PHD POSITION

Characterising the vulnerability of forests to climate change through demographic and physiological analyses

The LESSEM research group at INRAE Grenoble (https://www6.lyon-grenoble.inrae.fr/lessem/) invites applications for a PhD position on "Characterising the vulnerability of forests to climate change through demographic and physiological analyses" under the supervision of Thomas Cordonnier and Georges Kunstler.

The successful candidate will develop a combination of modelling and field data analyses to compare and integrate a demographic approach and a physiological approach to assess the vulnerability to climate change of the following tree species: Norway spruce, silver fir, European beech, Scots pine, sessile oak and Douglas fir. This thesis will build on National Forest Inventory plot data to build climate-sensitive demographic models and on available physiological traits database (P50 for tolerance to drought, LT50 for tolerance to frost) as well as new field data to assess species safety margins. An abstract of the proposed thesis is provided below. The PhD candidate will gain from the expertise of the team in vegetation modelling. The thesis is included in a project (VULCADYS) funded by Auvergne-Rhône-Alpes region. It will allow interactions with forest engineers from ONF (public forests) and IDF-CNPF (private forests). Strong interactions are also expected with two post-docs that will contribute to the ANR DECLIC (coordinator: Georges Kunstler) project and the BIODIVERSA project FUNPOTENTIAL.

Applicants must hold a Master degree in ecology or evolutionary biology. Significant experience in statistical analysis (e.g. in R) is expected. Experience in Geographic Information System (GIS), ecophysiology and field observations would be an advantage. Strong oral and written communication skills in English are required. PhD students have fixed-term contracts providing them with standard social security. The contract term is three years; the monthly salary is around €1,700 net. If retained, the PhD will start in September-October 2021.

Please provide a maximum two-page cover letter that explains your motivation, research experience and interest, your mark and ranking in master 1 (or equivalent) and bachelor, a CV including publications, and a list of three professional references. Please address your application to thomas.cordonnier@inrae.fr and georges.kunstler@inrae.fr.

Abstract

Forest managers, forest owners and policy makers need tools to assess demographic processes that will be most affected by climate change, depending on species, environmental conditions and stand structure. The main objective of the thesis is to compare and integrate a demographic approach and a physiological approach to assess the vulnerability to climate change of the main forest species in the Auvergne-Rhône-Alpes region (Norway spruce, Silver fir, Scots pine, Douglas fir, sessile oak, European beech). The thesis will developed two complementary approaches. Firstly, it will mobilise National Forest Inventory data to estimate the response to climate and competition of the main demographic processes (recruitment, mortality, growth) for the species considered. The consequences on population dynamics will be assessed using Integral Projection Models (IPMs; a first version of these IPMs is already available). Secondly, based on the physiological traits of the species, enriched by field observations, it will develop physiological safety margin maps for species facing drought and frost using the same climate data as in the demographic approach. These two approaches, physiological and demographic, will then be compared (consistency of results,

uncertainties) and then combined by directly integrating the physiological traits into the demographic models through species specific physiological safety margins. The thesis will thus develop species vulnerability assessments at the scale of the IGN Sylvo-Ecoregions which will specify, according to the IPCC scenario, the most sensitive demographic process(es) and the consequences for populations.