

MESSYA



Mapping Ecosystem Service Supply in conservation Areas

Principle investigator: Géraldine Bocquého, UMR Bureau d'Economie Théorique et Appliquée (BETA)

With the collaboration of David Shanafelt

Actions thématiques concernées : : WP4 - WP2

Context — Ecosystem services (ES) are increasingly recognised for their usefulness in spatial planning and land-use management. This framework has proven relevant for assessing landscape options to reconcile multiple economic and environmental objectives and achieve landscape multifunctionality. More specifically, analysing spatial synergies and trade-offs between ES can help identify which specific locations decision makers should target for each ES, in order to achieve multiple objectives in an efficient way at the territory scale. These issues fall within the broader debate on land-sparing versus land-sharing, i.e., regional specialization versus joint production of ES.

Objectives — We aim to examine to what extent forested conservation areas can reconcile economic, environmental and social objectives, using local data when possible. Conservation areas are of particular interest to study ecosystem multifunctionality because they face numerous challenges, including production of wood and high-value agricultural products, conservation of sensitive species, water quality regulation, tourism and peri-urban recreational activities.

Approaches — We will first build a homogeneous spatial database to quantify the environmental and economic services French forests provide at the territory scale in a conservation area. Second, we will assess synergies and trade-offs between forest ES in spatially-explicit terms. It will allow us to appraise the productive efficiency of the current management with respect to the joint provision of wood products and other ES, including global climate regulation (through carbon sequestration), recreation, water purification, while preserving biodiversity. This work will be applied to the *Ballons des Vosges* Regional Nature Park.

Key results —

- Internship (M2) of Siwar Saadaoui from September 2021 to March 2022 (6 months).
- We measured and mapped the supply of the climate regulation service on the whole park territory through carbon sequestration by vegetation. We used two different methods. One is based on the suite of models InVEST to estimate quantities of carbon stored in four carbon pools (aboveground biomass, belowground biomass, soil, dead organic matter) by land cover type. In the second method, we used the Landsat satellite images to calculate the NDVI (Normalized Difference Vegetation Index) by spatial unit, and deduce the quantity of aboveground biomass.
- We measured and mapped the supply of recreation on the whole park territory thanks to InVEST. The model provides a spatial visitation index corresponding to the total number of annual person-days of photographs uploaded to the photo-sharing website *flickr*.
- We produced a spatial biodiversity index for the forests of the park thanks to InVEST. The model uses habitat quality and rarity as proxies for biodiversity. It estimates the extent of land cover types across the area and their state of degradation. Degradation is based on data on threats to habitat and habitat response.

Main conclusions including key points of discussion — It is possible to use the InVEST models to map the supply of forest ES in the *Ballons des Vosges* park. Alternative methods (like NDVI for carbon sequestration) give different results that we need to analyse and discuss.

Perspectives — The next step for the internship of Siwar Saadaoui will consist in developing methods to measure one or two additional services (wood production and water quality regulation). A second internship will begin in March 2022 to lead the economic analysis of the ES synergies and antagonisms.

Valorization — Article in English under progress. Homogeneous spatial database being built.

Leveraging effect of the project— Synergies with MANIFEST project coordinated by D. Shanafelt (BETA), which leads similar analyses at a larger scale (whole France).