From international harbor to native habitat

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In the 1930s, soil used as ballast to weigh down cargo ships from South America to Mobile, Alabama introduced the red imported fire ant to the southern United States. Since then, the ants have been found as far north as Maryland and as far west as California, shorting out streetlights and eating through crops and native plants in the process.

Plant pests like the fire ant cost the U.S. an estimated $37.1 billion per year in agricultural and forest ecosystem losses. And since these pests primarily enter the country through international hubs like Mobile and then spread to nearby ecosystems, the early detection of exotic pests should start at the most vulnerable urban areas.

At least that is the approach Manuel Colunga-Garcia from Michigan State University and colleagues propose in the March issue of *Ecological Applications*. The researchers suggest that, by establishing specific risk zones and using the information to focus resources, officials can take additional measures to prevent an influx of exotic pests while gaining knowledge about invasions.

"We can learn from cases like the fire ant that the first line of defense against exotic pests is inspections at U.S. ports," says Colunga-Garcia. "But, it doesn't stop there. With the sheer volume of imports that enter the U.S. on a daily basis—only about two percent of the imports are actually inspected—new measures have to be implemented. Our risk-zone analyses, based on recent pest invasions across an urban gradient, can help prioritize surveillance efforts."

The urban gradient framework the researchers describe starts at forests and farms in areas with the densest population and spreads outward to rural areas. The researchers base their framework on two basic assumptions: 1. The threat of introduction is greatest in urban areas receiving large quantities of imported products and their associated wood packaging, like pallets and crating that are known to harbor exotic pests, and 2. Plant ecosystems located closest to these urban areas have the greatest risk of invasion.

To identify the most threatened areas, Colunga-Garcia and colleagues selected 39 invasive plant pests reported by the North American Plant Protection Organization or the Cooperative Agriculture Plant Survey as being of U.S. economic importance. They then compiled a list of all U.S. county occurrences for each selected group of pests through July 2009. They found one or more of the 39 selected pests in 504 counties in 36 out of 48 states; 357 counties harbored just one pest, and 147 counties had two or more. Additionally, the coastal states seemed to be at greatest risk for invasion with at least one pest occurring in each.

"Major coastal urban areas, for instance, should be carefully monitored since they hold a double threat of invasion: a populous area receiving large volumes of potentially infested imports," says Colunga-Garcia. "These characteristics can lead to the rapid spread of plant pests, starting in the urban end of the gradient and moving outward to rural areas as people transport infested materials for development or recreation."

Humans are a driving factor in the spread of exotic plant pests, not just from importing plants and their associated hitchhikers directly to the ports, but likely dispersing pests inadvertently into exurban areas as well, say the researchers. Exurban development and recreational activities, such as camping, have the potential to bring infested material, like firewood, directly into sensitive ecosystems. The researchers claim the key to early detection is through careful monitoring of human activity in

coastal states and other vulnerable urban areas.

"A challenge for detecting invasive pests in urban and nearby ecosystems is the fragmentation of the landscape and the many ownerships involved" says Colunga-Garcia. "Public participation in monitoring efforts will perhaps be the most economic and efficient solution for the early detection of exotic pests."

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