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Participatory valuation and modelling of ecosystem services under land use change

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Ecosystem service (ES) is a conceptual linkage between biodiversity and human well-being. In a context of increased urbanization combined with the effects of climate change, the level of biodiversity is expected to be reduced, and from the point of view of the ES, the loss of biodiversity is not only an environmental problem for itself, but is also a major issue for society's sustainable development. Thus, it is necessary to identify adaptations of ecosystem use and management that will minimize the biodiversity loss while maintaining the production of ES for the society. To achieve this goal, ES must be valuated, but this valuation needs to consider a broad set of goals that include ecological sustainability and social fairness, along with the traditional economic goal of efficiency. Participatory approaches should be used in all ES valuation steps. Indeed, local stakeholders and end-users have a central role in the valuation process, as they are the direct beneficiaries of the provision of services. Moreover, biodiversity management must be focused onto human needs to deliver more integrated policy and management at a landscape-scale and be more firmly directed towards human well-being.

Here, we present the framework developed within the VOTES (Valuation Of Terrestrial Ecosystem Services in a multifunctional peri-urban space) project for integrating all these factors in a quantitative tool designed for a sustainable landscape management, as well as for the evaluation and the monitoring of ES for policy designers. The originality is that this framework will provide an integrated valuation of ES in a spatially and temporally explicit way, based on the following steps: social valuation, biophysical valuation, economic valuation, landscape modelling & dynamics and finally integration of ecosystem service indicators. The biophysical assessment and landscape modelling steps rest on the combined use of two spatial models: a dynamic vegetation model (CARAIB DVM) and an agent-based model (ABM). These models will be used to construct future (dynamic) scenarios that include the major driving forces of the system (e.g., global socio-economic context, urbanization pressure, climate change, etc) together with adapted management. The computed scenarios will provide the changes in the biophysical system consistent with the socio-economic evolution, including changes in land use, crop productivity, carbon sequestration, or more generally ecosystem structure and function. This will allow an estimate of a change in the provision of ES through time, so that the sustainability of ES under the studied scenarios can be assessed. The framework is meant to be applicable to any given landscape, but here it is applied to a case study area in central Belgium, known for its strong periurban character, due to the proximity to Brussels.