

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: T17a

Gross Ecosystem Product: towards policy applications and inclusive measures

Hosts:

	Name	Organisation	E-mail
Host (s):	Marta Sylla Shang Chen	Stockholm Resilience Center; Wrocław University of Environmental and Life Sciences First Institute of Oceanography, Ministry of Natural Resources of China	marta.sylla@upwr.edu.pl schen@fio.org.cn
Co-host(s):	Ioanna Grammatikopoulou Alessandra La Notte	European Commission - Joint Research Centre European Dynamics SA	ioanna.GRAMMATIKOPOULOU@ec.europa.eu alelanotte@gmail.com

Abstract:

Natural Capital Accounting (NCA) provides a systematic framework to measure changes in the stock and condition of ecosystems while integrating the flow and value of ecosystem services into standardized accounting and reporting systems. Within this framework, Gross Ecosystem Product (GEP) has emerged as a key aggregate monetary measure that captures the total value of final ecosystem goods and services generated within a defined area over a specific period—functioning as an ecological counterpart to Gross Domestic Product (GDP).

Since its introduction by Zhiyun Ouyang in 2013, GEP accounting has gained significant traction in both research and policy contexts. It is increasingly used to assess ecosystem sustainability, evaluate the capacity of ecosystems to support socio-economic systems, and gauge the ecological performance of conservation and restoration initiatives. Applications in ecosystem management—such as protected area planning, ecological conservation redlining, and restoration projects—illustrate its growing policy relevance. This session aims to take stock of the current state of the art in GEP and NCA applications and explore pathways for their integration into inclusive and macroeconomic modeling frameworks. By examining the dynamics of GEP and its role in reflecting nature's contribution to economies, we seek to advance aggregate accounting measures that ensure nature is adequately represented in decision-making.

We invite contributions that address the following questions:

- What are the latest scientific advancements in GEP based on Natural Capital Accounting?
- How do GEP and other inclusive measures inform policies for sustainable futures within planetary boundaries?
- How can net GEP account for natural capital depletion and degradation?
- What are the methodological frontiers in embedding natural capital and GEP into macroeconomic models?

This session provides a platform for exchange among scholars and practitioners working on GEP, ecosystem services, ecosystem-based management, and ecosystem sustainability, fostering dialogue on how to advance aggregate accounting measures for nature within economic systems.

Goals and objectives of the session:

- To enhance the methodology of GEP accounting and to promote its application in ecosystem management in more countries
- To outline the state of play of NCA at global level and in relation to macroeconomic indicators such as GEP
- To set agenda for going beyond the current scientific frontier in natural capital related to inclusive income and modelling.

Planned output / Deliverables:

- Position/ opinion paper discussing the goals and objectives of the session, based on knowledge shared among presenters and participants.
- A task force will be established to advance the science and policy application of Gross Ecosystem Product (GEP)

Voluntary contributions accepted:

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

Related to ESP Working Group:

[TWG 17 – ES Accounting & Greening the economy](#)

II. SESSION PROGRAM

Room: B1

Date of session: Thursday, 21 May 2026

Time of session: 09:00 – 12:30

Timetable speakers:

Time	First name	Surname	Organization	Title of presentation
09:10-09:25	Marta	Sylla	Stockholm Resilience Centre	A global state of play for country-level monetary ecosystem accounting
09:30-09:45	Alessandro	Bosso	ART-ER, Italy	Gross Ecosystem Product as a Measure of Natural Capital Value: the case of Emilia-Romagna region (Italy)
09:50-10:05	Marta	Sylla	Stockholm Resilience Centre	Gross Ecosystem Product in Sweden: Advancing Natural Capital Accounting for Sustainability Transitions
10:05-10:20	Monica	van Alphen	Wageningen Research	Gross Ecosystem Product in the Netherlands: An Application of GEP in Policy Decision-Making
10:20-10:30	Discussion			
10:30-11:00	Coffee break			
11:00 - 11:20	Shang	Chen	First Institute of Oceanography, Ministry of Natural	Gross Ecosystem Product Accounting: Frameworks and Application Scenarios

			Resources of China	
11:20-11:35	Yuanmei	JIAO	Yunnan Normal University	Impact of Tourism Development on Ecological Product Value in Hani Rice Terrace Villages
11:35-11:50	Song	Ge	Zhejiang university	Sustainability pathways enable China's marine economic sectors to reach a 2030 emissions peak
11:50-12:05	Xiaolong	Gao	Beijing Water Planning Institute	From Paradigm to Implementation: Achieving Inclusive Accessibility in Beijing's Waterfront Spaces
12:05 - 12:20	Zheneng	Hu	Tsinghua University	Turn green into gold: National key ecological functional zones policy and supply efficiency of ecological product

III. ABSTRACTS:

The first author is the presenting author unless indicated otherwise

1. Gross Ecosystem Product as a Measure of Natural Capital Value: the case of Emilia-Romagna region (Italy)

First author: Alessandro Bosso

Other author(s): Irene Diti , Arianna Cecchi

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In recent years, in Emilia-Romagna have been developed several projects of assessment and mapping of ecosystem services (ESs) in biophysical and monetary terms.

In 2023 ART-ER, the joint stock consortium that acts as regional development agency, carried out a study on Gross Ecosystem Product (GEP) in the territory of the Union of Municipalities Appennino Parma Est, located in the Province of Parma. The study has been carried out involving representatives of Provincial Authority and Municipalities.

Analyzed area covers a surface of 607 Km² (62% mountain area), with 7 municipalities and 25000 inhabitants.

The methodological approach is developed in three steps:

- Identification of the area of interest and priority definition of ESs
- Mapping and biophysical quantification of selected ESs
- Economic evaluation of selected ESs.


GEP is defined as the sum of the economic value of all ESs produced in a territory (Ouyang et al., 2020) and in the analyzed area has been estimated in 83,5 millions of euros.

Methodology and results have been presented and discussed with Prof. Zhiyun Ouyang of Chinese Academy of Sciences and Prof. Gretchen Daily of Stanford University.

The study has been presented at the International Conference on Realizing the Value of Ecosystem Goods and Services, held in Beijing at 24th October 2023. An article has been published on magazine Earth Systems and Environment (<https://doi.org/10.1007/s41748-024-00492-z>) at October 2024.

A decision process by the Public Administration is in progress about "What to do with GEP". Some options are considered:

- support to urban planning
- offsetting policies
- conservation policies
- conflict management (e.g. soil consumption, nature restoration)
- stakeholders involvement
- PES development (to support rural areas)
- rethink relationship between mountain area and the city



Experience taught us that GEP can be a powerful tool to improve the governance of land management process.

Keywords: gross ecosystem product, payments for ecosystem services, natural capital value, decision making, land management

2. Driving mechanism of new-quality productivity for the value realization of marine ecological products

First author: Keliang Chen

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Realizing the value of marine ecological products holds significant strategic importance for national economic development and public welfare. The proposal and implementation of new-quality productive forces provide crucial impetus for enhancing marine resource utilization efficiency, alleviating the ecological burden of traditional marine industries, and promoting the transformation of marine ecological products toward higher added value and lower environmental costs. However, the current application of new quality productive forces in realizing the value of marine ecological products still faces challenges such as urgent technological bottlenecks, imperfect policy frameworks, and insufficiently developed market mechanisms. Therefore, this study clarifies the conceptual underpinnings of marine ecological products and new quality productive forces, proposing the following pathways: (1) Strengthen technological innovation to achieve precise monitoring of marine ecological resources and efficient conversion of ecological product value; (2) Establish a policy framework for realizing marine ecological product value characterized by "government guidance, enterprise leadership, societal participation, and public sharing"; (3) Foster the development of diversified and standardized market transaction mechanisms. By establishing a trinity-driven mechanism of "technology empowerment—policy safeguards—market drivers," this paper aims to promote the efficient conversion and sustainable development of marine ecological product value.


Keywords: new-quality productivity; marine ecological products; value realization; driving mechanism

3. Turn green into gold: National key ecological functional zones policy and supply efficiency of ecological product

First author: Zheneng Hu

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The supply of ecological products plays a fundamental role in the realization of ecological product value, and its efficiency improvement is closely related to the overall ecological co-prosperity. Based on county-level panel data and difference in difference (DID) model, we explore the impact and triggering mechanism of National key ecological function zones policy (NKEFZP) on the supply efficiency of ecological product (SEEP). The results show that NKEFZP has significantly improved SEEP, and the policy effect is more significant for counties with good ecological quality, poor economic development level, more local cooperation, and lower supply barriers. Mechanism analysis shows that NKEFZP is based on a blood transfusion channel, which promotes the improvement of SEEP through ecological transfer payments, on the other hand, SEEP is also improved through hematopoietic channels, that is, by leveraging the innovative effects of green technology. Expansion analysis shows that the improvement of SEEP caused by NKEFZP can not only increase the income of rural residents, but also achieve ecological co-prosperity by narrowing the income gap between urban and rural areas. This paper provides supply side empirical evidence for a deeper understanding of the value realization of ecological products, and it also provides inspiration for the optimization of NKEFZP.



Keywords: National key ecological functional zones policy; Ecological product supply; Efficiency accounting; Ecological co-prosperity

4. Gross Ecosystem Product in Sweden: Advancing Natural Capital Accounting for Sustainability Transitions

First author: Marta Sylla

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Gross Ecosystem Product (GEP) has emerged as an indicator that quantifies the economic value of ecosystem service flows, aiming to systematically account for nature's contributions to human well-being. Drawing on empirical and policy insights from Sweden and beyond, we critically examine potential conceptual, ethical and operational concerns about GEP, including monetization, equity, valuation limits, and policy uptake. We argue that when framed within a social-ecological perspective and aligned with existing ecosystem accounting standards, GEP offers a pragmatic and scalable tool for making ecosystem services visible, informing land-use trade-offs, and supporting beyond-GDP sustainability transitions.

We present estimates for multiple ecosystem services in Sweden, including carbon sequestration, recreation, non-timber forest products, and pollination, demonstrating how GEP can capture diverse value flows across different landscapes and temporal scales. These empirical applications illustrate both the opportunities and challenges of operationalizing GEP at national and regional scales. We further discuss policy applications, examining how GEP can inform spatial planning, support EU Biodiversity Strategy 2030 requirements for ecosystem accounting, and integrate nature values into decision-making processes.

Keywords: natural capital accounting, valuing nature, ecosystem services, ecosystem accounting, Sweden

5. A global state of play for country-level monetary ecosystem accounting

First author: Marta Sylla

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This study presents a comprehensive global analysis of country-level monetary ecosystem accounting under the System of Environmental-Economic Accounting-Ecosystem Accounting (SEEA EA) framework. We compiled and harmonized data from 36 countries implementing national-scale monetary ecosystem service accounts, representing 27 years of accounting practice across 23 ecosystem services. Using standardized methods for currency conversion (GDP deflators and PPP-adjusted exchange rates to 2019 international \$) and ecosystem service classification aligned with the SEEA EA reference list, we analyzed trends, methodological consistency, and comparability of results across countries.

Our database captures valuation approaches and methods. Results reveal substantial geographic variation in ecosystem service values, with carbon storage (terrestrial) representing a dominant service across multiple countries. We compare "bottom-up" national accounting approaches with emerging "top-down" global GEP estimates, demonstrating both convergence and persistent heterogeneities in methods and data sources.

Keywords: natural capital accounting, valuing nature, Gross Ecosystem Product, ecosystem accounting, Monetary ecosystem accounts

6. Gross Ecosystem Product in the Netherlands: An Application of GEP in Policy Decision-Making

First author: Monica van Alphen

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The Gross Ecosystem Product (GEP) indicator is developed and applied in the Dutch policy context to support nature-inclusive decision making. The study links data from the Natural Capital Accounts (NKA) of Statistics Netherlands (CBS) to the MAGNET macroeconomic model, enabling a comprehensive assessment of ecosystem service values alongside economic variables. A key advantage of the MAGNET model is its ability to simulate future policy scenarios, with expected land-use changes determined endogenously, allowing for dynamic projections of GEP over time.

Three future scenarios for the Netherlands were explored to assess potential GEP developments towards 2050: Sustainable Development (SSP1), Middle of the Road (SSP2), and Regional Rivalry (SSP3). Additionally, the GEP was applied to a specific policy scenario focused on afforestation. To complement the GEP indicator, a 'GEP stress index' was introduced, capturing pressures on natural capital resulting from policy choices.

The results illustrate how the GEP can support integrated decision-making by providing insights into the effects of policy options on both nature and societal benefits, including climate regulation, recreation, and the overall quality of the living environment. The indicator is particularly useful for comparing policy options and analysing temporal trends. However, careful interpretation is required: GEP values should be considered alongside conventional macroeconomic indicators, and disaggregated by ecosystem service categories to provide nuanced guidance for policy-makers. The findings underscore the potential of GEP to enrich policy analysis and promote integrated decision-making.

The GEP indicator in MAGNET is being further developed, including a decomposition of the drivers of GEP changes, with a focus on whether these changes over time result from shifts in the supply or demand of ecosystem services, changes in ecosystem extent or condition, or other factors, which require further research to clarify.

Keywords: Gross Ecosystem Product, MAGNET, ecosystem valuation, nature inclusive decision-making, natural capital

7. Gross Ecosystem Product Accounting: Frameworks and Application Scenarios

First author: Shang Chen


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In 2021, the United Nations Statistics Division released the System of Environmental-Economic Accounting – Ecosystem Accounting (SEEA-EA) Technical Guidance, which provides the methodological framework for integrated environmental-economic statistics. This guidance standardizes the accounting of ecosystem stocks and service flows in both biophysical and monetary terms. Within this framework, the concept of Gross Ecosystem Product (GEP) has been recognized as a key aggregate measure of the total monetary value of final ecosystem services supplied to humanity within a given accounting period. Specifically, GEP quantifies the value of ecosystem services with direct and indirect use values, such as provisioning, regulating and cultural services, but excludes non-use values like the intrinsic existence value associated with biodiversity conservation per se.

GEP serves as a comprehensive indicator for quantifying the total contribution of ecosystems, functioning as the ecological counterpart to Gross Domestic Product (GDP), which measures total output from



economic system. Together, GEP and GDP form a complementary, two-dimensional indicator system for assessing the productive capacity and sustainability of a region's or nation's integrated ecological and economic systems.

The practical application of the GEP accounting framework has progressed significantly in China. Specifically, national standard methodologies for terrestrial and marine GEP accounting have been established and formally promulgated by the Chinese government. These standards have guided pilot GEP accounting initiatives in over 30 local jurisdictions. The implementation of these standardized GEP accounting frameworks enables the systematic assessment of the productive capacity and sustainability of terrestrial and marine ecosystems. Furthermore, it facilitates the evaluation of the contribution of natural capital to socio-economic well-being and provides operational tools for local governments to integrate ecological values into decision-making and policy implementation.

Keywords: Gross Ecosystem Product, accounting, frameworks, ecosystem service, application

8. Impact of Tourism Development on Ecological Product Value in Hani Rice Terrace Villages

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Against the pervasive backdrop of global rural decline, rural tourism has emerged as a strategic mechanism for village revitalization and enhancing the value realization capacity of ecological products. This study adopts a comparative case approach, investigating Huangcaoling Village (specializing in landscape-based tourism and hospitality services) and Sheng Village (hospitality-focused operations) within the UNESCO World Heritage Site of Honghe Hani Rice Terraces. Using high-resolution land use classification maps (2005, 2009, 2013, 2017), we analyze three critical phases: pre-nomination (2005–2009), mid-nomination (2009–2013), and post-inscription (2013–2017). An integrated ecosystem service valuation (ESV) framework was applied to quantify variations in 11 crucial ecological product values derived from three dominant land use types: cropland, woodland, and grassland. Methodologically, we employed: Replacement Cost Method for valuing soil retention, fertility maintenance, and waste decomposition, Market Value Pricing for agricultural/fibre products and freshwater supply, Shadow Project Approach for climate regulation, biodiversity conservation, and flood mitigation Benefit Transfer Method for cultural services (recreational/aesthetic values). Results demonstrate starkly divergent trajectories in total ecosystem service value (TESV): Huangcaoling recorded a net increase of ¥12.9073 million (20.8% growth), largely driven by a ¥12.492 million surge in recreational value from terrace sightseeing. Sheng Village experienced a net reduction of ¥1.6996 million (-4.3%) despite minor gains in individual services. Both villages exhibited positive growth in regulating and supporting services, These differential outcomes reveal three critical insights: Tourism development modalities directly determine ecological product value capture: Landscape-integrated tourism amplified Huangcaoling's value realization through cultural service monetization. The ESV enhancement effect is nonlinear: Post-inscription growth rates in Huangcaoling tripled pre-nomination levels, underscoring UNESCO's catalytic role. Symbiotic reinforcement exists: Tourism revenue funded terrace maintenance, elevating provisioning services.

Keywords: village; Tourism development; ; Ecosystem products; Ecosystem services


9. Sustainability pathways enable China's marine economic sectors to reach a 2030 emissions peak

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Amid intensifying climate urgency, decarbonizing marine economic sectors presents both a critical challenge and a pivotal opportunity in global mitigation strategies. However, systematic approaches to assessing reduction potential remain limited. Here, we developed an integrated analytical framework with



statistical data and found a 28.35% increase in greenhouse gas emissions in China's marine economic sectors during 2000–2020. The decoupling trajectory of emissions from economic growth improved during 2005–2015 but deteriorated thereafter. Energy intensity reduction offsets 81% of cumulative emission growth driven by economic expansion. Scenario comparisons indicate that adopting the sustainability pathway could constrain the emissions peak to 126.4–143.2 Mt carbon dioxide equivalent during 2022–2028, achieving dual advantages of 10–35% lower peak volumes and 3–6 years earlier than the fossil-fueled development pathway. This study establishes a transferable framework for coastal nations to align blue economy growth with Paris Agreement targets through targeted peaking strategies.

10. Exploring the Application of Gross Ecosystem Product in Europe: Insights from an Italian Case Study

First author: Tommaso Pacetti

Other author(s): Marco Lompi, Giovanna Panza, Alessandro Bosso, Marco Monaci, Giovanni Pasini, Riccardo Santolini

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Gross Ecosystem Product (GEP) has emerged as a promising aggregate indicator to capture nature's contribution to economic systems. While GEP has been widely applied in China, its adoption in Europe remains limited. This contribution presents one of the first attempts to adapt and operationalize the GEP framework in a European context, using a case study from the Apennines east of Parma, Northern Italy.

The study develops a place-based methodology tailored to European biophysical, institutional, and data conditions. A stepwise approach is applied, combining the identification of locally relevant ecosystem services, their spatially explicit biophysical quantification, and economic valuation using market-based, avoided-cost, and replacement-cost methods. Regulating services (such as habitat quality, soil erosion protection, water purification, and carbon uptake) emerge as the dominant contributors to GEP, highlighting the critical role of ecosystem integrity in sustaining socio-economic systems. Provisioning and cultural services complement this picture, linking natural capital to regional development, land-use planning, and community well-being.

Beyond presenting empirical results, the case study critically reflects on methodological challenges, including data availability, valuation assumptions, attribution of human versus natural inputs, and the partial representation of cultural and non-market services. These limitations underline the need for continued refinement of the GEP framework, including improved valuation methods, clearer accounting boundaries, and closer integration with natural capital stock accounts and macroeconomic indicators.

By demonstrating both the feasibility and the current constraints of applying GEP in Europe, this contribution supports ongoing efforts to embed natural capital into economic decision-making, providing evidence to inform regional planning, policy development, and integration into broader economic indicators. Continued methodological development and iterative application of GEP can significantly enhance the recognition of ecosystem services in policy and management practice, strengthening the role of nature in guiding sustainable and resilient development pathways.

Keywords: Decision Making, Ecosystem services, Integrated natural resources management, Natural Capital Accounting

11. From Paradigm to Implementation: Achieving Inclusive Accessibility in Beijing's Waterfront Spaces

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The quantification of Gross Ecosystem Product (GEP) highlights the contributions of ecosystems to human societal well-being. However, to enable the public to tangibly perceive its value and advance socio-ecological synergistic development, it is crucial to establish a positive feedback loop between ecological



conservation and human welfare. As the most critical socio-ecological nexus within urban areas, waterfront spaces often suffer from diminished public accessibility under traditional management models, leading to issues such as ecological degradation, spatial privilege, and insufficient public participation. There is an urgent need to address these challenges guided by the principles of ecological civilization. This study conceptualizes waterfront spaces as sustainable public goods, emphasizing the integration of natural capital foundations, sustainable management mechanisms, and inclusive governance systems to create composite products that deliver multiple facets of well-being to urban residents. The opening up and sharing of Beijing's waterfront spaces serve as a case study for this analysis.

Keywords: Waterfront Space; Sustainable Provision; Opening Up and Sharing