Regeneration in uneven-aged forests:
Detecting risks of abrupt community changes
and adaptation of forest management to global change.

PhD supervisor: Benoit COURBAUD (Irstea - LESSEM)
PhD co-supervisor: Philippe BALANDIER (Irstea - EFNO)

Localisation:
Irstea Grenoble – UR LESSEM – Team Dynamics
Adress: 2 rue de la Papeterie, BP 76, 38402 Saint-Martin-d'Hères
Tel: 04 76 76 27 62 email: benoit.courbaud@irstea.fr

Abstract:
Regeneration is a key process of forest dynamics especially difficult to pilot for a forest manager. Climate change increases the risk of an abrupt shift of seedling species composition or a blocking by understory vegetation due to the intensification of competition for resources. The objective of this thesis is to answer three key questions: how can we estimate whether the quantity of seedlings and saplings observed on the field at a given time is enough to renew an uneven-aged forest stand? What are the risks of abrupt composition change under climate change? How can we adapt forest regeneration management under climate change in uneven-aged stands? We will study these questions in two contrasted ecosystems: spruce-fir-beech mountain forests and oak-beech low-land forests. We will use field observations on forest sampling plots and the Approximate Bayesian Computation (ABC) method to calibrate a model of forest regeneration (tree fecundity, sapling growth and survival, competition with understory vegetation). This model will be used to analyze differences of strategies among tree species and estimate the effects of tree canopy, climate, understory vegetation and soils conditions on regeneration demographic processes and regeneration fluxes. The simulation models Samsara (Individual based model of forest dynamics) and RReShar (model of regeneration and competition with understory vegetation) developed on the platform Capsis will be coupled and improved. Simulation experiments will then be conducted in order to identify the risk of abrupt changes of regeneration density and species composition because of climate change and competition with understory vegetation. We will then test a concept of “flexible management” making possible to adapt harvest type and intensity to disturbance and climate change.

Tools and methods:
Bibliography: sapling ecology, ecological regime shifts, demographic process modelling, estimation methods, experiment design, forest management strategies …

Filed measures: Regeneration measures on sampling plots along gradients of environment, and forest structure and management conditions.

Model calibration: Regeneration model calibration with Bayesian/ABC approaches.

Simulation model development: Coupling and improving Samsara2 and RReShar simulation models on the development platform Capsis.

Simulation experiments: Designing, performing and analyzing simulation experiments.

Publication: International journals in Ecology / Forestry / Modelling

Relevant competencies:
Forestry / Ecology / Statistics / Modelling / Programming / Numerical experiments / Science writing / Team-work / Curiosity / Creativity / Persistence / Rigor
References:


Simulation platform Capsis : http://capsis.cirad.fr/capsis/presentation