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Invasive alien species' impacts on ecosystem services: new tool to assess risks

Researchers have developed a new risk assessment scheme for invasive alien species that not only predicts their direct effects on biodiversity, but also their impacts on ecosystem services. Furthermore, the scheme allows sources of uncertainty in a species' impact to be identified, and can be applied to a range of different species.

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Invasive alien species are one of the greatest threats to biodiversity today and can also have severe economic, social and health impacts. However, fully assessing their risks to ecosystems and ecosystem services is a complex task. In this study, researchers developed a risk assessment scheme that considers impacts on the individual level, for example, the direct damage to an individual plant by a pest, as well as at the population and ecosystem levels.

To illustrate how their scheme works, the researchers used the example of the invasive citrus long-horned beetle (*Anoplophora chinensis*) in Lombardy, Italy. This species was introduced to Europe in 2000 and can cause damage and death to a range of trees including birch, willow, apple and pear.

The first step in the process is to define a 'service-providing unit', a component of biodiversity which provides an ecosystem service. In this case, the researchers chose trees planted in urban areas. At the individual level, the beetle can affect growth, reproduction and survival of any infected tree and at the population level almost all trees of the target species are at risk.

These data are then combined with estimates of the resistance and resilience of the ecosystem. Resistance to the beetle is considered very low, but resilience (or recovery of the ecosystem) is predicted to occur over a long time scale as natural enemies begin to prey on or parasitise the beetles. Finally, the impact of management practices must be included in the risk assessment. In this case, the EU requires eradication which currently entails felling infected trees.

Over a 30 year period, this scheme predicted that many ecosystem services would suffer following invasion of the beetles. These include ornamental value, air pollution reduction, erosion regulation and nutrient cycling. The worst affected ecosystem service was ornamental value, which was expected to be reduced by over 35%. As trees have been shown to remove pollutants from the air, a reduction in air quality services of between 10-15% was also predicted, which could have consequences for human health.

The risk assessment scheme presented here also incorporates sources of uncertainty; the researchers identified the efficiency of the control measures as the most important source. Predictions regarding the rate of spread are also associated with uncertainty in this case.

The authors of this study conclude that this approach provides a comprehensive measure of the risks that invasive alien species present, not only to the species directly affected, but also to the provision of ecosystem services. They also stress that this approach is not limited to plant pests, but can be used for other invasive species.