# Screening horticultural imports: New models assess plant risk through better analysis

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Weedy plants, many introduced to the U.S. for sale through plant nurseries, are responsible for extensive environmental damage and economic costs. Although legislation restricts the introduction of certain species, the procedures used to select species for inclusion on the restricted list are haphazard and out of date.

To meet the need for more systematic weed risk analysis, researchers at the University of Georgia Odum School of Ecology and the University of California, Davis have developed a "cost-sensitive" model to determine when importing a given plant is worth the risk. Their work was published in the May edition of the journal *Ecosphere*.

Although the problems caused by invasive plants are well known, Odum School postdoctoral associate J.P. Schmidt, the lead scientist on the study, said the U.S. has historically placed very few restrictions on the import of plants.

According to UC Davis economist and study co-author Mike Springborn, "our approach represents a shift from the current practice of scrambling to address invasives only after they are already established. In this paper, we develop tools for making informed decisions ahead of time about which plants have an acceptable level of risk given their anticipated benefits. We now have the combined biological and economic tools to take an informed look before we leap with trade in new species."

The model uses statistical procedures to assess how likely a plant is to become a weed. To do this, it compares the estimated probability with the average costs of a new weed and the expected losses from foregone sales of non-weed species that are presumably safe. Using the model as a screening tool, the researchers say, would provide a net economic benefit of at least $80,000 to $140,000 per species assessed, which could translate into tens of millions of dollars in total.

Had the proposed screening system been in place historically, they calculated—using just low-end estimates of invasive species damages—that one third of the most noxious species could have been excluded. To realize this benefit, only 15 percent of potential introductions would need to be prohibited.

At its core, the model consists of two parts. First, the researchers sought to identify a small number of plant traits that could be used to predict invasiveness.

"Amazingly, we found that just four traits could discriminate pest from non-pest species with an impressive degree of accuracy," Schmidt said. "Namely, pest species tend to have some combination of the following traits: seeds that are in the mid-range of seed sizes, that have higher chromosome counts than their close relatives, that have affinities for both wetland and upland habitats and that have large native ranges."

"Second," said co-author John Drake, an associate professor at the Odum School, "we asked where to draw the proverbial line-in-the-sand—in this case the line between probable pests and probable non-pests—which requires accounting for the value of the ornamental plant trade and the costs associated with weeds. The economically optimal decision rule is the one that settles that line where it exactly balances the costs from invasion with the benefits from trade."

Schmidt explained that the cost of mistakenly keeping out a non-invasive plant was far lower than the cost of mistakenly allowing an invasive plant in.

To make these results equally accessible to scientists, decision-makers and the interested public, the researchers then encapsulated the resulting decision rule in a series of four graphics. Every plant species can be placed somewhere on these diagrams. The location on the diagram indicates the economically optimal policy—either to admit or deny import.

Although these methods were developed to aid decision-making about potential plant pests, the techniques used may be helpful for other problems in environmental management, for instance in prioritizing rare species for conservation.

Results from the analysis inspired a companion study by Schmidt, Drake and Odum School assistant research scientist Patrick Stephens, in the journal Ecological Applications, which contrasts invasive and rare plants of North America.

Using a much larger data set—the roughly 15,000 species native to the U.S. and Canada—this second study developed predictive models to distinguish species classified as pests together with rankings developed by the Nature Conservancy concerning extinction vulnerability.

"In summary, decisions about allowing plants into the U.S. are being made every day," Schmidt said. "Our models could help to better guide those decisions, potentially saving tens of millions to billions of dollars in costs associated with plant invasions."

**More information:** The full text of the *Ecosphere* article is available at www.esajournals.org/doi/pdf/10.1890/ES12-00055.1 . The full text of

the *Ecological Applications* study is available at
www.esajournals.org/doi/abs/10.1890/11-1915.1

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