

# BOOK OF ABSTRACTS

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## I. SESSION DESCRIPTION

**ID: S8b**

Soil ecosystem services (SES): bringing out of invisibility and supporting decision-making

**Language:** English

**Format:** Online

**Hosts**

	Name	Organisation	Email
Hosts	Rachel Prado	Brazilian Agricultural Research Corporation – Embrapa	Rachel.prado@embrapa.br
Co-Hosts	Elaine Fidalgo	Brazilian Agricultural Research Corporation – Embrapa	Elaine.fidalgo@embrapa.br

### Abstract

Soils are capable of offering multiple benefits to humans, through all their ecosystem functions and flows, relating to water, climate, biodiversity, and being an essential element in food production. Soil Ecosystem Services (SES) can be understood as flows of soil natural capital stocks beneficial to humans and can be classified into regulation, provision, and cultural (Dominati et al., 2010). Comprehensive tools on how soil management practices and land use and land cover (LULC) changes affect SES and the consecutive benefits for society are essential to subsidize consistent decision-making (Aitkenhead and Coull, 2019). Despite their importance, SES tend to be invisible in decision-making and economic compensation mechanisms. In this way, it is necessary to develop, promote and disseminate more studies on SES, such as multifunctionality, evaluation and valuation, application in different scales, integrated approaches, and finally their insertion in public policies and decision support, mainly in relation to agricultural practices. We would like to highlight that the host and co-host are researchers involved with a project recently approved in the EJP Soil Call (<https://ejpsoil.eu/>).

### Goals & Objectives

- Contributing to give greater visibility to the theme of the soil ecosystem services.
- Identifying researchers on soil ecosystem services from different parts of the world, with emphasis on Latin America and the Caribbean, and establishing initial contact with them.
- Disseminating research results, tools and experiences on soil ecosystem services and their contribution to human well-being.

## Planned Output

- A list of researchers/participants related to the SES topic.
- A summary of the presentations and discussions of that session to be made available to participants.

## Session Format

This session will be entirely in online format (hosts and participants). This session will start with an introduction by the host or co-host on the topic to be addressed (5 minutes).

Presentations will be grouped in blocks of 2 to 3 presentations (5 to 10 minutes for each presentation). After each block of presentations, there will be time for asking questions and comments from participants (10 minutes total). At the end of the session, a conclusion will be made by the host or co-host (5 minutes).

## Acceptance of voluntary contributions

Yes, I allow any abstract to be submitted to my session for review.

## Relation to ESP Working Groups or National Networks

Sectoral Working Groups: SWG 8 – ES in Conservation

## II. SESSION PROGRAMME

**Date of session:** Tuesday 7

**Time of session:** 16:00–18:00

## Timetable speakers

Time	First name	Surname	Organization	Country	Title of presentation
16:00	Rachel	Bardy Prado	Embrapa Soil	Brazil	Introduction
16:15	A. Paulina	Guarderas	Universidad Central del Ecuador	Ecuador	Land use change alters soil-associated ecosystem services in a tropical mountain landscape of Northern Ecuador
16:30	Juan-Pablo	Fuentes-Espoz	Universidad de Chile	Chile	Conocimiento local de la calidad del suelo y su asociación con servicios ecosistémicos clave por agricultores de la zona altoandina de la cuenca del Huasco, Chile
16:45	Julian Richard	Massenberg	Helmholtz Centre for	Germany	From Investigation to Exploration: Unraveling Preference and

Time	First name	Surname	Organization	Country	Title of presentation
			Environmental Research		Motivational Heterogeneity for Soil-Based Ecosystem Services
17:00	María Paula	Barral	IPADS EEA INTA Balcarce – CONICET	Argentina	SOILGUARD project: Sustainable soil management to unleash soil biodiversity potential and increase environmental, economic and social well being
17:15	Rosana Maria	de Macedo Borges	SENAC University Center	Brazil	Analysis of soil ecosystem services and their economic valuation: remediation with residual contamination in urban environments
17:30	Fabrizio	Ungaro	Consiglio Nazionale delle Ricerche	Italy	Soil ecosystem services assessment and mapping in Emilia–Romagna (NE Italy): example at different scales, from the field survey to the decision-makers' agenda
17:45	Elaine	Cardoso Fidalgo	Embrapa Soil	Brazil	Conclusions

### III. ABSTRACTS

#### 1. Type of submission: Abstract / Resumen

S. Sectoral Working Group sessions / Sesiones del Grupo de trabajo Sectoriales: S8b – Soil ecosystem services (SES): bringing out of invisibility and supporting decision-making

Soil ecosystem services assessment and mapping in Emilia–Romagna (NE Italy): example at different scales, from the field survey to the decision-makers' agenda

*Presenting author: Fabrizio Ungaro*

*Other author(s): Costanza Calzolari, Alessandra Aprea, Stefano Bazzocchi, Paola Tarocco*

*Affiliation: National Research Council of Italy CNR*

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This contribution presents an indicators-based approach to soil ecosystem services (SES) assessment and mapping at different spatial scales in Emilia-Romagna (NE Italy). At regional scale, the information from the soil database has been used to assess and map indicators of potential soil ecosystem service supply resorting to digital soil mapping (DSM) at a 100m resolution over the entire region (22510 km<sup>2</sup>). In order to tackle the multifunctionality of soil, the following SES have been considered as indicated by local stakeholders: habitat for soil biodiversity, buffering capacity, carbon sequestration, food provision, biomass provision, erosion control, water regulation and water storage. In addition, an overall soil quality index based on a number of selected SES is assessed and mapped. The information about SES provision is made available by the regional soil service to provide the legally binding information that each municipality must take into consideration to produce or update the General Urban Plan (PUG) which is the most important instrument of land and urban planning. Upon request of the Municipality of Forlì, an ad hoc soil survey has been made to assess and map soil ecosystem services at the local scale to deliver information and maps at a finer resolution taking explicitly into account the properties and services of urban and peri-urban soils along with the benefits they deliver to citizens.

*Keywords:* Soil ecosystem services; Soil properties and functions; Land and Urban planning; Indicators; Spatial scales; Multifunctionality

## *2. Type of submission: Abstract / Resumen*

### *S. Sectoral Working Group sessions / Sesiones del Grupo de trabajo Sectoriales: S8b – Soil ecosystem services (SES): bringing out of invisibility and supporting decision-making*

Soil ecosystem services (SES): bringing out of invisibility and supporting decision-making

*Presenting author: Elaine Cristina Cardoso Fidalgo*

*Affiliation: Embrapa Solos*

*Contact: [elaine.fidalgo@embrapa.br](mailto:elaine.fidalgo@embrapa.br)*

Soils are capable of offering multiple benefits to humans, through all their ecosystem functions

and flows, relating to water, climate, biodiversity, and being an essential element in food production. Soil Ecosystem Services (SES) can be understood as flows of soil natural capital stocks beneficial to humans and can be classified into regulation, provision, and cultural. Comprehensive tools on how soil management practices and land use

and land cover (LULC) changes affect SES and the consecutive benefits for society are essential

to subsidize consistent decision-making. Despite their

importance, SES tend to be invisible in decision-making and economic compensation mechanisms. In this way, it is necessary to develop, promote and disseminate more studies on SES, such as multifunctionality, evaluation and valuation, application in different scales, integrated approaches, and finally their insertion in public policies and decision support, mainly in relation to agricultural practices. We would like to highlight that the host and co-hosters are researchers involved with a project recently approved in the EJP Soil Call

*Keywords:* Soil Ecosystem Services; Land Use; Agriculture; Decision Support; Public Policies

### *3. Type of submission: Abstract / Resumen*

S. Sectoral Working Group sessions / Sesiones del Grupo de trabajo Sectoriales: S8b – Soil ecosystem services (SES): bringing out of invisibility and supporting decision-making

#### ANALYSIS OF SOIL ECOSYSTEM SERVICES AND THEIR ECONOMIC VALUATION: REMEDIATION WITH RESIDUAL CONTAMINATION IN URBAN ENVIRONMENTS

*Presenting author: Rosana Maria de Macedo Borges*

*Other author(s): Paulo Antonio de Almeida Sinisgalli*

*Affiliation: SENAC*

*Contact: [rosb@uol.com.br](mailto:rosb@uol.com.br)*

Contamination in soils and groundwater in urban areas has been a matter of concern since the mid-twentieth century. This contamination represents more than a change in the natural quality of these matrices since it can also cause damage to human health and ecological damage. After identifying and quantifying contamination, it is necessary to assess whether there are risk scenarios to provide interventions in the area. In the case of ecological risk assessment, it is crucial to know the existing interactions in the soil, with the definition through biological indicators (ASTM,2003). This assessment makes it possible to analyze the possibility of using soil and groundwater for other activities. In situations where groundwater remains altered, slightly above the concentrations established by the potability ordinance, the decision regarding the need for pumping until the potability standard is reached requires studies to assess the impacts caused by contamination. This work contributes to the debate regarding the management of urban contaminated areas with a focus on assessing ecological risk and valuing the impacts of pumping groundwater up to the potability standards. The methodology used was that of bibliographical research associated with the authors' practical experience, considering the use of that stretch of the aquifer and the valuation of the impacts caused by the continuous pumping of water. This analysis included energy consumption, formation water deprivation, and other aquifer and soil dynamics changes.

*Keywords:* contaminated area, ecosystem services, economic valuation, groundwater, soil

#### *4. Type of submission: Abstract / Resumen*

##### **S. Sectoral Working Group sessions / Sesiones del Grupo de trabajo Sectoriales: S8b – Soil ecosystem services (SES): bringing out of invisibility and supporting decision-making**

Land use change alters soil-associated ecosystem services in a tropical mountain landscape of Northern Ecuador

*Presenting author: Adriana Paulina Guarderas*

*Other author(s): Camilo Rosero, Alisson Pérez, Kerly Trávez, Joseph Ureta, Joseph Ureta, Camila Acosta, Santiago Buítrón, Marc Dufrene*

*Affiliation: Universidad Central del Ecuador*

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Land use changes affect ecological structure and processes of terrestrial ecosystems and therefore their ecosystem services. However, land use change impacts on soil biota and soil-associated ecosystem services have received little attention in the highland landscapes of the tropics. In this research, using observational and metagenomic techniques, we assessed the impact of native forest conversion into anthropic systems (planted forests, pastures, and monocultures) on soil biodiversity, soil structure and function and their associated ecosystem services in the highlands of northern Ecuador. We hypothesized that native forests would present more diverse soil communities, with a robust and more active biomass which support a wider array of function and ecosystem services than anthropic environments. Our results showed that the structure and composition of the edaphic macroinvertebrate communities significantly differed between forested and non-forested sites. However, soil microbiota in pastures and native forests showed similar diversity patterns that significantly differed from planted forests and monocultures. Strong correlations were found between biomass, microbial respiration, enzymatic activity, and physicochemical parameters such as pH, C.O., M.O., N, bulk density, and soil moisture. Native forests demonstrated the highest averages followed by Pastures and Monocultures leaving Planted forests with the lowest values in terms of soil quality and microbial activity. Our findings demonstrated a significant loss of taxonomic biodiversity and degradation of soil quality anthropic environments especially monocultures and planted forests. Our results highlight the risk associated with current trends of native forest loss and conversion to managed systems in high mountain ecosystems in the tropics, illustrating how these alterations could cause biodiversity loss and degradation of the physicochemical attributes of soil health. Additionally, this research contributes to understanding of the ecological value

of native forests as biodiversity, one of the least studied and most threatened systems of the Andes, as a biodiversity reservoir to sustain ecosystem services.

*Keywords:* ecosystem services, soil health, mountain tropical systems, Ecuador, soil biota



5. *Type of submission: Abstract / Resumen*

S. Sectoral Working Group sessions / Sesiones del Grupo de trabajo Sectoriales: S8b – Soil ecosystem services (SES): bringing out of invisibility and supporting decision-making

Conocimiento local de la calidad del suelo y su asociación con servicios ecosistémicos clave por agricultores de la zona altoandina de la cuenca del Huasco, Chile

*Presenting author: Juan Pablo Fuentes-Espoz*

*Other author(s): Claudia-Loreto Cerda-Jiménez, Matías Guerrero Gatica, Javiera Sepúlveda Garay, Carolina Pérez*

*Affiliation: Departamento de Gestión Forestal y su Medioambiente, Facultad de Ciencias Forestales & Cons. de la Naturaleza, Universidad de Chile*

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Los conocimientos locales son dependientes de aspectos histórico-culturales que se asocian a condiciones ambientales tales como el clima, la geomorfología y consecuentemente el suelo. En este contexto, el desarrollo agrícola se ve asociado al tipo de suelo, su manejo y finalmente su capacidad para funcionar y entregar los servicios ecosistémicos necesarios para el bienestar humano. En un marco de globalización, el flujo de información ha hecho que los saberes y conocimientos locales se vean invisibilizados e incluso perdidos de forma permanente. Por ende, el rescate del conocimiento local cobra gran importancia para la sustentabilidad de los sistemas socioecológicos. En la sección altoandina de la cuenca del Huasco, en la región de Atacama de Chile, se indaga sobre la percepción de la calidad del suelo por personas que desarrollan diferentes tipos de agricultura (e.g. a. de subsistencia, a. intensiva). Estas percepciones locales se contrastan con propiedades del suelo usualmente utilizadas en el ámbito científico como indicadoras de calidad de suelo. Los resultados preliminares muestran que la pedregosidad, el color, el contenido de materia orgánica y la profundidad efectiva del suelo son propiedades clave para los agricultores. A nivel de agricultura orgánica, resaltan propiedades biológicas tales como el olor del suelo y la presencia de anélidos. Dichos conocimientos se encontrarían asociados positivamente con servicios ecosistémicos de provisión de alimentos y servicios ecosistémicos culturales relacionados con la variedad local de especies cultivadas.

*Keywords:* Calidad del suelo, servicios ecosistémicos del suelo, conocimiento local del suelo

6. *Type of submission: Abstract / Resumen*

S. Sectoral Working Group sessions / Sesiones del Grupo de trabajo Sectoriales: S8b – Soil ecosystem services (SES): bringing out of invisibility and supporting decision-making

From Investigation to Exploration: Unraveling Preference and Motivational Heterogeneity for Soil-Based Ecosystem Services

*Presenting author: Dr. Julian Richard Massenberg*

*Other author(s): Bartosz Bartkowski, Charlotte Schüßler, Nele Lienhoop*

*Affiliation: Helmholtz Centre for Environmental Research – UFZ*

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Soil provides multiple benefits for human well-being that are largely invisible to most beneficiaries. Against this background, economic valuation provides useful tools to elicit and understand public preferences for soil-based ecosystem services. However, the valuation of complex, spatially heterogeneous, unfamiliar, and multifunctional natural resources poses several methodological and practical challenges.

Here, we present the results of a discrete choice experiment on the preferences of Germans for soil-based ecosystem services. In an attempt to reduce complexity for respondents, we use index-based attributes to express ecosystem service provision relative to the site-specific maximum potential. The results show that a majority of respondents considered the provision of soil-based ecosystem services as important for society and themselves, and that most were willing to pay for an increase in the provision of soil-based ecosystem services, especially with regard to water quality. Additionally, we investigate how knowledge about soils, awareness of their contributions to human well-being, and experience with droughts and floods affect preferences. We find substantial yet heterogeneous preferences for soil-based ecosystem services. Yet, only some measures of familiarity exhibit significant effects on preferences.

To better understand the complexity of motivations underlying preferences for soil-based ecosystem services in light of the criticism against conventional economic valuation (methods) associated with value pluralism, we expand the analysis of preference heterogeneity by using a latent class model. We identify six latent classes, for which we explore the motivations underlying the heterogeneous preferences. Notably, we find differences in the motivations among the classes, e.g. with respect to individual utility versus societal fairness, but we also find a high relevance of non-individualistic, non-instrumental

and/or weakly anthropocentric intrinsic considerations for the stated preferences across all six classes.

*Keywords:* Discrete choice experiment, Economic valuation, Ecosystem services, Soil functions, Stated preferences, Willingness to pay, Environmental values

## *7. Type of submission: Abstract / Resumen*

### **S. Sectoral Working Group sessions / Sesiones del Grupo de trabajo Sectoriales: S8b – Soil ecosystem services (SES): bringing out of invisibility and supporting decision-making**

Soilguard project: Sustainable soil management to unleash soil biodiversity potential and increase environmental, economic and social well being

*Presenting author: María Paula Barral*

*Other author(s): Ximena Sirimarco, Alejandra Auer, Sebastian Muñoz, Juan Gaitan*

*Affiliation: National Institute of Agricultural Technology (INTA)*

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SoilGuard is a project funded by the European Union under the Horizon 2020 initiative. The project started in mid-2021 and will conclude in 2025, it is organized by a consortium of 25 institutions from Europe, Africa, Asia, and Latin America. The overall objective is to create robust evidence, through transdisciplinary research, on the links between soil biodiversity and its multifunctionality, and how these prevent land degradation and climate change. Based on this evidence, the project aims to promote sustainable soil management, increasing the societal perception of soil biodiversity as a nature-based key solution for protecting natural capital while enhancing social and economic well-being. Argentina's participation in this project aims to evaluate the impact of land degradation and soil management on soil biodiversity and ecosystem services in agricultural systems in the southeast of the Buenos Aires province. A land degradation gradient was generated, with two categories based on the combination of previous information on soil organic carbon content and potential water erosion. Soil and vegetation samples were collected during October and November 2022 from a total of 20 wheat or barley farms, 10 falling under the "low degradation" category and 10 under "medium-high degradation". Additionally, half of the sampled plots in each category carried out organic agriculture and the other half traditional agriculture. Various determinations were conducted, including bulk density, infiltration, decomposition rate and litter stabilization, and foliar damage. Furthermore, the landowners or decision-makers of the farms were interviewed to understand their management practices and their perception of the importance of soil biodiversity and ecosystem services. In addition, other important physico-chemical soil properties and soil enzymatic activities are also being analyzed. Preliminary results in Argentina indicate that organic agriculture shows better performance in the analyzed indicators. The primary information collected in this project will allow knowing how soil biodiversity affects soil multifunctionality and ecosystem

services in different regions of the planet, along with the impact of land degradation, soil management, and climate change.

*Keywords:* soil ecosystem services, land degradation, organic farming