



Postdoctoral project for 15–18 months: Forest inventory methods for estimating effects of disturbances in Metropolitan France

Project description

The project is part of the focal project X-RISKS of the French national research programme PEPR FORESTT (<https://www.pepr-forestt.org/>). The aim is to develop sampling strategies (sampling design and estimators) in the context of the French National Forest Inventory (NFI) for estimating the effects of multiple disturbances in forests. Examples of the disturbance effects of interest are volume or biomass loss due to a storm or a wildfire, and tree mortality or decline in growth due to an insect or pathogen infestation or a drought. Since disturbances differ from each other in the rapidity of their emergence, in the spatial extent and pattern of their manifestation, and in the severity of their effect, they necessitate tailored sampling strategies.

The sampling strategies to be developed will rely on auxiliary data that are correlated with disturbance manifestation, timely, and available wall-to-wall or on a dense grid for sufficiently large areas. Such data can be based on remote sensing or come from other sources (e.g., spatially interpolated meteorological data, or map products describing likelihood of drought, forest fire risk, bark beetle risk, etc.). The idea is to use auxiliary data for detecting potentially disturbed areas, for creating a sampling design with which field plots are placed within this area, and for improving the precision of the field-plot-based estimation of the disturbance effects. For the creation of the sampling design, methods of spatially balanced sampling and continuous-population importance sampling will be studied. For the estimation of the disturbance effects, design-based model-assisted estimators employing models between the target variable and the auxiliary variables will be investigated. Reflections start from dealing with a single disturbance but will then be extended to the challenges posed by multiple disturbances overlapping in space.

The strategies will be tested via simulations in a realistic, large-scale artificial tree population (“digital twin” of a 3600-km² region in North-Eastern France), which is being constructed in a separate project, with realistic bark beetle damages incorporated into it. For the testing, realistic tree attributes of other disturbances and realistic artificial auxiliary data need be created on the basis of expert knowledge and observations.

The project aims at producing sampling strategies that are compatible with the French NFI framework and that can thus be integrated in it if desired, or, alternatively, that can be applied in targeted campaigns by the NFI field crew, separately from the usual annual NFI campaign. Consequently, connections of the proposed sampling strategies to the NFI sampling design and estimators need be considered. Examples of the questions to be reflected upon are incorporation of the information obtained from disturbance effect estimation to standard NFI estimation, and adaptation of the annual NFI sampling design if part of the field work is allocated to a disturbance inventory.

The project will contribute to the development of disturbance detection and assessment systems, which are to produce reliable and up-to-date information on the effects of the disturbances in mainland France, by providing them with a sampling-theoretical methodological basis.

The project will be supervised by Minna Pulkkinen (Laboratory of Forest Inventory LIF, Nancy, France) and involve collaboration with Guillaume Chauvet (ENSAI, Rennes, France), Olivier Bouriaud (University of Suceava, Romania), and Cédric Vega (Laboratory of Forest Inventory LIF, Nancy, France).

Tasks

- Carrying out a literature review in order to get a good understanding of the methods utilising auxiliary data in sampling design (spatially balanced sampling, importance sampling in a continuous population) and in design-based estimation (model-assisted estimation, also in a continuous population) applicable to forest inventory
- Proposing auxiliary-data-based methods for creating a sampling design and a model-assisted estimator to estimate the effect of an individual disturbance, with an emphasis on the estimation of the variance of the point estimator
- Participating in the creation of (i) tree attributes characterising selected disturbances and (ii) artificial auxiliary data in the simulation population, and testing the proposed sampling strategies via simulations
- Participating in the reflection on how multiple simultaneous disturbances overlapping in space can be addressed
- Participating in the reflection on how the information obtained from disturbance effect estimation can be incorporated to / combined with the standard estimation of the French NFI
- Writing scientific articles on the results

Qualifications

- PhD degree in statistics, in forest sciences, or in another discipline relevant to the subject
- In-depth knowledge of sampling theory and methodology; knowledge of forest inventory methods or environmental sampling methods would be appreciated
- Programming skills in R
- Fluent written and spoken English
- Experience of writing scientific articles
- Methodological rigour
- Ability to work independently and to collaborate with researchers of other disciplines (remote sensing, forest ecology)

Benefits

- Funding for attending scientific conferences to present the results
- Contacts to the French NFI and to the forest inventory community in Europe
- Contacts to the research community working on different aspects of multiple risks in forests within the X-RISKS project

Practical information

Workplace: Laboratory of Forest Inventory LIF (National Institute of Geographic and Forest Information IGN / National School of Geographic Sciences ENSG-Géomatique), Nancy, France.

Salary (gross): 36-42 k€ per year depending on the experience.

Duration: 15–18 months depending on the salary.

Start: January 2025 at the earliest; the exact date will be agreed upon with the selected candidate.

Contact & application

Further information about the project: Minna Pulkkinen, minna(dot)pulkkinen(at)ign(dot)fr.

Further information about LIF: Jean-Daniel Bontemps, jean-daniel(dot)bontemps(at)ign(dot)fr.

Application: Please send (i) a detailed CV including a list of publications, and (ii) a cover letter explaining your motivation and qualifications and containing the names, affiliations and email addresses of two referees, by e-mail to Minna Pulkkinen, with subject “X-RISKS post-doc application”.

Deadline of application: November 15, 2024.