

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: T11

Interregional flows of ecosystem services / nature contributions to people and Europe's global impact

Hosts:

	Name	Organisation	E-mail
Host (s):	Thomas Koellner	University of Bayreuth	thomas.koellner@uni-bayreuth.de
Co-host(s):	Evangelia Drakou	Department of Geography , Harokopio University HUA, Greece	e.drakou@hua.gr
	Maria Felipe-Lucia	Instituto Pirenaico de Ecología (IPE, CSIC), Spain	mariafl@ipe.csic.es
	Nynke Schulp	VU University, The Netherlands	nynke.schulp@vu.nl

Abstract:

Ecosystem accounting, interregional flows and Europe's global impact is one of the six key challenges announced for the 6th ESP Europe Conference. On this one planet a multitude of ecosystem services (ES) / nature contributions to people (NCP) are flowing from regions in which they are provided to regions in which they are utilized. Such ES/NCP flows happen from landscape to regional to global scale. Mechanisms include i) international trade of food, feed, and fibers, ii) biophysical flows of regulating services, iii) flows mediated through migrating or dispersing species, and iv) information flows related to cultural services. The recent pandemics and geopolitical conflicts show the vulnerability, but also the necessity of the sustainable management of such interregional telecoupling. The European Union's Regulation on Deforestation-free products from 2023 is a step towards this. Still, regional and national studies still often neglect the dependence on distant ES/NCP and regularly disregard off-site effects in provision and use of ES/NCP. However, it is important to consider interregional flows of ES/NCP as they can cause telecouplings between regions. Through such telecouplings, a change in supplying ecosystems can affect ES/NCP beneficiaries in distant demand regions, but also the other way around ES/NCP demand can cause environmental problems in distant supply regions. For instance, inequalities originated in telecoupled systems could lead these systems to fall into maladaptive situations or socio-ecological traps. Ultimately, policies aiming at enhancing ES/NCP in a region should not lead to ecosystem damage elsewhere. To cover this field the ESP thematic working group "Global Ecosystem Service Flows (TWG 11)" was installed during the ESP World Conference in 2015 in South Africa.

This group invites contributions to this session. Submissions should address open research questions related to (i) quantitative or qualitative assessments of interregional ES/NCP flows and telecouplings, incl. (spatial) and long-term modelling of sending and receiving regions, and accounting for ES/NCP and biodiversity embedded in these flows, (ii) quantification of drivers behind these different interregional flows (iii) the evaluation of such flows in terms of effects, i.e. benefits, damages, inequalities, sustainability and health both in sending and receiving regions, (iv) motivations and perceptions of different actors involved (v) options to better govern interregional conservation of biodiversity and management of ES/NCP and health.

We welcome studies from both broad range of disciplines investigating effects of telecouplings from a biophysical as well as from a social/economic perspective in all types of habitats (i.e. marine, freshwater and terrestrial ecosystems). Specifically, linkages to the conference theme OneHealth are encouraged.

Goals and objectives of the session:

This session aims at exchange on methods and applications how to complement regional assessments of ES/NCPs with an interregional assessment of ecosystem flows to and from a specific region. This opens the possibility to present work relevant for ES/NCP on material flow analysis of trade, embodied water and land, environmental footprints as well as life cycle assessment. This session should also bring together researchers from different disciplines investigating inequality effects, valuation and sustainable managements of telecoupling from a social, economic and/or ecological perspective.

Planned output / Deliverables:

The output planned is to create a focus group working towards a joint position paper specifically on inequalities, power asymmetries, social-ecological-economic effects, etc. resulting from interregional ecosystem service flows.

Session format:

We plan to have two blocks of 1.5 h each, organized as 6 x 15 min time slots. In each block the first time slots will be for presentations (12 min talk + 3 min for questions), and the last time slot will be used to ask additional questions and discuss the main commonalities found across the talks. Detailed program will be planned, when all contributions are selected.

Related to ESP Working Group:

[TWG 11 – Global ES Flows](#)

II. SESSION PROGRAM

Room: B2

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	Luana	Meister	Universidade Federal do Paraná, Ecology and Conservation Program	Interregional flows of ecosystem services from telecoupling and transboundary perspective: a review
18:00-18:15	Davina	Vackarova	Charles University, Environment Centre	Telecoupled footprints of crop provisioning and trade on biodiversity intactness
18:15-18:30	Liam	Vezzani	PBL Netherlands Environmental Assessment Agency, The Hague, The Netherlands	Mapping worldwide pollination shortfalls in agricultural landscapes
18:30-18:45	Juliana	Socrate	Leibniz Institute for Baltic Sea Research (IOW)	Land-Sea Interactions as Social-Ecological Flows: Linking Conflict Patterns and Nature's Contributions to People in the German Baltic Sea
18:45-19:00	María	Felipe-Lucia	Social-Ecological Systems Institute, Leuphana University Lüneburg, Lüneburg, Germany	A metacoupling lens on the co-production of nature's contributions of people: insights for sustainability
19:00-19:15				Wrap-up and discussion on research needs

III. ABSTRACTS

The first author is the presenting author unless indicated otherwise

1. Interregional flows of ecosystem services from telecoupling and transboundary perspectives: a review

First author: Luana Meister

Other author(s): Márcia C. M. Marques

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The provision and delivery of ecosystem services (ES) are influenced by interregional flows that cross geopolitical boundaries and ecosystems. As human-nature dependencies extend over greater distances, the transfer of benefits from sending to receiving systems becomes important for natural resource planning. Although traditional ES research emphasizes local provision, the rise of interregional flows necessitates a conceptual framework that distinguishes between biophysically driven movements and those mediated by socioeconomic factors. To address this need, a systematic review of interregional ES flows was conducted using the framework provided by Schröter et al. (2018). A dataset of 619 scientific articles from the Web of Science was analyzed, with 439 studies that explicitly categorize service flows. These studies were classified into four flow types: (1) traded goods, (2) species migration, (3) passive biophysical flows, and (4) information flows. Additionally, a keyword co-occurrence analysis was conducted to identify thematic clusters and quantify the associations between the concepts of telecoupling and transboundary. The analysis revealed ES flows showed a predominance of traded goods (n=226) and passive biophysical flows (n=187). Telecoupling was most frequently associated with the keywords "sustainability," "land-use change," and "trade," highlighting its relevance in examining the effects of global commodity markets on local ecosystems. In contrast, transboundary flows were more often linked to "water management," "biodiversity," and "river basins." The results demonstrate that interregional flows are currently analyzed through a socioeconomic perspective for traded goods and a biophysical perspective for shared natural resources. Telecoupling is primarily employed as a framework for market-mediated flows, where distal consumption triggers localized land-use change. The transboundary framework remains focused on passive biophysical connectivity, particularly within the management of shared watersheds. The lower frequency of studies on information flows (n=107) and species migration (n=32) suggests a gap in the literature on information and biological communities.

Keywords: Interregional flows; telecoupling; transboundary; systematic review

2. Telecoupled footprints of crop provisioning and trade on biodiversity intactness

First author: Trong Can Nguyen

Other author(s): Jan Weinzettel

Presenting author: Davina Vačkářová

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Cropland provides essential provisioning ecosystem services (ES) by supplying food, feed, and industrial crops, yet they are also a major driver of biodiversity loss and degradation of regulating and supporting ES for long-term ecosystem resilience. A key challenge is to identify how these trade-offs vary across biodiversity conditions and are reshaped by supply chains. We integrate the biodiversity intactness index (BII) with a multi-regional input-output (MRIO) analysis to track cropland-related footprint representing provisioning services across BII classes. Cropland in high-intactness ecosystems poses high risk to ES due to substantial biodiversity loss as opportunity costs and diminished regulating and supporting services. In contrast, cropland in low-intactness ecosystems entails lower biodiversity costs, but may further degrade already compromised services and reduce long-term resilience and productivity.

We found the high and increasing dependence of global crop systems on degraded ecosystems with low and very low BII

classes, where regulating services such as soil fertility and pollination are diminished with potentially increasing ecological and production risks. Consumption of cropland-related footprints and biodiversity pressures are increasingly decoupled through international trade. Some regions including the European Economic Area (EEA) and Middle East and North Africa (MENA) rely increasingly on imports, displacing biodiversity loss and regulating service degradation to distant regions. In addition to staple and industrial crops, processed food sectors and hospitality further amplify the impacts, highlighting downstream consumption as a major driver of ecosystem service trade-offs.

Global food provisioning is increasingly telecoupled with biodiversity loss and ecosystem service degradation through supply chains. Integrating BII with MIRO provides a novel ecosystem service accounting that connects consumption to biodiversity conditions of producing landscapes. These findings underscore the need for consumption-based responsibility, commercially inclusive conservation policies, and strategies to protect and restore regulating and supporting services along with provisioning services in both degraded and intact ecosystems.

Keywords: Biodiversity intactness index (BII), cropland, MRIO, global supply chain, trade-offs

3. Mapping worldwide pollination shortfalls in agricultural landscapes

First author: Liam Vezzani

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Given the sharp expansion of pollinator-dependent crop production since the 1960s, it is paramount to quantify wild pollinator density and the pollination services they provide to agricultural landscapes in order to identify hotspots of agricultural areas lacking pollination services. Here, we model pollination shortfalls for conventional farming systems as a function of wild pollinator density in croplands, mediated by annual mean surface temperature. To that end, we combine the yield functions from Vezzani et al. (2025) with a global model of wild pollinator density in cropland parametrized based on a novel database of 2,074 pollinator density records from 109 studies from 25 countries. We model wild pollinator density in croplands based on the proportion of natural and semi-natural habitat in the surroundings, annual mean surface temperature and the presence of pollinator friendly measures. Our approach improves the modelling of the pollination supply by going beyond presence of habitat through the inclusion of temperature and improves the modelling of ecosystem services supply by explicating modelling the relationship between yield and pollinator abundance. Our results show uneven distribution of pollination shortfalls across global agro-ecological zones and shed light on a new potential case of environmental injustice, where tropical areas hosting the largest shares of croplands dedicated to pollinator dependent crops are experiencing the largest pollination shortfalls compared to temperate regions, with climate change expected to even exacerbate such pattern. Given that one solution to tackle the reduced crop production is to increase agricultural expansion, tropical croplands are at serious risk of entering a negative feedback loop where the increase in demand for pollinator dependent crops from the Global North triggers further biodiversity and land degradation in the Global South.

Keywords: pollination shortfalls, global modelling, crop production, environmental justice

4. Land–Sea Interactions as Social-Ecological Flows: Linking Conflict Patterns and Nature’s Contributions to People in the German Baltic Sea

First author: Juliana Socrate

Other author(s): Giulia Bellón, Maraja Riechers, Heinrich Laakmann, Miriam Niewöhner, Miriam von Thenen

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Land–Sea Interactions (LSI) shape key socio-ecological linkages between terrestrial and marine systems, influencing how communities perceive and benefit from coastal environments. This study conceptualizes LSI as interregional social-ecological flows connecting inland activities, coastal dynamics, and public perceptions of Nature’s Contributions to People (NCP) in the German Baltic Sea. The analysis had three objectives: (i) to identify LSI emerging from conflicts among human activities

based on socioeconomic data from two coastal states; (ii) to examine how these conflict-driven LSI relate to NCP identified through surveys of residents and tourists ($N \sim 3100$); and (iii) to assess whether theoretically derived LSI–NCP linkages spatially align with locations that respondents associate with specific NCP.

Conflict analysis revealed hotspots involving fisheries, tourism, maritime transport, shoreline modification, and land-based inputs, generating a list of LSI that connect terrestrial drivers with coastal ecological and marine dynamics. Parallel surveys captured how local users and visitors perceive NCP such as recreation, cultural identity, aesthetic values, coastal protection, and food-related contributions.

By linking conflict-driven LSI with socially perceived NCP distributions, this study highlights how interregional flows shape both benefits and tensions across land–sea systems. The approach offers insights into the social drivers behind these flows and points to governance opportunities for addressing problems, improving coordination across regions, and enhancing sustainability in coupled coastal–marine landscapes.

Keywords: Land–Sea Interactions, NCP, conflict analysis, coastal perceptions, socio-ecological flows

5. A metacoupling lens on the co-production of nature's contributions to people: Insights for sustainability

First author: Anna Mayer

Other author(s): Roman Isaac, Jaqueline Loos, Berta Martín-López

Presenting author: María Felipe-Lucia

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Nature's contributions to people (NCP) broaden up the ecosystem service concept and support human life in multiple ways. These contributions are partially derived from nature together with inputs from humans, a process known as co-production of NCP. The sustainability of NCP co-production not only depends on the use of anthropogenic capitals but also on where they are produced, how they are mobilized, or the access to these capitals. In fact, NCP co-production can occur at different places and across spatial scales: it may be affected by factors not only within a system but in other systems near and far. To this end, the metacoupling framework advances the telecoupling framework and offers a lens to analyze human-nature interactions within and between systems across spatial scales. Here, we illustrate the application of the metacoupling framework on NCP co-production by using the examples of wood production in temperate forests in Germany, natural pest control in German meadows provided by migratory birds, and non-material NCP from giant panda tourism in China. We reflect on the challenges of adopting a metacoupling lens when analyzing NCP co-production, such as working with different disciplines and engaging with diverse knowledge systems, defining social-ecological system perimeter, or collecting metacoupled data across scales based on mixed-method approaches. While considering the relevance of metacoupling of NCP co-production for sustainability, we highlight the opportunities of adopting this lens, such as visualizing hidden and overlooked sustainability issues or making global sustainability a relevant aspect of local decisions.

Keywords: interregional flows, global flows, ecosystem services, nature contributions to people, telecoupling