BOOK OF ABSTRACTS

I. SESSION DESCRIPTION

ID: T2

Assessing Ecosystem Condition: Integrating Science, Policy and Practice

Hosts:

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Host:	Fernando Santos-Martin	Universidad Rey Juan Carlos de Madrid	fernando.santos@urjc.es
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Abstract:

Ecosystems form the bedrock of biodiversity and provide vital services that sustain human society and economics. However, understanding ecosystem condition and assessing spatial variations remain complex challenges, particularly when covering a broad range of ecosystems in different biomes. This session seeks to explore the multiple dimensions of assessing ecosystem condition, emphasizing the integration of scientific methodologies, policy frameworks, and practical applications. Presentations are invited to explore the frameworks, methodologies, metrics, and applications used to evaluate ecosystem condition, with a particular focus on spatial assessments. We also aim to explore techniques for calibration, the relationship between ecosystem condition and restoration needs, and the capacity of ecosystems to provide essential services. We will also investigate how these assessments vary across different ecosystem types and biomes, providing valuable insights for informed decision-making and effective management strategies.

The session will delve into various approaches and tools utilized in assessing ecosystem condition, encompassing both biophysical and socio-economic indicators. We aim to highlight innovative methodologies, case studies, and interdisciplinary perspectives that contribute to a comprehensive understanding of ecosystem condition across different spatial and temporal scales.

Key topics addressed:

- Metrics that Matter: What are the most effective and informative metrics to evaluate ecosystem condition across diverse ecosystems?
- Spatial Smarts: How can we leverage spatial assessment tools to map and monitor ecosystem condition at various scales?
- Calibrating for Clarity: What methods are available to calibrate ecosystem condition assessments and ensure consistency?
- Condition to Capacity: How does ecosystem condition translate into its ability to deliver vital services?
- Restoration Roadmaps: Can ecosystem condition assessments inform targeted restoration efforts and prioritize areas of greatest need?
- Ecosystem Diversity: How do the ideal metrics and assessment approaches differ between various ecosystem types and biomes?

II. SESSION PROGRAM

Room: Expert Street 3

Part I

Date of session: 19th of November 2024

Time of session: 11:00-12:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
11:00	Fernando	Santos	URJC	Session introduction

Time	First name	Surname	Organization	Title of presentation
11:05	Xavier	Lecomte	INRAE	Advancing Ecosystem Condition Assessment: Refining the SEEA EA Framework
11:15	Joshua	Berger	EC-protocol	The Ecosystem Condition Protocol: a new major tool for corporates to measure and account for their impacts on ecosystem condition
11:25	Alessio	Bulckaen	BC3	EO-based forest condition assessment for Europe
11:40	Marious	Bellingen	Destatis	A deep dive into German condition account: systematic approach and the link to ecosystem capacity
11:55	Emily	Bank	LHU	Selecting and testing agroecosystem condition indicators
12:05	Eszter	Tanács	Colres	Validating a national-scale pressure-based cropland condition map using bird census data
12:15	Balint	Czúcz	NINA	References for ecosystem condition in major European biodiversity policies
12:30	-	-	-	Q&A disucussions

Part II

Date of session: 19th of November 2024

Time of session: 14:00-15:30

Timetable speakers

Time	First name	Surname	Organization	Title of presentation
14:00	Philippe	Roche	INRAE	Session introduction
14.05	Megan	Critchley	unep-wcm	Applying ecosystem conditions metrics to predict the provision of ecosystem services: a case study on supporting transformative policy and practice.
14:15	Fernando	Rodriguez	USAL	Enhanced logic chains based on value parameters. An application to the

Time	First name	Surname	Organization	Title of presentation
				economic valuation of ecosystem services at mediterranean forests
14:25	Ariadna	Álvarez	URJC	Methodology and application of the natural capital condition account: case study in Madrid (Spain)
14:35	Beñat	Egidazu-de la Parte	BC3	Integrated methodological approach to develop marine physical accounts
14:45	Anna Lilian	Gardossi	UNIUD	High Nature Value Farmlands: Preserving Biodiversity and Ecosystem Services
15:05	Grazia	Zulia	LHU	A multiple steps procedure for the analysis of intra- and inter-patches connectivity: an application in Lower Saxony, Germany
15:15	-	-	-	Q&A discussions

III. ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Methodology and application of the natural capital condition account: case study in Madrid (Spain)

First authors(s): Ariadna Álvarez Ripado

Other author(s): Adrián García Bruzón, Patricia Arrogante Funes, David Álvarez García

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We presented a methodology based on the SEEA-EA statistical framework to develop condition accounts for urban ecosystems. This methodology, which employs Euclidean distance in condition calculation, allows the condition accounts of urban ecosystems to be spatially and explicitly evaluated at a very detailed scale. The urban condition is calculated for each pixel. Still, the reference area is obtained through object-based evaluation, as the reference value for each variable is considered within a real territory rather than individual pixels.

This methodology involves achieving the following steps: 1. Delimitation of the urban categories to be evaluated; 2. Selection of the variables that characterise the abiotic and biotic

environment; 3. Establishment of the reference polygon with which to compare the condition values; 4. Calculation of weighted condition indicators; 5. Generation of a single condition index from the aggregation of the indicators.

In the city of Madrid, it has been observed that the areas with the highest condition are areas that host a significant tree density and are close to the reference area and those with the lowest condition are located far from the reference polygon, with high levels of contamination and are impervious zones, built-up areas and communication routes.

This novel approach to calculating urban condition accounts allows the natural capital accounting approach to be included in decision making and can serve as support in all phases of urban policy, from the identification of an urban problem to the review of the effectiveness of a plan already implemented. This condition account can be applied in almost all areas, from water, energy, climate, biodiversity and economic issues. Being an essential tool to detect urban problems, identify the variables that most influence the change in condition and act effectively and efficiently, identifying priority areas of action and obtaining the greatest benefits with the least expense.

Keywords: Urban ecosystem accounting, natural capital, condition account, SEEA-EA, Spain

2. Selecting and testing agroecosystem condition indicators for pollination ecosystem services modelling on a regional scale

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Ecosystems' capacity to provide services and to support human well-being strongly depends on their condition, comprising the composition, structures and functions promoting the systems integrity and resilience. Therefore, efforts are increasing to integrate ecosystem condition indicators in addition to land use/land cover information in ecosystem service models, for instance the adapted ESTIMAP model for pollination. To include ecosystem condition meaningfully, indicators are required that are conceptually and practically suitable and as comprehensive as possible.

In this research, a set of suitable agroecosystem condition indicators was identified and mapped to be applied in a series of ESTIMAP pollination models in the region of Hanover, Germany. The method is structured as follows: 1) a literature review was conducted to identify the most relevant agroecosystem characteristics to be considered, 2) the UN SEEA EA Ecosystem Condition Typology and selection criteria were applied on the characteristics to select a comprehensive set of indicators with respective datasets, 3) different indicator combinations were tested in the ESTIMAP model to gain insights into the influence of the selected indicators on the model results. In particular, the influence of the comprehensive indicator set, describing the entire ecosystem's condition, was compared with the influence of single indicators with special relevance for pollinators.

The preliminary results show that only a small proportion of important agroecosystem characteristics and indicators is suitable as SEEA EA-aligned condition indicator. Based on initial trials, we expect the incorporation of the comprehensive indicator set to result in a similar, but more differentiated pattern than the original model. Additionally, we anticipate the application of single indicators with special pollinator relevance to reveal divergent results, underlining the importance of a transparent indicator selection.

In conclusion, this research provides a) a comprehensive set of agroecosystem condition indicators and b) contributes to the challenge of selecting ES-specific condition indicators.

Keywords: Ecosystem characteristics, Review, UN SEEA EA, Selection criteria, ESTIMAP

3. A deep dive into German condition account: systematic approach and the link to ecosystem capacity

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As part of the environmental-economic accounts, the German ecosystem accounts record the interactions between humans and the environment following a systematic approach. The condition account is based on the extent account, which covers 74 ecosystem classes over six different ecosystem divisions. For each ecosystem division, an ecosystem condition typology,

describing the most important components of an ecosystem in terms of abiotic, biotic and landscape characteristics as well as information on pressure, management and ancillary data has been established. The data used for the condition account are derived from remote sensing, modelling approaches and existing monitoring systems. All these data have different properties according to spatial and temporal resolution, update frequency and data format. To overcome the challenge of technical implementation to account for ecosystem condition across different spatial and temporal scales, a metadata base was created. This metadata base enables the automatic production of condition accounts and is flexible enough to add or adjust new condition variables, new data or changes in methods. Accounting for condition in this way ensures consistency and allows for transparent tracking of changes. In addition to the condition variables, a methodology to set ecosystem specific reference levels was developed. Changes in extent and condition of an ecosystem can explain changes in a specific ecosystem service. Such observations in a timely fashion can provide information on the capacity of an ecosystem to deliver services.

The presentation will briefly introduce the extent account as it is the basis for the compilation of the condition account and then focus on its technical implementation, as well as different publication formats to satisfy interests of different user groups. Finally, a concept for obtaining information on the capacity of ecosystems will be presented using an example in an urban context.

Keywords: Ecosystem Accounting, Condition Account, Ecosystem Capacity, Environmental Economic Accounting, SEEA EA

4. The Ecosystem Condition Protocol: a new major tool for corporates to measure and account for their impacts on ecosystem condition

First authors(s): Joshua Berger
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The session will introduce the Ecosystem Condition Protocol (EC Protocol) and the works undertaken in this context.

Measuring and disclosing impacts on ecosystem condition is required from companies by major frameworks, but the concept lacks clear definitions and guidelines. Similar to the GHG Protocol but for ecosystem condition, the EC Protocol aims to provide guidance to non-financial corporates to accurately measure and account for their impacts on ecosystem condition. It will thereby enable them to report against key frameworks and standards (such as the ones from TNFD, GRI, EU standard ESRS E-4, or the SBTN methodology).

The session will introduce the EC Protocol overall context: how the protocol will bring the missing piece to the nature disclosure landscape and its collaborative approach and governance scheme, with the involvement of key organisations.

It will then focus on the current thinking of the EC Protocol and delve into the questions it would answer, based on a first mapping of needs and resources open for consultation, and on the consultation results. More specifically, those key questions include:

- Defining ecosystem condition: what are its components, the reference conditions against which it should be measured?
- What kinds of impacts should be considered (negative and positive impacts, reduced and avoided impacts, potential and actual impacts, future impacts, or the remaining ecosystem condition)?
- Methods and metrics: How to reconcile direct measurement methods at site level with top-down approaches at corporate level? What are the criteria a good ecosystem condition metric should meet? How do realm-agnostic and ecosystem-specific metrics relate to each other?
- How to track impacts over time?
- How to allocate responsibility to companies in the case of co-products (e.g. leather vs milk vs meat) or for sites where ecosystem condition is impacted by what happens at the landscape level?

Keywords: Impact, Corporates, Accounting, Measurement, Disclosure

5. EO-based forest condition assessment for Europe

First authors(s): Alessio Bulckaen

Other author(s): Stefano Balbi, Marcel Buchhorn, Caterina Gilli, Bruno Smets, Ferdinando Villa

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We present a state-of-the-art, open and free forest ecosystem condition assessment and accounting system for Europe, based on the publication “Accounting for forest condition in Europe based on an international statistical standard“, enhanced by the use of EO data, based on the datasets quality, relevance and scale (time and spatial resolution). This enables the

production of ecosystem condition accounts under the System of Environmental-Economic Accounting (SEEA), with higher temporal and spatial resolution and reduced latency compared to previously published results.

This work highlights the benefits of integrating Earth Observation (EO) for SEEA ecosystem accounting, to regularly generate environmental-economic accounts in a faster yet customizable fashion. While the current implementation aligns closely with the original methodology, the capacity to support tailored applications of forest ecosystem condition accounting, which incorporates country and locally-specific needs, is an important part of this work going forward. The combination of semantic modelling, coupled with on-the-fly generated remote sensing data, offers increased frequency, easier data access and faster computation of the accounts for the final user, reducing startup costs, as one can (re)use models and data already integrated into the system.

Moreover, the platform provides an efficient modelling environment for experts to quickly test different methodologies and scenarios (by producing digital twins), as well as to more easily verify the effectiveness of the combinations of data and models for their region of interest.

New information can be integrated in several ways: ecological experts and statisticians can calibrate or change the parameters of a model with fewer complications, substitute a dataset, or add new data or entire models or computational workflows made accessible online. This allows the generic European approach to be improved by applying local knowledge whenever available.

The results are useful for multiple user groups, from practitioners who generate accounts more easily and regularly but using expert-revised models, to scientists who contribute their expertise to improve current models, which can be (re)used by the wider community.

"The research and the development of the system was supported by the PEOPLE EA project, funded by the European Space Agency (ESA)"

Keywords: EO-based Forest Condition Accounts, Forest condition mapping, Integrated Natural Capital Accounting, Ecosystem Condition Accounting

6. Applying ecosystem condition metrics to predict the provision of ecosystem services: a case study on supporting transformative policy and practice

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Identifying robust and efficient metrics to rapidly inform policy and practice across multiple scales is crucial to advancing and monitoring global targets within the Kunming-Montreal Global Biodiversity Framework. One such metric is the Ecosystem Integrity Index (EII), which provides a simple and robust way of measuring, monitoring and reporting on terrestrial ecosystem condition. Ecosystem integrity encompasses the full complexity of an ecosystem, including the physical, biological and functional components.

Ecuador is home to a rich diversity of high-biodiversity ecosystems, depended on by millions. We adapted the global EII by including national or regional data and models to develop Ecuador-specific models and produce maps of EII. Additionally, projections of four ecosystem services were produced using the Co$tingNature model. This study aimed to assess whether EII can be used to predict ecosystem service provision spatially.

Results indicated that 32% of the Ecuador's ecosystem integrity has been lost, with a mean EII of 0.68. EII was highest in the Amazon region (mean, 0.86; SD, 0.15) and lowest across most of the Pacific coastal region (mean, 0.48; SD, 0.20) of western Ecuador. We found that EII correlates moderately well with the provision of three ecosystem services: sustainable fuelwood availability to local people, fraction of area with potential to supply non-wood forest products, and the occurrence of wild pollinators/pest controllers (Pearson's r, 0.65-0.69).

These results indicate that there is strong potential to use the EII as a proxy for a range of ecosystem services, but that some ecosystem services may not be represented well by ecosystem integrity. Further investigation into these relationships is needed to understand how ecosystem condition correlates with the capacity to deliver a broad range of services, and whether these spatial approaches can support transformative policy and practice for people and nature.

Keywords: Ecosystem integrity, Indices, Ecosystem services, Modelling, Policy

7. References for ecosystem condition in major European biodiversity policies

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The recent Ecosystem Accounting standards of the System of Economic Environmental Accounts (SEEA EA) constitute a major step towards standardising and operationalising the concept of ecosystem condition. Similar concepts can be discovered in several EU-level and national policy frameworks, which predate SEEA EA. Nevertheless, these frameworks apply highly different terminologies which conceals both similarities and differences, hindering mutual learning and collaboration. In this study we looked at major European biodiversity policies (e.g. Water Framework Directive, Marine Strategy Framework Directive) and national frameworks (e.g. the Index-Based Ecological Condition Assessment framework in Norway) that apply dimensionless condition indicators measured on a harmonised 0-1 scale to characterise the condition of ecosystems. Similarly to SEEA EA, these frameworks use references (reference levels and reference conditions) for rescaling raw variables to the common dimensionless scale. These references have a central role in establishing the salience, credibility, and legitimacy of the rescaled values as meaningful metrics of ecosystem condition. Here we present the main commonalities in the EU approaches using a simple harmonised terminology building on SEEA EA, with a particular focus on the use of references in these frameworks.

Keywords: Conservation status, environmental status, ecological status, ecological integrity, reference condition

8. Integrated methodological approach to develop marine physical accounts

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Ocean Physical Natural Capital and Ecosystem Accounts are still under development worldwide. The System of Environmental Economic Accounting – Ecosystem Accounting sets the international standard to fill in the quantity and their related condition of the accounting areas. Although there is now agreement on how to calculate the extent, the investigation of the condition of the accounting areas is still undertaken with different methods. Our ongoing Horizon Europe MARBEFES (Marine Biodiversity and Ecosystem Functioning leading to Ecosystem Services) project uses a mixed approach to report condition of the considered study areas. Our approach includes the use of the Marine Strategy Framework Directive indicators and the Ecological Value Assessment of the marine biodiversity in those specific areas. We aim to incorporate this methodology in the ARIES (Artificial Intelligence for Environment & Sustainability) platform, a cutting-edge integrated modeling technology in development since 2007, which allows to integrate natural science, human behavior and economic data. The methodology proposed here is aligned with ARIES for SEEA efforts to test these approaches in marine environments.

We envisage our method to make it faster for policy makers to visualize in a simpler form complex physical natural capital and ecosystem accounting information. We anticipate our contribution to inform the ongoing international development of physical natural capital and ecosystem accounting which includes specific marine biodiversity data and can be comparable worldwide. Our contribution will help improve monitoring over time of coastal and marine areas providing the necessary information to evaluate past and future policies and projects aimed at the sustainable management of the Ocean.

Keywords: spatial integration, marine physical accounts, ecosystem condition, ARIES, SEEA

9. High Nature Value Farmlands: Preserving Biodiversity and Ecosystem Services

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Agroecosystems are often perceived as incompatible with natural resource conservation. However, High Nature Value Farmlands (HNVFs) challenge this notion by recognizing the crucial role of low-intensity agriculture in biodiversity preservation. The EU's integration of HNVFs into policy frameworks underscores their importance.

This study is part of the project "SICANSE-Development of an information system on the natural capital and ecosystem services of the agricultural and forestry sector" (Action 2.1.3). Our aim is to estimate the total extent of HNV farmland and monitor trends in its extent and condition at the regional scale. HNVFs are cultivated landscapes rich in biodiversity or supporting endangered species and habitats. They are categorized based on semi-natural vegetation, landscape diversity, and presence of protected species.

To map HNVFs, we combined available datasets, identified potential HNVF types, integrated weighted indices, and characterized the results. This process involved scaling data to match the desired level of detail. First analysis suggests that a significant portion (84%) of the studied area with over 20% agricultural land is likely to be classified as HNVF.

HNVFs are important for ecosystem services: By preserving biodiversity and traditional farming practices, they contribute to essential functions like pollination, water regulation, and soil health. Understanding their spatial distribution and evolution is crucial for effective conservation strategies and sustainable land management.

This study contributes to the growing body of knowledge on HNVFs. By quantifying their extent and monitoring their changes, we can inform policies and practices that safeguard these vital landscapes and the ecosystem services they provide. As we strive for a more sustainable future, HNVFs emerge as key players in ensuring the balance between agricultural production and environmental conservation.

Keywords: Agroecosystems, High Nature Value Farmlands, Mapping techniques, Biodiversity conservation.

10. Advancing Ecosystem Condition Assessment: Refining the SEEA EA Framework

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The European Biodiversity Strategy for 2030 emphasizes the importance of maintaining ecosystems in good condition to combat biodiversity loss and provide ecosystem services. However, ecosystems face relentless pressures from human activities, climate change, and invasive species, adversely affecting biodiversity. A standardized framework for assessing ecosystem condition (EC) and trends is crucial in this context. The UN System of Environmental-Economic Accounting Ecosystem Accounting (SEEA EA) offers a comprehensive protocol for evaluating EC, based on abiotic and biotic characteristics. Nevertheless, it falls short in addressing ecosystem responses to disturbances, which are vital for analysing environmental issues and formulating effective interventions.

The concept of EC aligns closely with ecological health and ecosystem integrity, encompassing the ecosystem's state in response to human pressures and its ability to provide services and ensure species conservation. EC can be succinctly defined as the sum of biophysical properties underpinning ecosystem diversity and functioning.

We introduce new insights into the SEEA EA framework by proposing a clear separation between pressure indicators and ecosystem state indicators, aiming to develop a Human Pressure Index, directly related to EC. By distinguishing the causes affecting biodiversity and ecosystem functioning, and characterizing EC, this approach facilitates the identification of a minimal set of readily available indicators. Additionally, this refined framework seeks to bridge data gaps and leverage new scientific and technological advancements to support the European biodiversity strategy.

Given the complexity of EC, which involves various conditions supporting ecosystem services, defining a universal set of ecological features and functions is unfeasible. Therefore, it is essential to investigate individual services to identify critical determinants and establish criteria for EC. We highlight the importance of this nuanced approach in enhancing the robustness of EC assessments within the SEEA EA framework. We will also present a practical example of implementing this framework, demonstrating its potential to contribute to effective biodiversity conservation efforts.

Keywords: Ecosystem accounting, Human Pressure Index, Ecosystem condition indicators, Ecosystem functioning, Biodiversity conservation

11. Validating a national-scale pressure-based cropland condition map using bird census data

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The assessment and mapping of ecosystem condition is getting ever increasing attention. Croplands are artificial ecosystems but they occupy a large portion of the land, and thus it is important to study their suitability to support wildlife on a large scale. Due to the lack of suitable biodiversity data, mostly pressure-related proxies are used for this purpose, which increases the uncertainty of the resulting map. In this study, we aim to test the pressure-based cropland condition map of Hungary using bird census data. Besides validating the composite condition indicator, we also tested some key elements of the mapping process, such as the choice of variables and thresholds.

Using multiple comparisons of means by Tukey's contrast and Random Forest modelling, we examined the relationship of (1) the continuous cropland condition variables, (2) their rescaled, ordinal version (sub-indicators), and (3) sum of the sub-indicators (the final, composite cropland condition indicator) with a biodiversity measure, the standardised relative richness of characteristic farmland bird species (rRRCS). To get a picture of the spatial patterns of the examined relationships across Hungary, individual Random Forest models were constructed for all the spatial units of the bird census database, using focal analysis with a 30 km radius moving window.

We found significant differences in the rRRCS for nearly all sub-indicator categories, signifying that the literature-derived thresholds were mostly sound. Categories with higher (better) composite condition scores had higher rRRCS; the differences were significant in the mid-range but not in the extreme categories. The goodness-of-fit (R2) of the Random Forest models is spatially heterogeneous, similarly to the variable importance. The proportion of semi-natural areas proved to be the most important condition variable. Our results highlight the spatial context dependence of the uncertainty of condition maps.

Keywords: ecosystem condition, ecosystem integrity, spatial context dependence, Hungary, EU Biodiversity Strategy

12. A multiple steps procedure for the analysis of intra- and inter-patches connectivity: an application in Lower Saxony, Germany

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The current environmental policies of the EU recognize the importance of transnational Green Infrastructure (GI) to improve ecosystem condition. Ecosystem restoration and sustainable land use planning complement the efforts to protect nature made with the establishment of Natural Protected Areas.

This study proposes the implementation of a multiple steps procedure for the analysis of intra and inter-patches connectivity to identify areas for mitigation measures, using the example of Lower Saxony, Germany. Specific attention is given to the role of transportation networks, to quantify their impact on connectivity; the presence of highly modified ecosystems, to quantify to what extent they can support the deployment of GI; the location of Protected Areas, to detect sites, and surrounding areas, that need restoration actions.

Connectivity is measured using three landscape metrics included in the Guidos Toolbox: a modified version of Accounting (classifies green patches according to the sizes), the Foreground Edge Density (measures the intra-patches connectivity using a new procedure based on continuous data, in this case a NDVI) and the Morphological Spatial Pattern Analysis (classifies the GI in morphological components). The identification of areas for mitigation measures is based on two Cluster analyses, respectively done at the Settlement and Protected Area level.

Transportation network acting as a fragmenting element reduced the size of the biggest patches by 28.9%. Respectively 6 and 4 connectivity profiles were identified for settlements and Natura 2000 sites. Among the Natura 2000 sites in Lower Saxony, 45.7% terrestrial sites are impacted by a threat linked to connectivity. The clustering method coupled with more specific filters allows to select areas where tailored mitigation actions could be implemented. Mitigation actions were identified according to the IUCN mitigation hierarchy. This methodology allows for

status, trend, and scenario-based analyses. It can be implemented in a multi-scale perspective and can be part of restoration plans or protected areas management effectiveness assessments.

Keywords: Sustainable landscape management, protected areas effectiveness management , connectivity measures, spatial modelling

13. Enhanced logic chains based on value parameters. An application to the economic valuation of ecosystem services at mediterranean forests

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Even though SEEA-EA generic logic chains may be considered an important step forward, connecting ecosystems with well-being, they may fall short for operative goals, especially for the systematic collection of data, decision making, or benefit transfer. Instead, we advocate the use of enhanced value chains that conduct from Nature to net benefits and net economic value focusing on value connections, based on value parameters that are observable, can be measured, and whose effects can be assessed by way of the statistical estimation of a suitable value function. This establishes a common procedure that allows to focus on the set of building blocks of value, including attributes such as productivity, uniqueness, resilience, and condition.

The application of this procedure is eased by the adoption of a structured data collection model in which value parameters are collected for each combination ecosystem service – ecosystem, proxy variables are collected for each value parameter, and reported effects are collected for each proxy variable. Condition variables are considered as value parameters, with an upstream reference to ecosystems to account for possible diversities and downstream to proxy variables and their effects. The consideration of proxy variables separated from value parameters as the general case is very convenient for condition indicators and allows to keep a common structure for all sort of approaches, including benefit transfer. The model is presented from a theoretical standpoint, and then applied to the economic valuation of ecosystem services at five sites of mediterranean forest located in Spain.

Keywords: SEEA-EA logic chains, enhanced logic chains, value parameters, mediterranean forest