Assessing the invasion probability of the pine wood nematode with imported wood

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Christelle Robinet is a researcher at INRA since 2008. She develops simulation models to determine the potential range expansion of forest pests, either invasive or native species. She assessed the potential range expansion of the pine processionary moth in France in relation with climate warming and anthropogenic activities. She also studied the potential range expansion of the invasive pine wood nematode in China and Europe considering both short and long distance dispersal. She is now focusing also on social insects currently invading France: an invasive North American termite and the invasive yellow-legged hornet. In addition, she participated to the development of generic tools: a generic spread model to support pest risk analysis and a generic pathway model to assess the probability of entry of invasive pests with imported wood. She works in collaboration with several research labs, notably at IRBI (Tours, France) and Wageningen University (The Netherlands).

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The pine wood nematode, Bursaphelenchus xylophilus, is the causal agent of the pine wilt disease. Native to North America, it was introduced in Asia (Japan, China, Taiwan and Korea) and in Europe (Portugal). In invaded areas, the pine wood nematode can kill a tree within a few weeks. It is carried by insects of the genus Monochamus over relatively short distances, and can disperse from one tree to another during the beetle maturation feeding and beetle oviposition. The nematode can also disperse over long distances when it is accidentally transported with infested wood. Preventing introductions is very important as containing its range is very difficult once it arrived. Here, we present a probabilistic pathway model that keeps track of infested wood products coming from China and entering into Europe until the possible dissemination of the nematode on a suitable host in Europe. The model accounts for the structure of the trade pathway and the wood transformation chain, the applied inspection procedures and wood treatments, and the dissemination capability on a suitable host tree at each node. The performed study highlights the most important parameters that should be known to quantify the probability of introduction. We also search for the nodes and the European countries that contribute the most to this introduction. With these results, we can then determine the best strategies to reduce this probability of introduction. Our probabilistic pathway model was designed to be generic. Thus, it can be used by pest risk analysts for any forestry pest. To estimate the overall invasion probability, this model should be combined with other approaches which assess establishment and potential spread of the pest.