

Post-Doctoral Position

"Wind Damage to Forests in a Changing Climate: Impacts and Mitigation"

Description of Position

Wind is responsible for more than half of the damage by volume to European forests and is predicted to continue to increase with current management practices and the changing climate. Modifying forest management to reduce and mitigate the impacts of wind damage requires a detailed understanding of the influence of the forest structure on the vulnerability of the forest. However, the range of services provided by the forest (timber, recreation, high water quality) also needs to be maintained whatever management system is implemented for reducing wind risk. In addition other hazards such as fire and insects outbreaks need to be taken into consideration. Balancing these multiple requirements at a regional scale, with multiple forest ownership and objectives, is a challenging and non-trivial problem. It requires use of the latest computational techniques in Geographic Information, Artificial Intelligence and computer modelling in order to find acceptable solutions both in the short (<10 years) and longer term (~10-50 years).

This position will be responsible for integrating a range of data (ground-based and remote sensed), computer based tools and new measurements of flow over complex forests in order to develop methods for assessing the impact of different management strategies. Models of forest growth, soil hydrology, wind damage vulnerability, and airflow will be utilized. Particular use will be made of GIS in order to provide a spatial representation of the forest and to integrate models and data in order to allow calculation of the productivity of the forest and the risks of wind damage now and in the future. Following data and model integration artificial intelligence optimisation methods such as heuristic techniques, genetic algorithms and reinforcement learning will be applied to identify optimum solutions, under various scenarios (different management options and different future climates). The proposal is to develop a generic methodology for optimising forest management so as to provide acceptable levels of production from the forest but within defined risk thresholds. The methodology needs to be able to also incorporate other threats (e.g. fire, insect damage, and drought) at some future point.

The development and testing of the optimisation methods will initially use "academic" landscapes consisting of "idealized" forest structures based on growth model predictions and climate change projections. Such "idealized" landscapes will be used to test model and data integration and the use of different optimisation techniques. Subsequently the project will investigate optimal solutions for managing forests at the regional scale using Les Landes Forest in south-west France as a test case. This is a large forest area (~10,000 km²) with a complex spatial structure and ownership pattern, which supports a major wood processing sector. However, it suffered catastrophic wind damage in December 1999 and January 2009 and has also been badly affected recently by bark beetle and pine processionary moth damage.

Candidate profile

The candidate should have a background in computer science or the use of computer modelling in ecology. They should preferably have experience in artificial intelligence, optimisation or operations research techniques. Knowledge of the use of GIS or computer models for land use modelling would be an advantage. The position is for 3 years and is part of an INRA "package" awarded to Dr Barry Gardiner within the INRA-Ephyse team. The postdoc will work closely with Dr Gardiner and the other members of the INRA team working on forest risks including a new PhD student conducting detailed studies of flow over fragmented landscapes. The candidate will also be expected to collaborate with the rest of the team in promoting the findings of the project to the scientific community through publications and attendance at international conferences and to the forest based sector through workshops, seminars and articles in trade journals.

The postdoc will be automatically part of the extensive international network of the research team including being part of a new collaborative project testing hyper-heuristic schemes with Prof. Emma Hart at Edinburgh Napier University.

Practical information

Location: Equipe Mécanique Environnementale, UR 1263 Ephyse, Centre Inra Bordeaux-Aquitaine, 71 av. Edouard Bourlaux, 33140 Villenave d'Ornon (<http://www.inra.fr/ephyse/>). The position will begin at the latest by 1st January 2013 and last for 3 years. Deadline for application: 31st October 2012.

Project Team

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