



BOOK OF ABSTRACT

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I. SESSION DESCRIPTION

ID: T4a

Times are changing: temporal mapping of dynamic ecosystem services

	Title	Name	Organisation	E-mail
Host:	Dr.	Louise Willemen	ITC University of Twente	L.L.Willemen@utwente.nl
		Miguel Villoslada	Estonian University of Life Sciences	mpecina@emu.ee
Co-host(s):	Dr.	Ignacio Palomo	Basque Centre for Climate Change	Ignacio.palomo@bc3research.org
	Dr.	Evangelia Drakou	ITC University of Twente	e.drakou@utwente.nl
	Prof. Dr.	Benjamin Burkhard	Leibniz Universität Hannover	burkhard@phygeo.uni-hannover.de
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Abstract:

ESP has contributed to 10 years of advancing ecosystem services science, policy and practice for a sustainable future. In those years, the ecosystem services mapping community has seen shifts in policy priorities, technological advancements (e.g. the advent of big data acquisition methods, crowdsourced data, open access software and data), the emergence of remote sensing applications and products, unmanned aerial vehicles (UAVs) and lightweight sensors, and new transdisciplinary collaborations. Are these changes reflected on the way we map ecosystem services?

During this session, we will focus on how mapping approaches have developed in the way they capture temporal changes in ecosystem services. These mapping approaches can address the supply, demand, values, perceptions, and/or flows aspects of ecosystem services. We specifically invite participants to share their experiences and results of mapping ecosystem services over time. They could include studies on changing values, scenario explorations,



dynamic visualizations, real-time applications, field monitoring, tipping point modelling, or conceptual studies on adequate (multi-)temporal resolutions. We specifically welcome session contributions on innovative applications of earth observation data that go beyond ‘NDVI-for everything’.

This session aims at co-learning in an open and informal atmosphere. The session will not just target the ecosystem service mapping community as audience, but also ecosystem service map-users who would like to get more insight in what it takes to map ecosystem services.

Goals and objectives of the session:

This session aims to take stock of the development of mapping approaches that capture ecosystem service changes over time. For this, we ask all participants to reflect upon:

- How are developments in mapping approaches keeping up with capturing changes in ecosystem services?
- What research directions or elements need special attention in the next 1–2 years to improve the way we capture ecosystem service changes?
- How did/will you improve the temporal relevance of your ecosystem service maps?

Planned output / Deliverables:

Explored option for a joint article, for example in the ESP-related journal OneEcosystem, or Science of the Total Environment.

Related to ESP Working Group/National Network:

[Thematic working group: TWG 4 - Mapping ES](#)



II. SESSION PROGRAM

Date of session: Thursday, 24 October 2019

Time of session: 16:30 – 18:00

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
16:30–16:35	Louise	Willemen	ITC University of Twente	Introduction to the session
	Miguel	Villoslada	Estonian University of Life Sciences	
16:35–16:45	Rémi	Jaligot	Ecole Polytechnique Fédérale de Lausanne	On the use of historical patterns of ecosystem services in Switzerland to inform spatial planning
16:45–16:55	Alberto	González-García	Autonomous University of Madrid	Ecosystem services supply–demand mismatches: applications for landscape planning in the urban–rural gradient of Madrid metropolitan area and surrounding landscapes
16:55–17:05	Sara O. I.	Ramirez Gomez	Copernicus Institute for Sustainable Development	Assessing spatial and temporal equity in access to service provisioning hotspots in tropical forests regions under external pressure
17:05–17:15	Aveliina	Helm	University of Tartu	Importance of historical land–use and habitat continuity in assessing ecosystems and their services
17:15–17:25	Miguel	Villoslada	Estonian University of Life Sciences	The path towards MAES Estonia: Remote sensing as a tool to assess spatio–temporal dynamics of ecosystem services
17:25–18:00				Recap and conclusions



III. ABSTRACTS

The abstracts appear in alphabetic order based on the last name of the first author. The first author is the presenting author unless indicated otherwise.

1. Type of submission: **Abstract**

T. Thematic Working Group sessions: T4a Times are changing: temporal mapping of dynamic ecosystem services

Ecosystem services supply–demand mismatches: applications for landscape planning in the urban–rural gradient of Madrid metropolitan area and surrounding landscapes

First author: Alberto González–García

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Global trends in land–use changes, including urbanization and abandonment of rural areas, have important repercussions for the supply and demand of ecosystem services (ES). In this study, we assessed and mapped the supply and demand of three ES (water provision, climate regulation, and outdoor recreation) along an urban–rural gradient in the Madrid region (Spain) from 1990 to 2012. We mapped ES supply based on land use/land cover (LULC) data, using InVEST models and complementary methods, obtaining fine–scale quantitative maps. We mapped ES demand at fine scale using population density and demand indicators such as water consumption, carbon emissions and estimated population´s needs of green space for recreation. Then, we explored spatial supply–demand mismatches at a municipality spatial scale since municipalities are the local land–use planning unit in Spain. Despite an increase in ES supply in some areas, a general increase in ES demand led to increasing dependence by the Madrid metropolitan area on outlying areas. We found that the number of municipalities that exhibited mismatches between the supply and demand of ES increased throughout the study period, due mainly to urban sprawl and population growth. Our results suggest the need for comprehensive land–use planning at the regional scale, taking into account that many ES flows go beyond municipality boundaries. Finally, we discuss the utility of analysing spatial mismatches in the supply and demand of ES for land–use planning and decision–making at fine scale.



Keywords: land use and land cover; territorial planning; urban–rural gradient; urban sprawl

2. *Type of submission:* **Abstract**

T. Thematic Working Group sessions: T4a Times are changing: temporal mapping of dynamic ecosystem services

Importance of historical land–use and habitat continuity in assessing ecosystems and their services

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Despite the large changes in landscape structure over past century, historical land–use is often still very important determinant of current biodiversity. As multiple ecosystem services depend on biodiversity and functioning of ecosystems, we argue that the strong legacy effects of historical land–use are highly relevant to consider when assessing ecosystem condition and their services. By using data from various habitats in Estonia, we show how historical land–use patterns and temporal continuity of habitats significantly influence current functioning of ecosystems. Our results indicate that ignoring impacts of past land–use can hinder our ability to provide ecologically relevant assessments of ecosystem condition and reliably map the provision of ecosystem services. We introduce some potential tools and methods for quantifying past landscape structure, ranging from the direct use of historical maps to remote sensing and machine learning, and discuss the potential of considering past land–use in assessment of ecosystem condition and services.

Keywords: past land–use, ecosystem condition, biodiversity, habitat continuity, legacy effects



3. *Type of submission: Abstract*

T. Thematic Working Group sessions: T4a Times are changing: temporal mapping of dynamic ecosystem services

On the use of historical patterns of ecosystem services in Switzerland to inform spatial planning

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The concept of ecosystem services (ES) could be a valuable alternative for spatial planning. Despite the importance of understanding historical dynamics of ES, little research has focused on a historical, spatially explicit, assessment of ES supply. ES do not only change over space but also over time, and history is critical in their current provision. Despite the importance of understanding spatio-temporal dynamics of ES for planning, most ES research has focused on assessing several ES at a single point in time.

In Switzerland, most ES research focused on assessing the current and future state of ES at the field scale, with little work on the historical dynamics of ES and drivers of change. This research aims to understand the spatial patterns and drivers of temporal variations of ES supply to inform spatial planning in the canton of Vaud in Western Switzerland. We do so by assessing changes in associations of eleven ES temporal variations, delineating ES bundles from the spatial pattern of changes in ES supply over time, and identifying potential drivers of ES bundles.

Our findings show that over four decades (1979–2015), municipalities in the canton were grouped in four clusters. Food production showed the most negative associations with other ES. Regulating ES were not always synergetic and were less impacted by an increase in population density than cultural ES, which were found in low population density municipalities. In general, the same ES will not respond to the same driver in different bundles. Municipalities were able to supply ES at different levels but none showed an increase in all ES. In conclusion, ES can be synergetic in one bundle, but antagonistic in another. Different processes can cause a change in the same ES depending on their supply location. It seems unrealistic to require each municipality to have a multifunctional territory in the current context.



Keywords: Ecosystem services, Spatial planning, Bundles, Historical dynamics, Switzerland

4. *Type of submission:* **Abstract**

T. Thematic Working Group sessions: T4a Times are changing: temporal mapping of dynamic ecosystem services

Assessing spatial and temporal equity in access to service provisioning hotspots in tropical forests regions under external pressure

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Equity is an essential element in the implementation of policies related to ecosystem services. With the rapid expansion of commercial land use into tropical forest regions, the urgency and importance to integrate equity issues in space and time in decisions and actions stand without doubt. However, the scarcity of data in these regions limits the understanding of how land use affect spatial and temporal aspects of equity. This again emphasizes the need of rapid and robust ways to address spatio-temporal patterns of equity that are especially suited for data-poor environments. This study addresses this gap. We assess the impact of land use interventions on spatial equity through an empirical study that compares two regions in the Upper Suriname River Basin. One region has logging and road building; the other, however, is remote and such interventions are not yet developed but are merely planned. We collected spatial data for 1995 and 2015 using a participatory GIS survey (n= 493), registering provisioning service hotspots. We then explored different dimensions of spatial equity, according to clan and authority position, by analyzing variation over time and across regions. In the region with roads and logging, spatial equity concerns emerged over time regarding the provision of timber and fish. In the remote region, spatial inequity in access to hotspots of ecosystem services appeared early, ahead of the economic opportunities posed by new roads in nearby forests areas. Our analysis made spatially explicit the places where conflict between users of ecosystem services, associated to asymmetries in access to hotspots of ecosystem services, is most likely. In outlining these concerns, we argue that spatial equity analysis unveils an essential social dimension in the use of the space that is integral in spatial planning processes.



Keywords: Spatial equity, provisioning ecosystem services, external pressures, participatory mapping, data scarce regions

5. *Type of submission:* **Abstract**

T. Thematic Working Group sessions: T4a Times are changing: temporal mapping of dynamic ecosystem services

The path towards MAES Estonia: Remote sensing as a tool to assess spatio-temporal dynamics of ecosystem services.

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Estonia has recently started the process towards achieving the targets set by the Action 5 of the EU Biodiversity Strategy to 2020. In spite of the late incorporation into the MAES process, Estonia has the unique chance to implement the lessons learned in the ESMERALDA H2020 project and take advantage of the unprecedented amount of remotely sensed data available.

In this presentation, we outline the steps, remote sensing datasets and methodologies that are currently being used in the implementation of MAES in Estonia.

The conceptual framework used in this project is the “Integrated Ecosystem Service Assessment Framework (IESA)” built and tested within the H2020 ESMERALDA project. IESA drives the workflow of MAES Estonia and is closely aligned with the Common Assessment framework from MAES EU level.

Four priority ecosystems have been selected for assessment: Forests, grasslands, wetlands and agricultural land. The first step of the process is the creation of a consolidated basemap. A wide array of data sources will be overlaid on top of the Estonian Base Map, allowing for a complete and accurate representation of the ecosystems under study. The National LiDAR survey together with Sentinel and Landsat imagery, play a critical role in the creation of the consolidated basemap as they reshape outdated spatial datasets. Simultaneously, LiDAR



constitutes an excellent source of data for temporally dynamic ecosystem condition assessments.

Remotely sensed data also plays a crucial role in the assessment of ecosystem services supply throughout the multiple spatial scales envisioned in the project: Base levels of ecosystem services supply at the national scale and ecosystem services supply and supply change at pilot areas. A combination of satellite, LiDAR and UAV multispectral data will allow for a flexible mapping of ecosystem services supply.

Keywords: MAES Estonia, remote sensing, LiDAR, Sentinel, UAV