

Science for Environment Policy

The global spread of alien plants

Driven by trade, the spread of alien species is increasing worldwide. This study combined 60 years of trade data with that on biodiversity and climate to model the spread of plant species across 147 countries. The model predicts significant increases in plant invasions in the next 20 years, especially for emerging economies. The authors say trade legislation must consider biological invasion and focus on regions at high risk.

The numbers of alien species are increasing across the globe, causing dramatic changes to local [ecosystems](#). This is in large part due to increasing global trade, which has expanded the range of goods – and associated species – transported between countries. [Climate change](#) will also affect the distribution of species, by allowing species to adapt their habitat range to the changing temperature, for example. Globalisation combined with climate change may have profound [environmental effects](#). This study is the first to assess their combined effects, on a global scale, for a major taxonomic group – plants.

The researchers used a [model](#) previously used for marine invasions, modified to capture the dynamics of plant invasions. The model requires four inputs: 1) bilateral trade data, obtained from a [data set](#) comprising the annual amount of trade value exchanged between countries from 1948 – 2000, 2) environmental data, such as annual mean temperatures and precipitation, taken from the [WorldClim](#) database, 3) climate forecasts based on the medium-range [IPCC](#) scenario [A1B](#) (which projects an average global temperature increase of 1.4°C for 2020 – 2029 relative to 1960–1990), and 4) the number of native plant species in the donor country, compiled for 166 countries and taken from the Global Naturalized Alien Flora ([GloNAF](#)) database – the most complete database on alien plant species distributions worldwide.

When tested against real world data from 119 countries, the model was able to reproduce the flows and numbers of naturalised plants (non-native plants whose population is maintained) very competently. The researchers first used the model to assess the role of global trade on the number of naturalised plants in different countries. The model confirmed that trade is crucial for flows of plant species between countries, as excluding trade values from the model strongly reduced its ability to predict naturalised plant numbers. The analysis also indicated how alien plants invade new regions. Surprisingly, the results showed that Europe has imported more plant species during the last 60 years than it has exported.

Using historical trade data, the researchers identified an 'invasion debt'. As current numbers of naturalised plants are best explained by cumulative trade value data until 1990, they say the time lag until trade values manifest in increased naturalised plant numbers is at least 20 years. The researchers went on to apply this invasion debt to the most recent trade data, to predict future naturalised plant numbers up to 2028. In absolute numbers of plant species (rather than relative terms), the model predicted the highest increases for emerging economies, such as Argentina, Brazil, China, India, South Korea and Thailand, but also for Australia and the USA.

The researchers also ran the model with future changes in temperature and precipitation, finding significant differences to predictions without climate change. The model suggests that climate change will increase plant invasions in the Northern temperate countries, while countries in tropical and (sub)tropical regions will be invaded less.

Overall, the authors say recent increases in trade will cause significant increases in invasion in the coming decades. While climate change may decrease invasions in some tropical countries, this effect will not be enough to negate trade-related increases. Although numerous regulations have been introduced to reduce the introduction of invasive species, the authors say that, due to the invasion debt, the consequences of recent policies may not be felt for decades. They recommend stronger international collaboration to detect new invasive species and trade legislation that considers the issue of biological invasion.



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