

BOOK OF ABSTRACTS

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I. SESSION DESCRIPTION

ID: O8a

Emerging concepts in ecosystem services assessment

Hosts:

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II. SESSION PROGRAM

Date of session: Thursday, 10 June 2021

Time of session: 11:00 – 12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00 11:15	Juan Alberto	Molina – Valero	Universidade de Santiago de Compostela	The assessment and comparison of structural patterns among mediterranean, temperate and boreal mature forest of <i>Pinus sylvestris</i>
11:15 11:30	Frédéric	Joly	INRAE	Biological operability, a new concept based on ergonomics to assess the difficulty to optimize bundles of ecosystem services
11:30 11:45	Josef	Seják	Jan Evangelista Purkyne University	Why ecosystem service valuations should be counterbalanced by the Earth's thermodynamic costs
11:45 12:00	Alberto	Grando	University of Ferrara	Design with Ecosystem services: environmental performance tools as an integrated methodology for landscape design



Time	First name	Surname	Organization	Title of presentation
12:00 12:15	Madina	Bekchanova	Hasselt University	Biochar's effect on the ecosystem services provided by sandy-textured and contaminated sandy soils: a systematic review protocol
12:15 12:30	Solen	Le Clec'h	Environmental System Analysis group	Critical transitions of biodiversity and ecosystem services along a gradient of agricultural intensification in the Amazon

III. ABSTRACTS

Abstracts are ordered based on the session program. The first author is the presenting author unless indicated otherwise.

1. Type of submission: Abstracts

O. Open sessions: O8a – Emerging concepts in ecosystem services assessment

The assessment and comparison of structural patterns among mediterranean, temperate and boreal mature forest of *Pinus sylvestris*

Presenting author: Juan Alberto Molina-Valero

Other author(s): Eneli Põldveer, Diana Laarmann, Henn Korjus, César Pérez-Cruzado

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Spatial stand structure strongly influences the functioning of forest ecosystems and the supply of many ecosystem services. Forests with higher levels of naturalness and complex structure provide valuable ecosystem services and their assessment to define reference conditions for sustainable management is an emerging global issue. Here we assess patterns of spatial forest structure in mature, over 120 year-old *Pinus sylvestris* dominated stands located in mediterranean, temperate and boreal forests; which cover the whole latitudinal range of biomes where this species is distributed in Europe and represent some of the most maturity conditions in Spain and Estonia. For that purpose, we used individual tree indices based on the nearest-neighborhood approach: species mingling, deadwood distribution, diameter differentiation and diameter dominance indices, and distinguished the mean distance between



the closest neighboring trees. The results show that temperate forests are significantly more heterogeneous in terms of the mingling of different tree species, and boreal forests denser according to the mean distance between neighboring trees. Apart from those findings, we did not find any other significant differences between the values of structural indices among old *P. sylvestris* forests located in mediterranean, temperate and boreal areas. The results confirm that mature forests for mediterranean, temperate and boreal areas have similar structural patterns in spatial arrangement of deadwood, and vertical and age structure once they reach high levels of naturalness. Therefore, it is possible to distinguish the structural patterns of old mature forests using abovementioned indices in order to quantify structural characteristics of forests considered as reference ecosystems. Structural indices may serve as naturalness indicators in the planning of treatments and assessment of forest ecosystem complexity in the future.

Keywords: spatial forest structure, nearest neighborhood relationship, mature forest

2. Type of submission: Abstracts

[O. Open sessions: O8a – Emerging concepts in ecosystem services assessment](#)

Biological operability, a new concept based on ergonomics to assess the difficulty to optimize bundles of ecosystem services

Presenting author: Frédéric Joly

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How can we measure the difficulty to obtain optimal trade-offs between conflicting ecosystem services (ES)? To answer this question, we crossed metrics of optimality and robustness in a model simulating sheep/cattle mixed-grazing (mixed-grazing is grazing by more than one species). We hypothesized that mixed-grazing processes (parasitism dilution and complementary consumption of forage plants) would improve ES bundles by increasing meat production with limited additional environmental costs. We assessed the optimality of bundles with the help of a productivity frontier and their robustness through a management density approach, based on the number of management decisions leading to each bundle. We modeled the effects of management decisions, defined as the combination of livestock density and sheep/cattle ratio, on the monetary value of two provisioning ESs (beef and mutton



production), and two regulating ESs (carbon balance and erosion control). Our results confirm that mixed-grazing has the potential to improve ES bundles through an increase of the provisioning ESs value, with limited effect on the regulating ESs value. Our results also show that optimal bundles are the most robust, because of the shape of the biological function driving animal growth according to the sheep/cattle ratio. This function is hump-shaped with a plateau that buffers small ratio deviations, and makes bundles optimal or quasi-optimal over a wide range of ratio (e.g. over a wide range of management decisions). ES bundles are thus easily optimized and for this reason, based on the definition of the adjective operable ('capable of being put into use, operation, or practice'), we consider mixed-grazing a 'biologically operable' practice. We use this result to develop a framework inspired by ergonomics, to assess the biological operability of any ES optimization practice.

Keywords: trade-offs, frontier, robustness, grazing, pasture

3. Type of submission: Abstracts

[O. Open sessions: O8a – Emerging concepts in ecosystem services assessment](#)

Why ecosystem service valuations should be counterbalanced by the Earth's thermodynamic costs

Presenting author: Josef Seják

Other author(s): Keith R. Skene

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Recently R. Costanza et al. (2017) warned that the economic value of ecosystem services has been mostly understood too narrowly as aggregate WTP (willingness to pay) for the stream of services or the cost of compensation for their loss. Such unilateral valuations would require that ecosystems and their services are infinite. Furthermore, such unilateral valuations produce misleading value relations, as the value of forest ecosystem services, as a representative of a natural landscape, is lowest compared to any anthropogenically altered ecosystems (urban lands, croplands, grasslands) (Costanza et al. 2014). It is a priority to embrace the broader concept of economic value (as shown by A. Marshall and H. Daly), based on comparing human benefits from nature with the costs of the consumption of natural resources. As all life on Earth is thermodynamically driven, mainly by incoming solar energy, the costs in such calculations are mostly generated by solar energy dissipation losses caused



by anthropogenic alteration of natural ecosystems. A return to Marshall's twin-blades-of-value scissors cannot be achieved by corrections in national accounting systems, but must be placed at the very heart of our search for sustainable economic activities. Economic agents should start to pay for thermodynamic losses caused by their transformation of natural ecosystems. They should at least compensate biotope losses according to the biotope valuation method and some increments can be added according to Energy–Water–Vegetation Method (Seják et al. 2018). By incorporating solar energy dissipation losses as costs to ecosystems the proper value relations can be achieved, having climax forests as the most valuable ES producers, and recognizing that humans will be unable to substitute such native ecosystems through human technologies.

Keywords: ecosystem services, economic value, inclusion of ecosystem functions into landscape decision-making

4. Type of submission: Abstracts

[O. Open sessions: O8a – Emerging concepts in ecosystem services assessment](#)

Design with Ecosystem services: environmental performance tools as an integrated methodology for landscape design

Presenting author: Alberto Grando

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Despite in the last years the scientific debate in the Ecosystem Services (ES) has reached a mature stage, from the landscape design perspective there are still some open questions, which often limit the implementation of ecological actions in the territory transformation. The discussion starts from the consideration that ES are now mostly used either for promoting conservation policies or as environmental performance tool in the regulatory approval process: for example, in the construction of an infrastructure or in a wide territory transformation, ES helps public bodies to evaluate the impact of the new project to the natural resources and proposing mitigations actions. The scope of this session is to push the discussion a step forward, by investigating how the Ecosystem Services Evaluation can be integrated as a foundation framework for a landscape design process, rooted in a correct environmental strategy. In other words, ES can be used not only for monitoring policy, but also as an active tool. This concept would help designers to develop sustainable territory transformation and a



better integration of the new infrastructures in the territory. Therefore, this discussion aims to insert landscape designers and urban planners in the ES debate. Here are some of the main questions:

- How urban planners can use ES valuation for solving problems relating with climate changes (for example cost erosion, flooding risks, carbon sequestration)? Are there some successful examples?
- Which tools can be shared with designers in order to develop sustainable projects?
- Can designers use INVEST platform for planning interventions in urbanized area, which can help the territory to face problems related to climate change?
- How to use ES valuation for designing new infrastructures in the territory?
- How the assessment of natural capital values can help to trigger landscape transformations?
- Discussing some examples and past experience.

Keywords: landscape design, ecosystem services, natural resources, urban planning

5. Type of submission: Abstracts

O. Open sessions: O8a – Emerging concepts in ecosystem services assessment

Biochar's effect on the ecosystem services provided by sandy-textured and contaminated sandy soils: a systematic review protocol

Presenting author: Madina Bekchanova

Other author(s): Luca Campion, Tom Kuppens, Marijke Jozefczak, Ann Cuypers, Robert Malina

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Goal and background: Biochar is a relatively new soil amendment method in agricultural practices that can improve the ecosystem services of soils. Biochar has commonly been applied to soils that are less fertile, such as sandy – textured soils, or heavy metal polluted, such as sandy-textured and contaminated sandy soils, to improve their properties. Yet, not all sandy-textured and contaminated sandy soils respond to biochar applications positively, evidenced by some studies indicating no or a negative biochar effect. So, there is a lack of consensus regarding biochar's positive impact on soil ecosystem services, specifically biomass production, water cycle, nutrient cycle, and climate regulation. Therefore, the present study's



objective is to review studies systematically to identify the impact of biochar amendments on the ecosystem services of sandy-textured and contaminated sandy soils. Methods: This review follows the guideline of the Collaboration for Environmental Evidence and corresponds with the ROSES (RepORting standards for Systematic Evidence Synthesis) reporting standard. A comprehensive search strategy will be employed to cover peer-reviewed, and gray literature through bibliographic databases, organizational and institutional websites, and web-searches. The search results will be screened first by their title and abstract, and then by their full text. Two reviewers will do this, based on inclusion criteria. A validity assessment will be conducted to critically appraise and assess the validity of studies using the most common framework. Data will be extracted from the studies that are found valid for the review. Narrative synthesis and meta-analysis are planned to be employed to synthesize the review results. Through targeted meta-analysis, we intend to see the impact of biochar on soil ecosystem services, which later can be exploited by policymakers.

Keywords: nutrient cycle, crop production, climate regulation, water cycle, soil amendment

6. Type of submission: Abstracts

[O. Open sessions: O8a – Emerging concepts in ecosystem services assessment](#)

Critical transitions of biodiversity and ecosystem services along a gradient of agricultural intensification in the Amazon

Presenting author: Solen Le Clec'h

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Resilience of socioecological systems and critical transitions in the response to environmental changes have become an important framework for the environmental management. Yet, underlying mechanisms of resilience and the value of the ecological thresholds are still largely unknown. In addition, the implications of ecological thresholds for different types of ecosystem services (ES) are still lacking. Because humid tropical areas have been impacted on a large scale by the conversion of forests into agricultural lands, knowledge on critical transitions of biodiversity and ES is critical. We analyze here how deforestation activities and agricultural intensification affect biodiversity and the provision of multiple ES in family farms. To do so, we first analyze the effects agricultural intensification on biodiversity and we identify the critical transitions. Then, we reveal the implications of these transitions on the provision



of four ES indicators (tree C stocks, soil C stock, rates of water infiltration into soil and soil chemical quality). We focus on six study sites from the Colombian and Brazilian Amazon, affected by deforestation dynamics, that differ in the temporality of the deforestation. We use the differences that can be observe across space as a space-for-time substitution to analyze the response of a tropical forest system to increasing human-based pressures over time. The agricultural intensification resulted in a general loss of biodiversity, in a nonlinear way. Five stages in biodiversity levels, separated by clear thresholds, could be observed. These phases of the transition curve also shaped clear profiles of ES provision, although the influence of the intensification depended on the ES and the taxonomic groups. Our findings can provide important keys for improving forest management in the Amazon, and more broadly in major global forest basins and also contribute to feed a still lacking literature that analyzes the relationships between biodiversity and multiple ES.

Keywords: deforestation, resilience, rainforest, family farming, provision of multiple services