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Resource Modeling Association BORDEAUX MÉTROPOLE université BORDEAUX

Date

June 29 - July 1, 2015

Conference Title

Modeling and Sustainability of Biodiversity and Ecosystem Services

General presentation and topics

The 2015 International Conference of the Resource Modeling Association will be held at the **University of Bordeaux** from 29 th June to 1st July 2015.
The main goal of the 2015 conference is to foster cooperation and exchanges among scientists involved or interested in the mathematical and numerical modeling of ecosystems, socio-ecosystems, renewable resources management and scenarios of marine and terrestrial biodiversity. Thus, the central theme of RMA 2015 is the "**Modeling and Sustainability of Biodiversity and Ecosystem Services**". Such an issue requires interdisciplinary exchanges between Ecology, Economics, Mathematics and Computer Sciences. In terms of applications, particular attention will be paid to the following fields: fisheries, agricultural systems, forest management, wildlife management, invasive species and climate change impacts. Methodological contributions are especially invited on the themes of ecosystem-based modeling, model-based scenarios, sustainability criteria, diversity metrics and resilience formalization.

RMA 2015 is also a great opportunity for students and young researchers to present and discuss their first results.Submissions of PhD students are especially welcome. They can be potentially articulated with the summer-school of LabEx COTE to be held in Bordeaux just before the conference.

A special issue of the journal NRM (Natural Resource Modeling) focusing on "modeling and sustainability of biodiversity and ecosystem services" will be derived from the 2015 conference.

The use of ecosystem services integrated modelling in LCA

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Introduction

In the framework of industrial ecology, Life Cycle Assessment (LCA) is the one of the most used methodologies to assess the potential impacts of production systems on the environment and human health [1]. One of the main methodological phases of LCA is the Life Cycle Impact Assessment (LCIA). In LCIA, characterization factors (CF) are used to translate previously inventoried flows of harmful emissions and potentially depletable resource uses into specific potential impacts. While the impact assessment of emissions to air, soil and water, and of the consumption of abiotic resources is well-established and operational in LCIA, broader evaluation of ecosystem services (ES) is still quite hampered by the lack of combination between LCA and ES accounting and valuation methods. Our research therefore focuses on the characterization of ES in LCA, with the aim to calculate a number of CF that can be used to evaluate the potential loss of ES associated with these impacting flows (e.g. eutrophying or acidifying substances, land use change-LUC). Taking as a case study the Luxembourgish energy cropping systems, we intend to both improve conceptually the integration of ES assessment in LCA and provide results useful to the definition of sustainable development strategies for Luxembourg. To this end, we use the Multi-scale Integrated Model of Ecosystem Services (MIMES; [2]). This model aims to describe the inter-linkages between the geobiosphere (natural capital) and the anthroposphere (divided between social capital, human capital and economy), through the modelling and valuation of ES over different time and spatial horizons [3]. Because of its high flexibility, MIMES can be improved and specifically adapted to fit the methodological conditions of LCA.

Method and results

A first problem we address is the definition of archetypes for the provision of ES. Indeed, LCA can suggest in which country a given LUC will take place, but not its exact location. To cope this lack of precision, we need to (1) model “average” pathways for the provision of ES, sensible to the information present in life cycle inventories, and (2) evaluate the variability and uncertainties associated with the low level of detail available. The identification of key concepts from ES literature not yet implemented in LCA, such as the modelling of ES supply, demand and flows [4], is at the heart of our research.

In a second step, we focus on hierarchizing ES and their related metrics, so they can fit the framework of LCA impact indicators. For the case of ES, we need to identify which available metrics are the most relevant ones to depict the damages done to ecosystems functionality and society’s

welfare. Accordingly, the notions of intermediary ES and final ecosystem goods and services [5] are investigated in order to define a clear and transparent framework for the modelling and valuation of ES.

Finally, we study the modelling of dynamic feedbacks taking place between the natural capital and society. In this regard, we aim to link several ecosystem functional models in MIMES (e.g. InVEST for pollination; [6]) with an economic model (based on the Exiobase, an international environmentally-extended input-output table; [7] to analyse how a given impact will influence the provision of ES to society, thus influencing its production systems, which in turn may induce new impacts on ecosystems supply of services.

This 3-step approach is applied to a case study on the impacts of energy crops production on the pollination service in Luxembourg, assessing pollination demand (needs from pollination dependent crops across 116 municipalities in Luxembourg) and modelling pollination flows in order to quantify and value the benefits provided to society [2] [4]. The pollination service is thus spatially characterized by the abundance of bees (qualitative index) and by the monetary value of the crops they pollinate (similar to an 'endpoint' indicator). Focusing on the characterization of LUC flows, the marginal pricing approach in MIMES enables us to assess and value the impacts of a certain LUC (e.g. from broad-leaved forest to rapeseed culture) depending on its location in Luxembourg (municipality). As a result, we can for example assess the potential impact from the replacement of 1 ha of forest by 1 ha of rapeseed culture in the municipality of Bous, which is the loss of 414.41€ in pollinated crops for Luxembourg. This loss of pollination is related to the decrease of 0.0017% in pollinators' abundance due to that LUC (i.e. to the transformation of potential habitats and foraging resource for pollinators as modelled in InVEST). These two values represent potential CF (respectively endpoint and midpoint) for this LUC type in Luxembourg.

Our methodology is a first step towards the inclusion in LCIA of intra- and inter-relationships among ecosystems elements and socio-economic patterns along the path of ES supply to society over different spatial and temporal scales. The on-going refinements to the model will later evolve in an integrated framework able to encompass economic and ecological dynamics as pursued in MIMES.

References

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