# QUEDAD

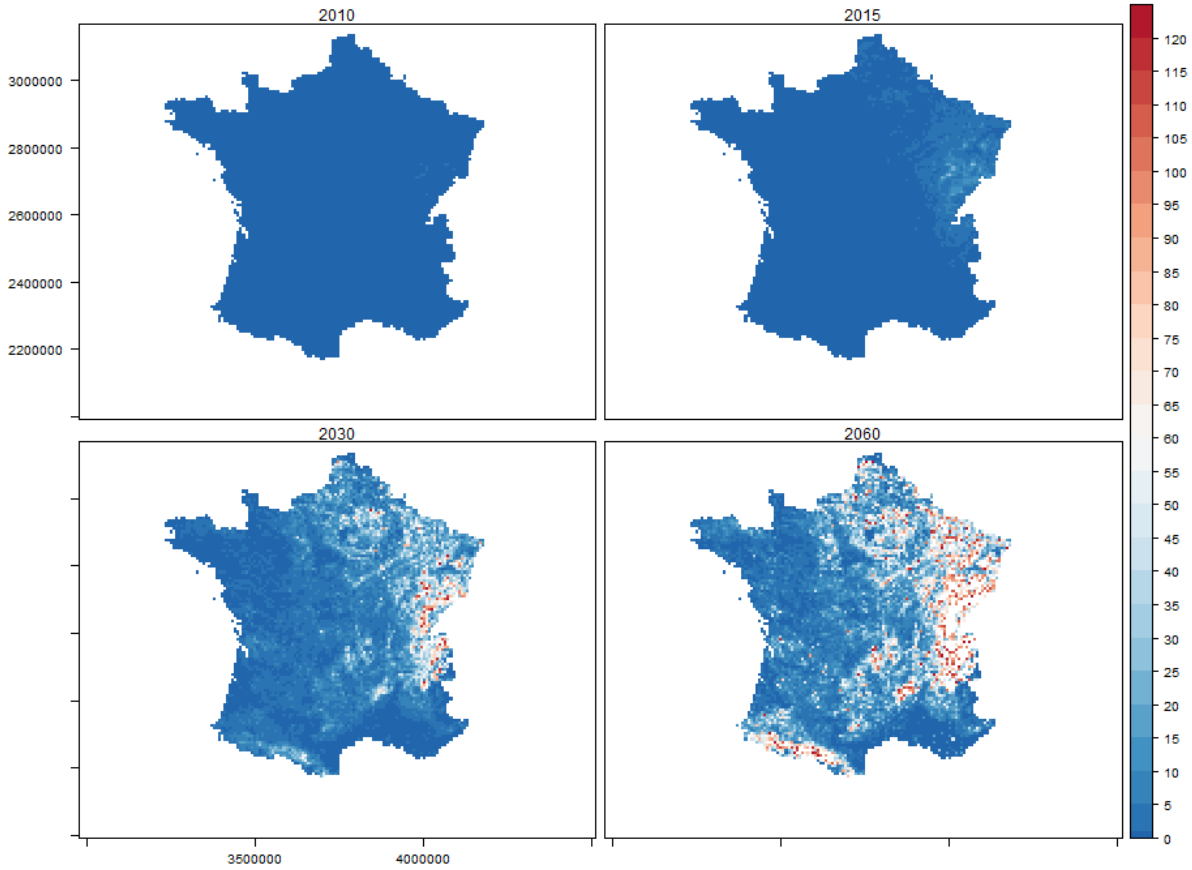


FIGURE: Ash dieback impacts: Common ash (*Fraxinus excelsion*) expected standing volume losses (cubic metres per hectare, resolution 8x8 km)

## Quantification of Economic Damages and costs of Ash Dieback in France

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***Context*** —
In the beginning of the 1990s, ash dieback was observed in Central Europe successively spread across the continent. In 2006, the cause of the ash dieback was identified as the new anamorphic species Chalara fraxinea (Hymenoscyphus pseudoalbidus in its sexual stage). Mortality rate on ash trees of all age is high after few years of infection, although the death is induced faster on young plants. In 2008, ash dieback was reported in North-Eastern France and it is currently spreading through the country. The disease spreads mostly through airborne spores, however long-distance dispersal can be human-mediated.

***Objectives*** —
The main objective of this research project is to assess the economic impacts of ash dieback in the French forest sector from 2008 to 2060. By simulating the evolution of the French forest sector with and without the pathogen presence, we analyse the impacts both on the resource and on the markets.

***Approaches —***
We built on the the French Forest Sector Model (FFSM), a recursive partial equilibrium model, composed of two interrelated modules: the resource module and the economic module. We modified the resource module in order to account for Common Ash (*Fraxinus Excelsior*) explicitly. The ash volume distribution was estimated via kriging with external drift using data from the French National Forest Inventory (IGN) and the portal on forest spatial data SILVAE (LERFoB and IFN). The pathogen spread was modelled as a radial range expansion model, which is a simplified version of the reaction diffusion model. We estimated the annual spread rate to 50 km per year using data from the French Forest Health Department (DSF). We modelled the pathogen related mortality rate as a function of the years since the infection and diameter class and calibrated the mortality function using data from DSF. We run six different scenarios reflecting different types of market structure (degree of substitutability between the ash wood and other) and decision makers' expectations (ranging from myopic to perfect foresight). We simulated the evolution of each scenario, with and without the pathogen, until 2060.

***Key results —***
- We expect the whole France territory to be invaded by 2024.
- Compared to the case without the pathogen, the standing volume is expected to be 42% lower in 2030 and 78% in 2060.
- On average, the supply of ash round-wood is expected to decrease by 2.1% to 3.6% in 2030 and by 9.1% to 15.3% in 2060. Similar trends are predicted for ash plywood and sawn-wood.
- According to the simulations' results, the prices of ash round-wood are going to increase by 13.3%-14.8% in 2030 and by over 95% in 2060. The price increments in 2060 will be between 11.5% and 13.9% for ash plywood, and in the range of 18.1%-22.1% for ash sawn-wood.
- Given that ash products represent a niece market, the impact on the total surplus of the whole forest sector (not considering amenities values) is negligible. Nonetheless, the producers' surplus losses are estimated to be between 18 and 38 million euro over the horizon 2008-2060 (0.04%-0.07% of the cumulated producers' surplus).

***Main conclusions including key points of discussion —***
In this work, we integrated the biological aspect of the invasion with its economic consequences. In particular, at the resource level, we capture not only the direct effects of the pathogen-induced mortality on the ash population, but also the indirect impacts caused by the forest managers' reactions to the invasion (i.e. use of different species to reduce the risk). This accentuated the overall reduction of the standing volume, which is expected to be significant if control methods remain unavailable. At the market level, prices are expected to rise following the negative supply shocks. These results are sensitive to the degree of substitution between ash and other hardwood products. The producers' surplus in general is reduced. However, some producers may gain from higher prices caused by the invasion.

***Perspectives —***
The model created within this project can be easily adapted to integrate more sophisticated diffusion modules which take into account climatic conditions and host density variations. Moreover, the model can be applied to multiple pest/pathogen invasions simultaneously.

**Valorisation —**
- This work was presented at the SSAFR 2015, 19-21 August 2015, Uppsala.