FOSTERING COLLABORATION BETWEEN PATHOLOGISTS AND ENTOMOLOGISTS FOR BETTER MANAGEMENT OF FOREST PEST AND PATHOGEN INVASIONS

HOMED

HOLISTIC MANAGEMENT OF EMERGING FOREST PESTS AND DISEASES

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James Johnson, Georgia Forestry Commission
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Summary

This policy brief is based on a statement prepared by the HOMED project consortium on the occasion of the International Year of Plant Health (2020) and published in the open access scholarly journal Neobiota. Exotic pest and pathogen invasions are a long-standing problem of forests, with their relevance growing due to the global change. There is now significant evidence that the pathways of entry of alien pests and pathogens into European forests are often the same and that insects and fungi often coexist in the same affected trees. In an effort to mitigate the spread and impact of these invasions, forest entomologists and pathologists have been using different concepts, and have often proposed specific management methods without recognising complementarities and synergies between their respective fields. For that reason, we advocate increased collaboration between these two scientific communities to improve the long-term health of forests and optimise the management and prevention of alien species invasion in EU forests.

Keywords

Capacity building, detection, fungi, forest health, identification, insects, interdisciplinarity

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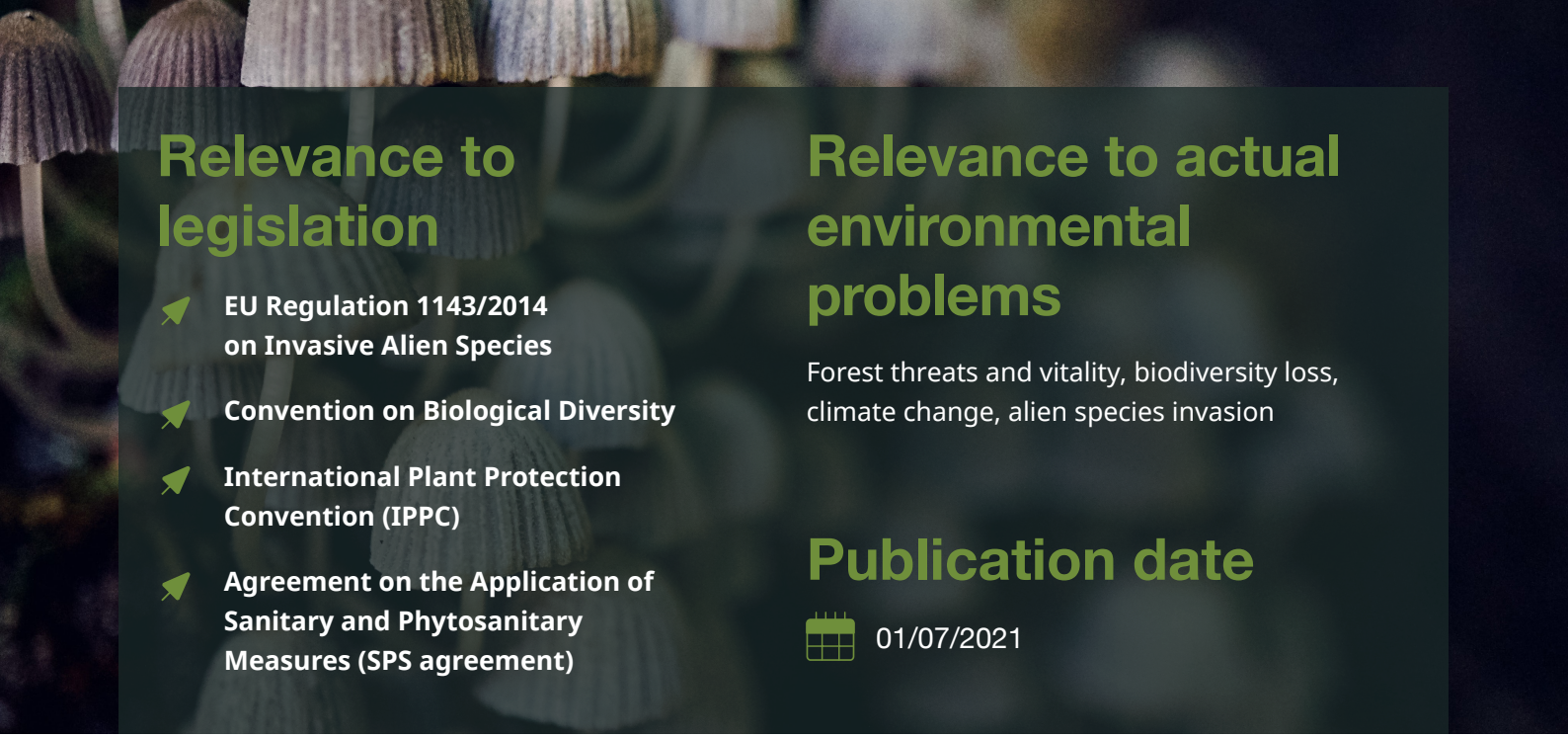

Relevance to legislation

- **EU Regulation 1143/2014 on Invasive Alien Species**
- **Convention on Biological Diversity**
- **International Plant Protection Convention (IPPC)**
- **Agreement on the Application of Sanitary and Phytosanitary Measures (SPS agreement)**

Relevance to actual environmental problems

Forest threats and vitality, biodiversity loss, climate change, alien species invasion

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Description of the problem

In the context of global change, the world's forests are exposed to unprecedented threats from biotic hazards (Simler-Williamson et al. 2019). The increase in volume and acceleration of global trade, especially of wood products, and travel has boosted the risk of invasion by non-native species into forests. In fact, it has been observed on all continents that the number of non-native insects and pathogens established in forests has increased dramatically (Seebens et al. 2017, Roques et al. 2020). Aside from the profound impact on forest vitality, such invasions could have severe economic consequences (Aukema et al. 2011). Non-indigenous forest invaders cause damage to forest ecosystem goods and services, with both market and non-market values being affected (Holmes et al. 2009).

The regulation and management of alien species invasion problems is convened through coordination of both international and national authorities. The general international framework of managing alien species invasion is provided by the International Plant Protection Convention (IPPC) and UN's Food and Agriculture Organization (FAO). Under the guidance of the IPPC, integrated pest management (IPM) is executed by national plant protection organisations (NPPOs) (FAO 2011). International phytosanitary standards are the main instrument through which the protection of forests is governed internationally. Recognising the hazards of alien species invasion, the EU has adopted the EU Regulation 1143/2014 on Invasive Alien Species that foresees the identification of a list of invasive alien species of particular concern and the importance of their prevention. The supporting organisations to the EU Commission in terms of alien species invasion management (Committee on IAS, Invasive Alien Species Expert Group, Scientific Forum on IAS, Working Group on IAS), aim to support the decision-making process and governance (EC 2020). The risk assessment of alien species invasions in the EU is regulated with the supplementing Commission Delegated Regulation (EU) 2018/968 act of 30 April 2018.

The pathways of entry of exotic pests and pathogens are often the same and alien insects and fungi often coexist in the same affected trees. Innovative methods for preventing invasions, early detection and identification of non-native species, modelling of their impact and spread and prevention of damage by increasing the resistance of ecosystems can be shared for the management of both pests and diseases. Increased collaboration between forest entomologists and pathologists is thus needed to improve the long-term health of forests.

Despite the adoption and global implementation of phytosanitary standards such as ISPM 14 and ISPM 15, it is clear that further improvement is needed for

the identification of emerging pathways common to pests and pathogens, particularly those associated with trade of plant, germplasm or wood materials. (Jactel et al. 2020). Surveillance for arrivals of alien forest pests and pathogens should focus in high-risk areas, such as urban and peri-urban forests close to industrial and commercial areas and near ports and airports (Branco et al. 2019).

Alien insect pests and pathogens that cause damage in invaded areas are often not yet described and can hardly be identified at species level on the basis of morphology. Cooperation between forest entomologists and pathologists is therefore considered a necessary step for the acceleration of the development of next generation sequencing pipelines for rapid identification of alien organisms (Feau et al. 2011; Malacrinò et al. 2017).

Risk modelling is an approach that pathologists and entomologists could share in order to obtain more accurate and precise insight into pest and pathogen invasion behavior. Such models can help design quantitative pest and pathogen risk assessments, which allow various risk reduction options to be tested, such as eradication (Jactel et al. 2020). Characterization of geographical variation in invasion risk can also lead to optimal allocation of surveillance resources.

An improved understanding of the effect of biodiversity on forest vulnerability to damaging biotic agents (Jactel et al. 2017) and joint research between entomologists and pathologists are required to identify the silvicultural and land use management practices that could effectively reduce the impact of multiple damaging agents. As a control measure, classical biological control has been much studied and applied to manage pests and less so to control pathogens (Rigling and Prospero 2018). This approach certainly deserves more research in forest pathology, using concepts developed by entomologists.

Researchers could also join forces in communicating their results, engaging citizen science communities or in sharing data. Examples such as the European Union's EUROPHYT-Outbreak platform, Silvalert smartphone app and the British Tree Alert tool have proven to be helpful in the tree health protection and the management of forest pests invasions. However, to be efficient and accurate, such initiatives require the support of both entomology and plant pathology experts (Jactel et al. 2020).

Recommendations

- We conclude that in order to improve forest protection, exotic insects and pathogens should be considered collectively. To tackle effectively the problem of forest invasions, development of **interdisciplinary research projects** dealing with the adaptation of forests to global change and the risks to forest health is necessary. The projects should involve researchers from various disciplines and more specifically entomologists, plant pathologists, economists and social scientists.

- The **design of innovative tools for early detection, identification and eradication of exotic pest and pathogens through collaboration between forest pathologists and entomologists** is of priority, along with **development of science-based guidelines for sustainable management improving forest resistance and resilience**.

- In terms of **capacity building**, we believe that joint **multidisciplinary curricula that aim to sensitise students** to the need to consider forest risks in a holistic manner and educate future managers would build capacity in integrated forest protection. We recommend **creation of early warning systems using citizen science** to involve the public in tree health issues, including opportunities for learning and participation in scientific research, monitoring and surveillance.

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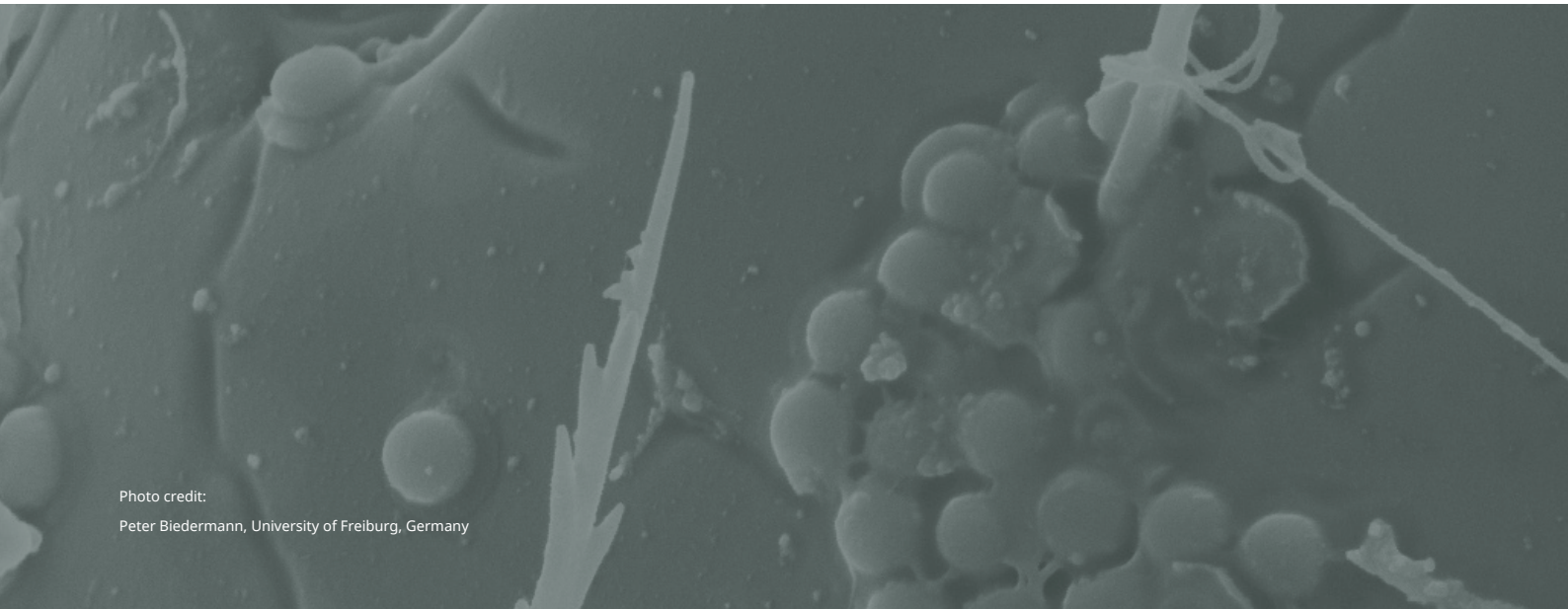

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