European Commission

Science for Environment Policy

Effective tools to predict spread and improve monitoring of invasive alien species

September 2013
Thematic Issue 41: Invasive Alien Species

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Effective surveillance and risk analysis are key to preventing the ecological damage caused by invasive alien species (IAS). Habitat suitability models provide highly effective tools for predicting the spread of IAS and guiding monitoring strategies, new research suggests.

Along with habitat loss, IAS are a serious threat to European biodiversity, displacing native species and causing the deterioration of many ecosystems. Conservation managers currently face the challenge of determining where introductions of IAS are likely to occur, and how they will spread across the landscape.

Habitat suitability models (HSMs) are mathematical tools for mapping the potential distribution of IAS, and facilitating risk analysis, monitoring and control. However, the ability of these models to prioritise monitoring efforts has not been tested in the field. Many sampling designs are costly, time-consuming and ineffective at detecting newly arriving species. This study had two main objectives. Firstly, to test if HSMs can be improved by using an 'iterative' sampling design; this uses observations to guide subsequent data collection and improve the original design. Secondly, to assess the ability of HSMs to predict the spread of IAS.

The researchers examined three plants invasive to the US. The spotted knapweed and the wild parsnip, invasive to Wisconsin, US, were examined using data on a state-wide scale. The salt cedar was analysed on a regional scale using data from 957 counties in the western US. These initial data provided a 30 m^2 resolution within Wisconsin and 1 km^2 resolution for western US, and were used to produce the first iteration and subsequently inform more targeted sampling. The model's success at species detection was then compared to other surveys conducted during the same season using non-targeted sampling.

Across all three species, researchers found that model performance at species detection increased by using the initial model results to inform more targeted sampling. In addition, HSMs were able to accurately predict the spread of IAS across the landscape, and the use of targeted sampling detected more species with less sampling effort than a non-targeted random approach.

This approach may help guide early detection, rapid response and containment of harmful IAS and even diseases at local and global scales. The reduction of already limited monitoring and control budgets makes development of tools such as HSM even more important for managers in future. However, the models are limited by sparse data across large geographical areas, and the study's authors stress that data sharing and regular data updates should be encouraged to provide valuable improvements in HSM performance.

Source: Crall, A. W., Jarnevich, C. S., Panke, B., *et al*. (2013). Using habitat suitability models to target invasive plant species surveys. *Ecological Applications.* 23:60-72. DOI:10.1890/12-0465.1

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To cite this article/service: "Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.