Invasive species could cause billions in damages to agriculture

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Invasive insects and pathogens could be a multi-billion- dollar threat to global agriculture and developing countries may be the biggest target, according to a team of international researchers.

"Invasive pests and diseases are a major threat to agriculture, natural ecosystems and society in general," said Matthew Thomas, professor and Huck Scholar in Ecological Entomology and a researcher in the Center for Infectious Disease Dynamics, Penn State. "In the U.S. you only need to think about current problems such as Emerald Ash Borer or the Asian Tiger Mosquito and the potential threat of Zika virus to appreciate this. One of the challenges we face is predicting the next threat and where it will come from. This study explores some of these issues at a global scale."

The researchers, who report their findings today (June 20) in the *Proceedings of the National Academy of Sciences*, analyzed the impact of 1,297 known invasive insect pests and pathogens on 124 countries. They also determined which counties posed the biggest threats based on their trading partners and numbers of invasive species.

The United States, China, India and Brazil, all large agricultural producers, would have the highest potential cost from invasive species, according to the researchers. China and the United States ranked one and two, respectively, as the highest potential source countries for the pests.

"China and the U.S. are large and have diverse cropping systems ranging

from subtropical to temperate environments and this diversity of cropping systems supports a wide range of potential pest and disease species," said Thomas, who is also a co-funded faculty member of the Huck Institute, Penn State. "Also, China and the U.S. have very active trading relationships with many countries worldwide and these provide potential links for transport of pest and disease organisms to novel areas."

While big agricultural countries, such as the United States and China, may take the biggest monetary hit, smaller developing countries may suffer proportionately higher damage.

Dean Paini, senior research scientist, Commonwealth Scientific and Industrial Research Organization and Plant Biosecurity Cooperative Research Centre, who worked with Thomas, said the most vulnerable countries were located in sub-Saharan Africa.

"These countries generally do not have diverse economies making them disproportionately more dependent on agriculture," Paini said. "As a result any threat from invasive species can potentially have a greater relative impact on these countries."

To estimate the relative cost of species invasion, the researchers divided a country's total invasion cost by its mean domestic product from 2000 to 2009.

As trade increases and more connections are made between countries, the researchers suggest that the problems associated with invasive species will mount.

"Dealing with this problem is a major challenge," said Thomas. "We hope that by identifying the countries and regions that are most vulnerable, our study can help governments make informed decisions

regarding the deployment of resources necessary to protect their borders and agriculture industries by limiting the further spread of invasive species."

More information: Global threat to agriculture from invasive species, *PNAS*, www.pnas.org/cgi/doi/10.1073/pnas.1602205113

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