



## Mapping Ecosystem Service Supply in conservation Areas

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

Collaboration: David Shanafelt

Thematic actions concerned: 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 examine to what extent forested conservation areas can reconcile economic, environmental and social objectives. 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 first build a spatial database to quantify the environmental and economic services French forests provide at the territory scale in a conservation area. Second, we assess synergies and trade-offs between forest ES in spatially-explicit terms. It allows 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 is applied to the *Ballons des Vosges* Regional Nature Park.

**Key results —**

- Internships (M2) of S. Saadaoui from September 2021 to March 2022 and S. Haya from March to August 2022.
- For the whole park territory, we measured and mapped the supply of (i) the climate regulation service through carbon storage by vegetation (InVEST method and Landsat NDVI - Normalized Difference Vegetation Index – method), (ii) recreation (indicator from InVEST), (iii) wood production (standing wood volume from IFN - *Inventaire Forestier National* – data), and (iv) biodiversity (indicator from InVEST).
- Economic analysis of antagonisms and synergies between services using several methods including: spatial correlations, maps of hotspots and coldspots, production possibility frontiers.
- We find weak and/or weakly significant relationships between services at the territory scale. There is a hotspot in the eastern half of the Park for the supply of the trio carbon, recreation and biodiversity, especially in the northeast.

**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 (e.g., NDVI for carbon sequestration) give different results. It shows how important it is to compare several ES evaluation methods.

**Perspectives —** This work could be fine-tuned thanks to more specific local data.

**Valorization —** Two conferences and one article in preparation, for publication with the corresponding spatial database.

(2022) Saadaoui Siwar, Bocquého Géraldine, Shanafelt David, *Spatial Analysis of the Relationships Between Wood Production and Other Ecosystem Services in the Ballons des Vosges Regional Park*, IUFRO Division 4.04.07 Risk analysis Conference (International Union of Forest Research Organizations), Nancy, France (31.05-02.06.2022)

(2022) Saadaoui Siwar, Bocquého Géraldine, Shanafelt David, *Analyse spatiale des relations entre la production de bois et d'autres services écosystémiques forestiers sur le territoire du Parc Naturel Régional des Ballons des Vosges*, 58e colloque ASRDLF (Association de Science Régionale de Langue Française), Sciences Po Rennes, France (29.06-01.07.2022)

**Leveraging effect of the project—** Synergies with the MANIFEST project coordinated by D. Shanafelt (BETA), which leads similar analyses at a larger scale (whole of France). Synergies with the PERCEVAL project coordinated by S. Garcia (BETA) which will be launched on March 9, 2023. This last project aims at developing an exchange platform for forest ES, between producers and local actors from South *Lorraine* and North *Vosges*.