Geophysical Research Abstracts
Vol. 21, EGU2019-15017, 2019
EGU General Assembly 2019

Vulnerability of European forests to climate risks

Giovanni Forzieri (1), Marco Girardello (1), Guido Ceccherini (1), Achille Mauri (1), Matteo Pecchi (2), Sebastiaan Luyssaert (3), Giovanni Strona (1), Jonathan Spinoni (1), Lorenzo Mentaschi (1), Gherardo Chirici (2), Guillame Marie (3), Luc Feyen (1), Pieter Beck (1), and Alessandro Cescatti (1)

(1) European Commission, Joint Research Centre, Ispra (VA), Italy (giovanni.forzieri@ec.europa.eu), (2) geoLAB Laboratory of Forest Geomatics, Department of Science and Technology in Agriculture, Food, Environment and Forestry, Italy, (3) Vrije Universiteit Amsterdam, Departement of Ecological Sciences, Netherlands

Forest disturbances are large pulses of tree mortality that originate from abiotic and biotic agents. They represent a serious threat to the maintenance of healthy and productive forests. In the last decade, about 3.1% of Europe's forests were damaged by disturbances largely attributed to climate change. Examples from other countries, like Canada, show that disturbances driven by the rapidly changing climate may substantially alter the state of forests to the point that they become carbon sources instead of carbon sinks. Understanding forest risks is of particular concern for forest management because the long life-span of trees limits the possibility of a rapid adaptation to environmental changes. However, the substantial knowledge and methodological gaps of the physical processes and the uncertainties associated with existing disturbance databases have hampered so far a quantitative assessment of the vulnerability of forest ecosystems to natural disturbances.
We developed a novel data-driven modelling approach to estimate a set of vulnerability functions of tree species to climate-related hazards. Vulnerability is expressed in terms of biomass loss and retrieved as a function of satellite-based vegetation data, climate features and landscape metrics. The method is applied on multiple spatially-explicit datasets of forest disturbances and implemented in a machine learning model. We focus on European forests and the three major natural disturbances for this region, namely fires, insect outbreaks and windthrows.
Preliminary results show substantial spatial differences in tree species vulnerability amongst the different agents. Overall, forest structural parameters appear to play a key role in affecting vulnerability and their effects are of comparable magnitude to those of climate drivers. This highlights the importance of identifying suitable forest management measures to increase the resilience of forest ecosystems to climate-related risks.