Forest pathogens invading Europe: the first of new research findings from ISEFOR

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Fungi top the list of invasive forest pathogens (IFPs) arriving in Europe in the last 30 years through increased trade of living plants from North America and Asia. Researchers investigating the threats to Europe's forests from foreign pathogens have revealed dramatic increases in IFPs since the 1990s the majority of them attacking broadleaved trees in forest and ornamental plantations. Living plants transported in soil are now a major pathway for the introduction of new diseases to Europe's forest trees.

Cross breeding between closely related but previously geographically isolated pathogens presents an opportunity for rapid emergence of modified pathogens. This phenomenon of interspecific hybridization, particularly frequent in the 90s, has resulted in pathogens with greater fitness that can live on different hosts.

The team of researchers brought together in ISEFOR painstakingly assembled historical and biogeographic patterns of invasion by 124 alien forest pathogens using records from 20 European countries. Countries in a southern central belt of the European territory recorded the greatest numbers of IFPs with increased entrance and establishment of invasive species. Statistical analysis showed that invasion was associated with a wider range of environments, higher human population size and density and greater international volume of commercial exchange. Land area, vegetation cover and rainfall also influenced spread. ISEFOR researchers predict that countries commercially isolated in the recent past that are now more densely populated might be at higher risk for further spread. "*Such countries are possibly the weakest links in attempts to prevent new introductions*" said Alberto Santini who led the research team. "*Protection will require tight coordination of actions by phytosanitary authorities and industry with special attention to the risk inherent in the trade of ornamental plants for planting."*

This is the first of a series of articles on ISEFOR findings about emerging infectious diseases (EIDs) of forest plants. Plant EIDs are tightly linked to biological invasion. Alberto's team examined the ability of a disease-producing species to invade a new territory and the susceptibility of a territory to invasion. The new European Database of Invasive Forest Pathogens is available on the ISEFOR website **{** HYPERLINK "http://www.isefor.com/" **}**.

ISEFOR is a consortium of 13 research organisations and 3 forest businesses. As well as the research reported here on which tree species are at risk from which invasive pathogen ISEFOR tested new methods for pest and pathogen detection; analysed commercial flows of plants most likely to carry pathogens; and is developing mathematical models to predict spread in Europe. The research received funding from the European Union Seventh Framework Programme FP7 2007-2013 (KBBE 2009-3) under grant agreement 245268 ISEFOR