OPT²FOR

Spatial and dynamic optimisation of forest management

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Thematic action concerned: *WP4*

Context —
Climate change is having a major impact on forests and the goods and services they provide. As a result, the practices of forest owners are undergoing radical change in response to this changing environment. Consideration is therefore needed to find new forms of management that are adapted.
Forest management (from regeneration to harvesting) involves time horizons extending over several decades and multiple interactions with the environment. These interactions affect the biophysics and biogeochemistry of forests, as well as the quantity and quality of harvested products. Climate change is a dynamic and complex phenomenon. Its impacts may be perceived differently by forest owners over time - affected by their perception of this uncertain context, risk aversion (Brunette et al. 2013; 2017), or even other behaviours (Blennow et al. 2012; Yousefpour and Hanewinkel 2015; Brunette et al. 2020) - leading them to adjust their strategies or reassess management alternatives at various times.

Objectives —
The aim of the project is to evaluate a set of technical forest management itineraries on the basis of a 'multi-criteria' analysis including the resource produced and the vulnerability of the components of the forestry-wood industry to environmental and economic risks in maritime pine forests in the former Aquitaine region.
More specifically, the objectives are (i) to evaluate these technical itineraries in terms of economic profitability for the private forest owner by considering various natural risks (drought, storm, fire, bark beetle) and economic risks (price) under various climatic projections and available water content (low, medium, high); (ii) to determine the impact of the forest owner's behaviour on his/her management decision. We focussed on the impact of aversion to economic losses in the event of a wood price risk. Indeed, losses and disadvantages can have a greater impact on decisions than gains and advantages (Tversky and Kahneman 1991). Finally, the results will be used to determine economically optimal management trajectories in the Aquitaine region for (i) and (ii).

Approaches —
We designed and carried out an evaluation based on a cost-benefit analysis including the impacts of natural risks (drought, storm, fire, bark beetle) and economic risks (fluctuation in the price of wood) as well as dynamic optimisation based on a decision tree, all on a set of points in the Aquitaine region. We had 4 maritime pine silvicultural itineraries simulated under 3 climate scenarios (RCP 2.6, 4.5 and 8.5), 3 available water content (low, medium, high) and 4 age classes (i.e. stands of 0, 16, 26, 36 years) over a period of 2005-2100.
For the evaluative part, the analysis considered the depreciation of the remaining products post-impact and the forest owner's aversion to economic losses.
With regard to dynamic optimisation, we calculated the silvicultural trajectories offering the best forest return for the private owner, for various parameters in order to assess their impact on this management decision (trajectories): impact of climate scenarios, available water content, natural and economic risks, and aversion to economic losses. These trajectories are then mapped out.

***Key results* —**

- The development of an innovative methodology for spatial and dynamic multi-criteria analysis of adaptive management choices for production forests under different scenarios.
- Characterising these choices in environmental and economic terms, while taking into account the behaviour of forest owners in the face of economic losses.

***Main conclusions including key points of discussion* —**

The first 12 months focused on developing the methodology and researching and producing the data required for the study. The results are currently being finalised.

***Perspectives* —**

The project has been extended by two months (April-May). The aim of this period will be to finalise the mapping of the results and the spatial analysis (in particular through matching), and to produce the final deliverable in the form of a scientific article.

Valorization —

(Scientific: publications, book chapter, presentation at conferences...); economic: Soleau envelope, patent, license...; distribution: press release, interview...)

The results will be presented in the form of a scientific article (at least one) and oral presentations (at least two).