time, mostly due to consumer behaviour, fashion and economic trends. The researchers evaluated trends in the most important pathways (horticulture/ornamentals; stored product pests; biological control; forestry; unknown) using the [DAISIE](#) database, with arthropods as an example organism group.

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1. Regulation (EU)
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and management of the
introduction and spread of
invasive alien species.
<http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1417443504720&uri=CELEX:32014R1143>

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The numbers of alien species introduced through some pathways stayed stable (e.g. stored product pests, biological control agents), but numbers introduced by horticultural trade and 'unknown pathways' increased. These findings may facilitate more targeted policy responses.

3) Red List Index

The Red List Index (RLI) is used to calculate the rates at which species affected by IAS are moving towards extinction. The researchers used global IUCN Red List assessments with amphibians as a model group, because they are particularly vulnerable to IAS and many species are in strong decline.

The RLI for amphibians in Europe decreased between 2004 and 2009, suggesting an overall increase in extinction risk. Of the 11 species whose status had deteriorated, IAS were regarded as a threat to eight.

4) Impacts on ecosystem services

The researchers analysed the number of ecosystem services negatively affected by IAS over time. Since 1600, the number of affected ecosystem services in Europe has steadily increased, for all environments and taxonomic groups considered. There were particular accelerations in the mid 1800s and after World War II.

5) Trends in livestock disease

This indicator reports livestock diseases caused by alien pathogens in Europe using data from the [Animal Disease Notification System](#). Wildlife diseases are not included. The researchers found no clear trend in disease outbreaks between 1984 and 2011.

6) Costs of management and research

The economic costs of IAS can include direct and indirect losses to the economy, as well as investments into surveillance, monitoring, research and management. As a cost indicator, the researchers used the amount spent by the EU through the [LIFE programme](#) and the the Framework Programmes for Research and Technological Development (RTD) on IAS management and research between 1992 and 2006.

There was a large overall increase in investments since 1992. Costs increased from less than €10 million in 1992–1994 to around €100 million in 2004–2006 (data were not available from 2007 onwards).

The application of the proposed IAS indicators faces substantial challenges due to data availability and quality, the lack of a consistent definition of invasiveness, inconsistent use of pathway terminology, knowledge gaps regarding impacts, the low temporal sensitivity of the RLI, inconsistent use of ecosystem service terminology and a lack of financial information.

Nevertheless, the indicators show that the impacts of IAS are increasing in Europe, across all taxonomic groups and environments, with no sign of saturation, which is in line with global trends. The IAS indicators presented here serve as a starting point for future improvements, and as a basis for monitoring the efficacy of the EU legislation on IAS.



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