Optimal Inspection of Imports to Prevent Invasive Pest Introduction

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Abstract

The United States imports more than 1 billion live plants annually—an important and growing pathway for introduction of damaging nonnative invertebrates and pathogens. Inspection of imports is one safeguard for reducing pest introductions, but capacity constraints limit inspection effort. We develop an optimal sampling strategy to minimize the costs of pest introductions from trade by posing inspection as an acceptance sampling problem that incorporates key features of the decision context, including (i) simultaneous inspection of many heterogeneous lots, (ii) a lot-specific sampling effort, (iii) a budget constraint that limits total inspection effort, (iv) inspection error, and (v) an objective of minimizing cost from accepted defective units. We derive a formula for expected number of accepted infested units (expected slippage) given lot size, sample size, infestation rate, and detection rate, and we formulate and analyze the inspector's optimization problem of allocating a sampling budget among incoming lots to minimize the cost of slippage. We conduct an empirical analysis of live plant inspection, including estimation of plant infestation rates from historical data, and find that inspections optimally target the largest lots with the highest plant infestation rates, leaving some lots unsampled. We also consider that USDA-APHIS, which administers inspections, may want to continue inspecting all lots at a baseline level; we find that allocating any additional capacity, beyond a comprehensive baseline inspection, to the largest lots with the highest infestation rates allows inspectors to meet the dual goals of minimizing the costs of slippage and maintaining baseline sampling without substantial compromise.

Read the full article in *Risk Analysis* [1].

Associated Project:
Globalization of the Live Plant Trade: Informing Efficient Strategies for Reducing Non-Native Pest Invasion Risk [2]
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Links
[1] https://onlinelibrary.wiley.com/doi/full/10.1111/risa.12880
[2] https://www.sesync.org/globalization-live-plant-trade