BOOK OF ABSTRACTS

This Book of Abstracts provides a comprehensive overview of the session content and is structured into three main sections:

I. Session Description – an introduction to each session, including its objectives and expected outputs
II. Session Program – a detailed schedule for each session, including speakers and timing
III. List of Abstracts – a complete compilation of all accepted abstracts

I. SESSION DESCRIPTION

ID: T4b

Bridging the gap with hybrid approaches: Understanding amalgamation of recent digital advancements with conventional assessment methods of Ecosystem Services

Hosts:

	Name	Organisation	E-mail
Host (s):	L.R. Lakshmikanta Panda	Forest Research Institute, Dehradun, India	lrlakhmi@icfre.org
Co-host(s):	Dr. Shachi Pandey	Climate Change Advisor, Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH India	shachi.pandey@giz.de
	Rahul Yadav	Researcher, Forest Research Institute, Dehradun, India	yadav.9394rahul@gmail.com
	Aditi Mishra	Regional engagement lead, Restor foundation and PhD Scholar, GB Pant National Institute of Himalayan environment, Almora	aditi@restor.eco
	Dr. Keshav/ Tyagi	Environment Consultant, AECOM	keshav.tyagi@aecom.com

Abstract:

The accurate assessment of Ecosystem Services (ES) is fundamental for sustainable environmental management and policy-making. Conventional assessment methods, such as field surveys and stakeholder workshops, provide essential local context and social values but are often resource-intensive and limited in scale. The effective valuation and management of Ecosystem Services (ES) are frequently hindered by a critical disconnect between conventional, site-specific assessment methods and the capabilities of recent digital advancements. Conversely, recent digital advancements, including remote sensing, artificial intelligence (AI), and big data analytics, offer unprecedented capabilities for large-scale, dynamic monitoring of ES. However, these technologies can overlook the nuanced, socio-cultural dimensions of human-nature interactions that are critical for equitable outcomes. The necessity and efficacy of hybrid approaches is that, it strategically combines established ecological and socio-economic methodologies with cutting-edge digital tools. This session aims to bridge this gap by exploring innovative hybrid approaches that amalgamate the strengths of both worlds. The session will delve into methodologies that synergise participatory mapping with GIS, integrate local ecological knowledge with machine learning models, and use mobile applications for citizen science-based data collection. Discussing best practices of hybrid methodology will equip researchers, resource managers and policymakers with a comprehensive, and widely applicable toolset for sustainable natural resource governance and evidence-based decision-

making. Such integrated frameworks can produce more robust, holistic, and policy-relevant ES assessments.

This session invites researchers, practitioners, and policymakers to discuss the challenges and opportunities in developing and implementing the hybrid methods. The session will enrich the perspective towards technological developments in the field of ES assessment.

Goals and objectives of the session:

1. To showcase innovative hybrid methodologies that successfully integrate digital technologies with conventional ES assessment techniques across various ecological and social contexts.
2. To foster a collaborative network of researchers and practitioners to co-create best practices and the advancement of integrated ES assessment approaches.

Planned output / Deliverables:

1. A synthesis paper for a special journal issue summarising the key challenges, opportunities, and promising case studies on hybrid assessment approaches of ES discussed during the session.
2. The establishment of an online working group targeting ECRs to facilitate continued dialogue, knowledge sharing, and collaboration on developing and applying hybrid assessment approaches.

Session format:

The session will be conducted in the format of an Impulse presentation followed by a discussion and potential collaborations.

Related to ESP Working Group:

TWG 4 – Mapping ES

II. SESSION PROGRAM

Room: Lounge
Date of session: Tuesday, 19 May 2026
Time of session: 17:45 – 19:15

Timetable speakers:

Time	First name	Surname	Organization	Title of presentation
17:45 – 18:00	L.R. Lakshmikanta & Shachi	Panda & Pandey	Forest Research Institute, Dehradun, India & Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, India (RECAP4NDC project)	Welcome and introduction, context setting in view of assessment of Ecosystem Services
18:00-18:13	Elvi	Liiv	University of Tartu	Relationship between soil carbon stock and biodiversity ecosystem services and their connection to environmental factors
18:13-18:26	Loes	Verkuil	Institute for Environmental Studies,	Contrasting interpretations of sustainable agriculture

			Vrije Universiteit Amsterdam	concepts between farmers and science using web-scraped text data
18:26-18:39	Hao	Chén	Xinjiang Agricultural University	The Impact of the Digital Economy on Carbon Emissions and Its Spatial Effects
18:39-18:52	Rahul	Yadav	Forest Research Institute, Dehradun, Uttarakhand, India	Exploring spatial heterogeneity of Environmental drivers affecting water yield in the Himalayan watershed
18:52-19:05	Zhuàng zhuàng	Yīn	Xinjiang Agricultural University	The impact of digital literacy on entrepreneurial decision-making among young farmers
19:05-19:18	Neha	Tamhankar	Forest Research Institute, Dehradun, Uttarakhand, India	Impact assessment of Land Use/Land Cover change on Mangrove Ecosystem Service Values along the Western Coast of India: A Hybrid Valuation Approach

Note: 8 minutes for presentation and 5 minutes for discussion.

III. ABSTRACTS

The first author is the presenting author unless indicated otherwise

1. Relationship between soil carbon stock and biodiversity ecosystem services and their connection to environmental factors

First author: Elvi Liiv
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Both biodiversity (plant richness) and soil organic carbon (SOC) stock are important ecosystem services and key indicators of ecosystem health and their capacity to support human well-being. However, anthropogenic pressures are driving biodiversity loss at an unprecedented rate and reducing soil carbon storage.
To address these interconnected crises, we analysed if there is trade-off between SOC stock and plant diversity ecosystem services and are they influenced by climate, legacy effects, land-use type, and landscape characteristics same way using observational, analytical, and remote sensing approaches. Research was conducted across 301 grassland and forest sites in Estonia, encompassing all major habitat types in both degraded and well-preserved conditions. Plant diversity was assessed using an eDNA from soil samples, and SOC stock was calculated for the upper 10 cm of soil.
Our results reveal a significant, though relatively weak, positive association between vascular plant richness and SOC stock. These variables were primarily shaped by different environmental drivers. Notably, the Topographic Wetness Index (TWI) was the only factor significantly associated with both: negatively with plant richness and positively with SOC stock. Furthermore, cross-habitat analysis did not indicate strong legacy effects from historical land use. Habitat type had some significant interactions with SOC stock, but plant richness did not have any interactions. No single set of variables emerged that reliably predicts a habitat's capacity to simultaneously support high plant richness and SOC stock.
These findings underscore the complexity of ecosystem interactions and highlight the need to conserve diverse habitat types to maintain adequate levels of both biodiversity and soil carbon storage ecosystem services.

Keywords: eDNA, vascular plant richness, SOC stock, remote sensing, carbon stock, temperate grassland, temperate forest

2. Contrasting interpretations of sustainable agriculture concepts between farmers and science using web-scraped text data

First author: Loes Verkuil
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A wide range of approaches of sustainable agriculture exist today in response to challenges in food production for sustaining ecosystem services. Although extensive conceptual paradigms exist that establish how farming can be developed in a more sustainable direction, it is unclear how farmers understand and translate these concepts in their farm management. Official datasets on farming practices are not suited for non-conventional production models, rarely including alternative practices or qualitative information on values. To address this knowledge gap, we analyzed text data from 770 websites of Dutch farmers who identify with six major agricultural concepts aiming for sustainability: agroecology, biodynamic, organic, regenerative, circular, and nature-inclusive agriculture. We examined which concepts these non-conventional farmers relate to, and how they interpret these concepts in farming practices, using logistic regression models. We grouped the practices into four levels of socio-ecologically sustainable food systems, ranging from reducing inputs use, redesigning agro-ecosystems, to re-establishing connections between producers and consumers. Finally, we compared farmers' practical interpretation of the concepts to scientific ideas of implementation. The results indicated that 45.3% of farmers identify with multiple concepts, which indicates a pragmatic attitude towards the implementation of sustainable agriculture. All concepts except for biodynamic farming relate to practices across the four levels of socio-ecologically sustainable food systems, albeit in distinct practice patterns. Further, the results show that scientific and farmers' interpretation of practice uptake is highly divergent: the highest level of convergence was found for agroecology (30.6%) and the lowest for biodynamic farming (2.79%). For most concepts, farmers implement practices across four levels of socio-ecologically sustainable food systems, making the organization of farm management well-rounded to fit objectives of sustainability. We advise focusing policies on stimulation of practice uptake based on promoting principles of sustainable agriculture rather than endorsing categorical approaches to sustainable agriculture, closing the science-practice gap through participatory research methods, and creating favourable conditions for uptake.

Keywords: non-conventional farming, science-practice gap, web scraping, ecosystem services, socio-ecologically sustainable food systems

3. The Impact of the Digital Economy on Carbon Emissions and Its Spatial Effects

First author: Hao Chén
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Promoting the deep integration of digital economy and green low-carbon is of great strategic significance for realizing China 's " dual-carbon " goal and high-quality economic development. Based on the panel data of 30 provinces (autonomous regions and municipalities directly under the central government) in China from 2000 to 2023, this paper empirically tests the impact and spatial effect of digital economy on carbon emissions by using fixed effect model and Durbin model. The research shows that : (1) The digital economy can significantly curb carbon emissions. (2) The digital economy mainly reduces carbon emissions through green technology innovation and driving the upgrading of industrial structure. (3) There are significant regional differences in the impact of digital economy on carbon emissions, which is most significant in the eastern region, but not significant in the central and northeastern regions. （4）The digital economy can not only reduce carbon emissions in the region, but also have a negative spatial

effect on the surrounding areas. Accordingly, it is suggested that the coordinated development of digital economy should be promoted to strengthen the basis of emission reduction, the upgrading of industrial structure should be accelerated to build a green industrial system, and green technology innovation and digital integration should be promoted to improve the efficiency of emission reduction.

Keywords: digital economy ; carbon emission ; industrial structure upgrading ; green technology innovation ; spatial effect

4. Exploring spatial heterogeneity of Environmental drivers affecting water yield in the Himalayan watershed

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Ecosystems in the Himalayan region have been transforming and deteriorating at alarming rates over the last three decades due to the substantial dependence of human societies on natural resources. Understanding people-nature interactions in the Himalayan ecosystem is a primary need for long-term planning and achieving sustainable development goals. Therefore, it is essential to use integrated approaches to assess existing Ecosystem Services (ES) and recognise the underestimated economic contributions of watersheds to human well-being. Hence, this study aims to quantify the spatial impact of environmental variables on the water supply ES and to evaluate ES in the Giri watershed of the north-western Himalayan region, located in Himachal Pradesh, India. The InVEST Annual Water Yield (AWY) model estimates annual water runoff, representing an ecosystem's water supply, aiding informed water resource management. The AWY model was used to quantify the water supply service. Economic valuation of the water supply service is conducted using the market price method. Various environmental variables strongly influence water supply in fragile mountain watersheds, yet the effects are spatially heterogeneous and not captured in empirical models. Therefore, this study also investigates the role of various environmental variables, i.e., land use and land cover, slope gradient, slope direction, elevation, and others, in regulating water supply using Geographically Weighted Regression (GWR). The total water yield of the watershed was calculated to be 2.8 billion cubic meters, and the value was calculated at 657.19 million US$. The study also provided spatial information on the protective role of each environmental variable on the estimated water yield. The findings provided context-dependent roles of environmental variables on the water supply ES and demonstrated the value of spatially explicit modelling for targeted watershed management. The critical insights into quantified and valued ES will support the formulation of more effective and sustainable conservation and management strategies.

Keywords: Geographically Weighted Regression, InVEST, Annual Water Yield, Provisioning Services

5. The impact of digital literacy on entrepreneurial decision-making among young farmers

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Under the background of deep integration of digital economy and rural revitalization strategy, young farmers ' entrepreneurship has become a new driving force for county economic development, and digital literacy is a key enabling factor. Based on the data of China Family Panel Survey (CFPS) in 2020-2022, this paper takes young rural households aged 18-45 as the research object, constructs a digital literacy index system covering six dimensions such as digital foundation, entertainment and shopping, and uses Probit model and instrumental variable method to empirically test the impact, mechanism and

heterogeneity of digital literacy on young farmers ' entrepreneurial decision-making. The purpose of this study is to reveal the internal logic of digital literacy affecting young farmers ' entrepreneurial decision-making, and to provide empirical basis and policy reference for building a support system for young farmers ' digital entrepreneurship and promoting rural revitalization.

Keywords: Digital Literacy; Young Farmers; Entrepreneurial Decision; Mechanism Analysis; Heterogeneity

6. Impact assessment of Land Use/Land Cover change on Mangrove Ecosystem Service Values along the Western Coast of India: A Hybrid Valuation Approach

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Mangrove ecosystems along the western coast of India provide high-value ecosystem services such as coastal protection, carbon regulation, habitat support, and livelihood security. However, studies from Indian region specifically from a western coast, remain limited. LULC changes strongly influence mangrove ecosystem structure and functioning and the associated ESVs. Conversion, degradation and regeneration of mangroves can therefore substantially alter ESVs. In such data-limited contexts, hybrid approaches are useful for capturing these associations and addressing information gaps. Accordingly, present study adopts a hybrid approach to assess how LULC dynamics in the Ratnagiri mangrove forests have influenced ESVs between 2013 and 2023.
LULC maps for 2013 and 2023 were prepared using Landsat imagery with spatial resolution 30 m using ArcGIS software to delineate mangrove cover and other land-use classes (Agriculture, Vegetation, Barren-land, Built-up and Waterbodies). Estimation and change analyses of ESVs were conducted for datasets 2013 and 2023 by using benefit transfer method. The economic valuation coefficients for mangrove derived from published literature, following established ecosystem service valuation frameworks. Among the wide range of valuation estimates for ESs, the values applied were selected based on methodological robustness and geographical relevance.
The results suggest that mangrove extent increased by 21.9% between 2013 and 2023, indicating localized expansion or recovery over the ten-year period. The reported average total economic benefits of goods and services provided by India’s mangroves exhibit substantial variability, with maximum estimates approximately 35 times higher than minimum estimates and an average total economic benefit of Rs. 9,58,766/ha-/yr = US$ 20540.41/ha-/yr. The hybrid approach effectively integrates land-use dynamics and ecosystem service valuation to guide targeted mangrove management interventions.

Keywords: Coastal wetland, Spatial analysis, Benefit transfer, GIS, Natural Capital