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# Editorial: Forest Biosecurity Systems and Processes: A Global Perspective

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## Editorial on the Research Topic

## Forest Biosecurity Systems and Processes: A Global Perspective

*Forest biosecurity* is a catchall phrase encompassing all efforts associated with preventing invasions of forest environments by damaging/lethal alien tree pathogens and pests. The key aspect here is "prevention" and is one critical component of humanity's attempts to protect their precious forest resources. As is true of all health issues (human, animal, plant, and environmental), prevention is the least expensive and most efficacious measure, because dealing with the downstream impacts is often very difficult, costly, or impossible.

The typical generalized invasion curve (e.g., Victorian-Government, 2010) has variously been conceptualized into essentially four phases: pre-invasion, introduction, establishment, and spread. Each of these phases is associated with a discreet management approach: prevention (biosecurity/biosurveillance), early detection and rapid response (which also includes surveillance), mitigation, and restoration/rehabilitation, respectively. Historic invasions (e.g., emerald ash borer in the United States and Canada; ash dieback in Europe) have typically beat the first two approaches, even with the best of intentions. The structural features of invasions, e.g., the barriers that invaders must cross at different stages of the process, have been well-analyzed by others (Blackburn et al., 2011). All invasions also have jurisdictional dimensions, as they are predicated on bypassing international, national, and local governmental boundaries.

This Research Topic focuses specifically on forest biosecurity approaches around the world, which are, almost invariably, woefully inadequate and keep failing. The many reasons for this failure are highlighted in the five papers that constitute this Research Topic. The contributors hail from drastically different contexts: Canada (Allison et al.), Australia (Carnegie et al.), New Zealand (Kuru et al.), and Italy (Vettraino and Santini), which are well-developed economies, and India (Gupta and Sankaran), which is still a developing economy. Economic development probably has quite a bit to do with how well preventive measures are organized and can work, but geo-political and cultural contexts are also quite important. For example, while Canada is a wholly independent nation, Italy is part of a supernational organization, the European Union, which imposes certain restrictions on what Italy can actually do for itself. Australia and New Zealand, as island nations, benefit from having no porous borders, but also spend, in proportion to their economies, a large amount of money on biosecurity.

Fundamentally, however, forest health is a wicked problem (Rittel and Webber, 1973). As Kawa et al. (2021) state, wicked problems are "complex *and* political" and have inherent fundamental features: (1) they "are complex and without clear boundaries," (2) "there are no perfect or permanent solutions, and solutions inevitably change the system in ways that are difficult to assess," (3) "the range of solutions is limited by what is feasible and what is imaginable," and (4) "worldviews shape how all stakeholders, including researchers, envision the problem and its solution."

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Biosecurity is definitely "complex *and* political." Indeed, the difficulties inherent in strengthening biosecurity have much more to do with international cooperation than any individual country's ability to self-organize or technical solutions science may offer. This situation contains traits that suggest concepts such as the *tragedy of the commons* in economics and the *prisoner's dilemma* in game theory (Williams et al., 2023). Both concepts arise from mistrust between players, e.g., individual countries (but this applies to structures even within a country, such as States in the United States, Australia and India, Provinces in Canada, or Regions in Italy). Each jurisdiction tends to favor economic self-interest and short-term decisions, even though everyone loses natural capital in the end while being aware this is happening.

Such difficulties emerge clearly from the five papers that make up this Research Topic. Allison et al. describe a system in Canada that is well-integrated from the federal to the provincial levels. The authors note, however, that in the absence of strategic and efficient border security and collaboration among government and non-government stakeholders, forest biosecurity is a difficult proposition.

Australia has a similarly well-organized and integrated plant biosecurity system, as summarized by Carnegie et al. The authors note, however, competing interests for limited biosecurity resources across multiple plant industries, declining technical expertise, and subsequent gaps in forest-specific biosecurity. This has led to the forest industry and national and state governments developing and funding a forest-specific biosecurity surveillance program for early detection of forests pests and pathogens. Under the "shared responsibility" paradigm (Nairn et al., 1996), the forest industry is likely to need to be more engaged in biosecurity to protect commercial and environmental values and export markets.

Biosecurity systems in Italy, described by Vettraino and Santini, are complicated by Italy's membership in the EU, so that the country's borders, in terms of forest biosecurity, are not the national borders, but those of the EU's Schengen area. This means that commerce, particularly in plants-for-planting (a major pathway for forest invasives), is unrestrictable within this very large area. This fact highlights the overwhelming role that international treaties, including the World Trade Organization and all emanating regulations, have in stymying even the best-intentioned controls (such as the International Standards for Phytosanitary Measures) aimed at protecting national forest resources.

Gupta and Sankaran describe a situation in India in which existing legislation mainly addresses the agricultural sector with very limited application to forests. They note that, ultimately, "successful implementation of all management options demands formation of an exclusive national policy to manage invasive alien species and an action plan governed by a single agency."

Kuru et al. highlight that "current biosecurity systems and processes in many countries are constructs of Western principles, values and science knowledge," yet indigenous people are often the most severely impacted by invasive pests and pathogens. There is a growing understanding globally of the need to harness the knowledge and value of indigenous peoples in biosecurity (Lambert and Mark-Shadbolt, 2021) to improve forest biosecurity and manage the impact of invasive species.

It is clear from these reviews that the world needs more harmonization, of international laws and treaties as well as organizational structures within countries. Lack of harmonization/coordination/centralization, communication, and political will are all fundamental limiting factors in our ability to confront this wicked problem. This problem has been known for quite some time to the experts, but it has clearly metastasized to the point that we are left basically powerless. This is not just a problem in developing economies, such as India. It is also a problem in the United States, as noted by Bonello et al. (2020). Clearly, the need for harmonization/coordination is upon us and is our call to action.

## AUTHOR CONTRIBUTIONS

PB ideated the document. AC and MO contributed to the writing. All authors contributed to the article and approved the submitted version.

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