Poster Book of Abtracts

I. Biome Working Group Posters

1. Poster abstract

B. Biome Working Group sessions: B1a Advancing methods in marine ecosystem services quantification, mapping and modeling

Establishing System Dynamics Model for Linking DPSIR and Marine Ecosystem Services: A case study on Marine Sand Mining in the Republic of Korea

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An Ecosystem-based Marine Spatial Planning (MSP) in Republic of Korea has been recently launched for the sustainable use of marine ecosystem services (MES) by preventing reckless development and resolving conflicts over marine space. A technical tool to comprehensively assess human activities and their impact on changes of MES can improve the effectiveness of decision-making in MSP. Comprised of five components including Driving forces, Pressures, State, Impacts and Responses, DPSIR framework is an appropriate conceptual framework for integrated assessment as it is of help to investigation into interactions between human activities and MES changes. While several researches on links between DPSIR and MES have been conducted, actual research findings are yet insufficient due to poor data and information on complicated causality between human actions and their impact on MES. Addressing the causality would be integral part in connecting DPSIR and MES, and in MSP decision-making process, accordingly.

The purpose of this study is to design a DPSIR-based ecosystem services assessment using System Dynamics model as one of decision-making support tools for development and exploitation of marine resources and spaces. The sand mining in offshore area including EEZs is widely known to make impact on provisioning, cultural and supporting services of marine ecosystem. We suggest the DPSIR-MES system dynamics model on marine sand mining, a very controversial issue of marine management in Korea. The dynamics model is expected to

provide better understanding of quantitative changes on marine ecosystem and its services, and effective decision-making measures based on cost-benefit analysis.

Keywords: DPSIR, System Dynamics Model, Marine Ecosystem Services Assessment, Marine Spatial Planning, Marine sand mining

2. *Poster abstract*

B. Biome Working Group sessions: B1a Advancing methods in marine ecosystem services quantification, mapping and modeling

Designing Marine Ecosystem Services-based Decision Making Support System in Korea

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The Korean government enacted the Marine Spatial Planning and Management Act in April 2018. Based on the act, the Korean government has prepared and established marine spatial plans for sea waters of coastal provinces and EEZs. In the meantime, ecosystem-based approach draws more attention in spatial planning and management, the government has launched a research project named 'Marine Ecosystem Service-based Spatial Analysis and its Application to Marine Spatial Planning' since 2017. The project aims to develop tools for Marine Ecosystem Services (MES) assessment & valuation and trade-off analysis. One of main pillars of the research is to establish an Integrated Spatial Information System with MES visualization and decision making support modules. Main functions of the system covers mapping of the assessment & valuation results, and simulation of spatiotemporal changes of MES in response to change of human uses.

The system provides visualization of MES and its values on web-based GIS platform. To prevent modifiable areal unit problem in assessment and valuation processes, all data are polygonized or rasterized in a same spatial resolution (0.5 decimal minutes; 900 meters approx.). MES

assessment and its economic values are sorted into four services (provisioning, regulating, supporting and cultural), and integrated.

The decision-making support module adopts the trade-offs system using MES-based cost-benefit analysis, and prediction model to assess change of MES values from change of human activities. In the meantime, societal perspective is incorporated into the system. Spatial conflict map also functions as visualization supporting tool for minimizing users' conflicts by exploring minimum conflict location. Conflict minimization and MES value maximization principle is applied to the decision-making support system.

Keywords: Marine Spatial Planning, Spatial Information Visualization, Decision-making Support System

3. *Poster abstract*

B. Biome Working Group sessions: B1b From the tropics to the poles: assessing marine cultural ecosystem services

Economic valuation of marine cultural ecosystem services from recreational fishing in Korea

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Saltwater fishing is one of the most popular cultural services that people benefit from the use of coastal and marine ecosystems. As recreational fishing has become more popular in Korea recently, there are voices of concerning expected problems such as a decline in fishery resources and increase in fishing trash from anglers. There have been some rules and regulations sporadically used such as minimum sizes and protected periods but monitoring programs are not active in Korea. Anglers have a low level of awareness about these regulations and do not need any qualifications to fish because no effective fishing management system like fishing permit (license) exists in Korea. Fishery resources is an important common good to be managed. Consequently, it is imperative to estimate the economic value of recreational fishing and check whether anglers are supportive of fishing

license through a non-marking valuation method. The purpose of this study is to first estimate the economic values of the non-material benefits of recreational fishing and second visualize these values using GIS mapping ultimately for marine spatial analysis. The data were collected using a face-to-face survey with 721 anglers. The survey questionnaire included the economic valuation question and spatial information questions. We used the contingent valuation method as a non-market valuation tool and both license fee and conservation fund were used as payment vehicles. Diverse economic values were estimated depending on the fishing place, payment vehicle, and respondents' consumptive orientation. These values will be shown on the map as a part of the spatial information for marine spatial planning and management. These results expectedly provide policy implications for the introduction of fishing license system and the more effective management of recreational fishing resources.

Keywords: recreational fishing, economic valuation, marine cultural ecosystem services, contingent valuation method

4. *Poster abstract*

B. Biome Working Group sessions: B1b From the tropics to the poles: assessing marine cultural ecosystem services

Assessment of tourist carrying capacity for sustainability of coral reef ecosystem services in the Western Gulf of Thailand

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Coral reef ecosystems harbor high biodiversity and provide goods and services, particularly provisioning, cultural, regulating, and supporting services. Coral reef-based tourism, especially SCUBA diving and snorkeling, depends upon the ecosystem health. Maintaining coral reef ecosystem services is very important to ensure the sustainability of marine tourism. Scientific knowledge plays a significant role in understanding coral reef ecosystems and how to sustain their ecosystem services. Carrying capacity is one of the management tools for managing human impacts on coral reefs. It can be used as a precautionary measure to prevent

tourism impacts. This study focused on assessing tourism carrying capacity at some coral reefs and underwater pinnacles in the Western Gulf of Thailand, covering psychological carrying capacity, physical carrying capacity, facility carrying capacity and ecological carrying capacity. Our results showed that most study sites have been used for snorkeling while some sites, including Ko Ngam Noi, Ko Lak Ngam, and Hin Pae are SCUBA diving sites. The divers at all study sites felt that the level of congestion varied from low to the medium reflecting that those are still below the psychological carrying capacity. The results also showed that the number of divers at all study sites were still below the physical carrying capacity. The current demand for tourism facilities was still below the facility carrying capacity even in the tourism season reflecting that tourism facilities such as buoys and tourism boats can still support tourism demand. The surveys on ecological carrying capacity revealed that all parameters of seawater quality examination at each study site including temperature, transparency, pH, salinity, dissolved oxygen, floatable oil and grease, and coral health parameters were in normal condition. This study provides baseline information on carrying capacity of some dive sites in Thailand, which is beneficial for coral reef-based tourism management and promotion.

Keywords: coral reef, carrying capacity, ecosystem service, sustainability, Gulf of Thailand

5. *Poster abstract*

B. Biome Working Group sessions: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

Remote technologies for the assessment of habitat provision related ecosystem services in the Nemunas River Delta

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Among the most important ecosystem services in the Nemunas river delta is the habitat provision for migratory waterfowl. These birds use flooded areas for feeding and resting on their way back from wintering areas to breeding grounds. The suitability of this habitat depends on the inundation cycle characteristics. In this study, we reconstruct the temporal

dynamics of spring flood to identify the changes in habitat suitability combining data derived from remote sensing with goose tracking data.

The study area covers the Nemunas Delta Regional Park. The whole territory is globally significant and is designated as Ramsar and Natura 2000 sites. Annual spring flood extends over 200 km2 in the northern part of the Nemunas river delta, while severe floods resulting in a large inundation area (~400-600 km2) occur once every 10-20 years. In this study we used the Synthetic Aperture Radar (SAR) images to identify extent of inundation area during the geese migration period. Additionally, telemetry data of ten White-fronted goose (Anser albifrons) individuals, tracked by GPS/GSM transmitters, were analyzed to provide patterns of their feeding behavior during their stay in the study area.

Results showed that geese mostly used flooded areas during nighttime (80%), while during daytime they preferred non-flooded areas (72%). 61% of whole period geese spent in agricultural lands and 38% in pastures or grasslands. In flooded territories they spent more time in pastures and grasslands (54%) and in agricultural lands (79%) in non-flooded territories. Combining both GPS tracking and SAR images, we were able to identify both the habitats used by geese for feeding and roosting in a relationship of their inundation cycle.

Keywords: habitat suitability, inundation, white-fronted geese, telemetry

6. *Poster abstract*

B. Biome Working Group sessions: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

Spatial and temporal influence of invasive halophyte Spartina alterniflora on the food supply service in Ganghwa Island, Korea

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Benthic invertebrates are supported by the salt marsh ecosystem, specifically the characteristics of primary producers such as biomass and diversity. It can be greatly influenced by invasive halophytes resulting in habitat alteration. Invasive halophyte, Spartina alterniflora

has been spread out ca. 31,180 m2 in Ganghwa Island, Korea over the decade since 2008. We focused to assess the invasive halophytes influence on the food supply service comparing by the food utilization of deposit feeders in three sites in the Ganghwa tidal flat: 1) one for Spartina habitat (DM); and 2) others for native halophytes habitat (DG and YC). Stable isotopes of carbon (δ13C) and nitrogen (δ15N) were used to examine the three deposit feeders (Cerithidea ornata, Perinereis aibuhitensis, and Macrophthalmus japonicus) and potential food sources (invasive halophyte S. alterniflora, native halophytes Suaeda japonica and Phragmites australis, particulate organic matter, sediment organic matter, microphytobenthos, and meiofauna) along the seasons in 2018. The deposit feeders showed a narrower δ13C range (−13.69 ± 0.56 ‰) in DM compared to that in native halophytes habitats (YC, −14.35 ± 1.14 ‰; DG, −13.30 ± 1.33 ‰). A cluster analysis based on the isotope values revealed a clear separation of deposit feeders in DM to others, indicating the differentiated diet utilization of them in DM. An isotopic mixing model revealed the highest dietary contribution of the S. alterniflora, which was seasonally resulted from growth of it in DM. In contrast, both microphytobenthos and meiofauna were significant food sources in the native halophytes habitats. The smaller dietary contributions of native halophytes back supported that the three deposit feeders might more actively utilize the invasive S. alterniflora in Ganghwa. Overall, our study indicates that habitat alterations by invasion of new halophyte species might lead to change in food supply service of salt marsh ecosystem, primarily for deposit feeders.

Keywords: Salt marshes, microphytobenthos, meiofauna, Spartina alterniflora, stable isotopes

7. Poster abstract

B. Biome Working Group sessions: B2a Ecosystem services assessment methods for riverine and wetland ecosystems

Integrating River Regulating Ecosystem Services In Urdaibai Biosphere Reserve

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Aquatic ecosystems are key ecosystem to provide multiple ecosystems services (ES). In the case of rivers, there is a need of application for an ES framework in an integrated manner at river basin scale. The objective was to assess regulating services in a small catchment and to provide an integrative assessment for future management actions to promote sustainability in the study area. The evaluation was carried out in the Oka River Basin, a small catchment of 220 km2 situated in the Basque Country (North Spain). Additionally, this basin is inside the Urdaibai Biosphere Reserve. Four relevant ES were evaluated and mapped within the river systems: habitat maintenance and quality, nutrient depuration, erosion prevention and flood protection. Several indicators that determine ecological status where obtained from developed indexes and metrics within the Water Framework Directive (WFD), including those that assess the biological (macroinvertebrates, fish, phytobenthos and macrophytes), hydromorphological (riparian forest, ecological flows) and chemical status. Other indicators were obtained either from the literature or proposed by the authors using GIS databases available in the study area to assess the main biophysical characteristics of the rivers. The results showed that several pressures and their impacts, together with land use practices may compromise the ES natural capacity of the rivers. Main land uses were coniferous plantations and farming (including agriculture and cattle rearing). Natural forest surface was positively related with the riparian forest, phytobenthos and macrophytes quality metrics; whereas artificial surface was negatively related with macroinvertebrate and physicochemical quality metrics. Nutrient and organic enrichment in waters increased with artificial and farming surfaces, as well as hydromorphological alterations increased with artificial surfaces in river sections. This type of work is of high relevance to achieve Sustainable Development Goals by 2030 related with fluvial ecosystems, as well as WFD River Basin Management Plans by 2027.

Keywords: fluvial ecosystems, riparian forest, nitrogen, land use, management

8. Abstract

B. Biome Working Group sessions: B3 Semi-natural forests and forest plantations: ecosystem services and trade-offs in the face of land use and climate change

Under the pine: understanding trade-offs in ecosystem services of forest plantations in Indonesia

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Land tenure and access rights surrounding state forestry plantations in Indonesia are complex, and often depend upon plantation type and past informal agreements. Pine production forests are found across Java, but have been little studied in an ecosystem services context. Many of them consist of “state owned pine: smallholder coffee” agroforestry systems where, in return for tapping the pine resin, villagers were allowed to grow understorey crops on their plot.

Under the rise of social forestry policies, management of forest plantations in Indonesia is undergoing change. Combined with global fluctuations in the demand for timber and non-timber forest products, such as the decline in pine resin, there is uncertainty regarding the future management of this pine and coffee agroforestry system. In this study, we explore a range of future options for pine production forests and the implications on ecosystem services. Using InVEST tools to model services of; carbon storage, soil retention, water purification, water yield, habitat risk, and pollinator abundance with additional methods to model product provision, we investigate the scenarios of:

- Maintaining and formally expanding current pine-coffee agroforestry systems
- Converting pine production forests to agricultural crops
- Reforesting pine production forests with natural vegetation
- Replacing pine production forests with alternative plantations of rubber, oil palm or acacia

The outcomes of this work will inform policy on management of pine production forests to enable sustainable socio-economic growth.

Keywords: social forestry policy, agroforestry, trade-offs, carbon storage, land use change

9. Poster abstract

B. Biome Working Group sessions: B3 Semi-natural forests and forest plantations: ecosystem services and trade-offs in the face of land use and climate change

Roles of N-related soil microbial functional groups for services provided by forest ecosystems according to tree species

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Soil processes rely on soil microorganisms and their biodiversity which play important roles in the provisions of different ecosystem services (ES). In particular, N-cycling microbial communities are key biological players for the maintenance of soil fertility, climate regulation, and water purification, and are indirectly involved in biomass production. However, microbial diversity-ES relationships are rarely analysed, and microorganisms are often neglected by stakeholders when taking decision to address environmental issues.

In temperate forest ecosystems, low nitrification rates can occur in stands of particular tree species. We found that nitrification rates under spruce and Nordmann fir plantations and native forest stands were 10- to 1000-fold lower than those under beech, Corsican pine and Douglas fir plantations. The current explanation is that these tree species may have biological nitrification inhibition (BNI) capacity, which corresponds to the production of specific compounds by roots and/or litter that inhibit some nitrifier groups. However, how such tree species influence on nitrification can directly or indirectly determine the level of delivery of multiple ES remains unknown.

In this study, we analysed the effects of 6 BNI or non BNI tree species in pure stands in (i) soil nitrifiers and denitrifiers, (ii) soil physic-chemical characteristics, and (iii) proxies of 4 ES, i.e. water purification, climate regulation, maintenance of soil fertility and wood production. We hypothesized that by minimizing nitrate production, BNI would decrease N-leakage and gaseous N losses through denitrification. This would facilitate soil N build-up by promoting a more closed N cycling, likely with positive consequences for N-related provisioning, supporting and regulating services. Our results demonstrate the role of N-cycling microbial groups for the provision of some ES and allowed us to quantify the synergies or trade-offs between the 4 ES studied.

Keywords: biological nitrification inhibition, forest ecosystem services, water purification, climate regulation, wood production

10. Poster abstract

B. Biome Working Group sessions: B3 Semi-natural forests and forest plantations: ecosystem services and trade-offs in the face of land use and climate change

Climate change impact assessment on the potential area for rubber cultivating in mainland Southeast Asia

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In order to map potential shifts of rubber (Hevea brasiliensis) cultivation as a consequence of the ongoing climate change in mainland Southeast Asia, we applied rule-based classifications to a selection of nine gridded climatic data projections (precipitation and temperature, and global circulation models (GCMs)). These projections were used to form an ensemble model set covering the representative concentration pathways (RCPs) 4.5 and 8.5 of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change at three future time sections: 2030, 2050 and 2070. We used a post classification ensemble formation technique based on a majority outcome of the classification to not only provide an ensemble projection but also to spatially track and weight the disagreements between the classified GCMs. A similar approach was used to form an ensemble model aggregating the involved climatic factors. The

level of agreement between the ensemble projections and GCM products was assessed for each climatic factor separately, and also at the aggregate level. Shifting zones with high confidence were clustered based on their land use composition, physiographic attributes and proximity. Following the same ensemble formation technique and by setting a 28°C threshold for annual mean temperature, we mapped areas prone to exposure to potentially excessive heat levels. Almost the entire shift projected with high certainty was in the form of expansion, associated with temperature components of climate and temporally limited to the 2030 time window where the total area conducive to rubber cultivation in the mainland Southeast Asia is projected to exceed 50% by 2030 (from 44.3% at the turn of the century). The largest detected cluster (41% of the total shifting area), which also is the most ecologically degraded, corresponds to Northern Vietnam and Guangxi Autonomous Region of China. The area exposed to potentially excessive heat is projected to undergo a 25-fold increase under RCP4.5 by 2030 from 14568 km2 at the baseline.

11. Poster abstract

B. Biome Working Group sessions: B3 Semi-natural forests and forest plantations: ecosystem services and trade-offs in the face of land use and climate change

Forest tree breeding enhances the recreational value of Scots pine stands: case study in Latvia

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Breeding of coniferous trees (Scots pine and Norway spruce) in Fennoscandia and Baltic States had been carried out since the beginning to middle of previous century. Its results are used – plants of these tree species are primarily grown from seed orchard seeds and main regeneration method in most of the region for coniferous trees is planting. Substantial benefit (increase) in wood production have been demonstrated as a result of tree breeding. Selection are primarily made for growth, but also for traits affecting vitality and survival (like frost hardiness, resistance against specific diseases) as well as quality. Aim of our study was to

assess, if breeding of Scots pine had provided a co-benefit for the visual appearance and willingness to visit the stands.

Survey had been carried out for the forest owners across Latvia, including altogether 362 people; 43% women (representative for the ownership structure), independent on their education, age or profession. Pairwise comparisons of pictures representing results of tree breeding for specific trait and the unselected material were carried out. Stands and individual trees at relative young age (30-40 years) and mature age (90-100 years) were included. Pearson's Chi-squared test with simulated p-value (based on 2000 replicates) was used to estimate significance of differences.

Branchiness of young pines had the most notable (and significant) impact on visual appearance: selected pines was preferred by 64%-92% of the respondents when assessing the individual trees and 71%-91% when assessing the stands; they were also preferred as sites to visit for active recreation. Disease resistance was also important: 65% to 87% preferred young trees and stands with no visually detectable loss of vitality. Trees with straight stems were preferred in young stands, but not in mature. Tree breeding in most case has positive influence to visual appearance and willingness to visit Scots pine stands.

Keywords: Pinus sylvestris, breeding, visual quality, recreation benefits

12. Poster abstract

B. Biome Working Group sessions: B3 Semi-natural forests and forest plantations: ecosystem services and trade-offs in the face of land use and climate change

Wild berry occurrence and cover assessment in Latvia`s forests

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Dwarf shrubs in forests provide multiple ecosystem services, including wild berries, nectar and medical plant resources, pollination and biological diversity. Non-timber products have significant socioeconomic value. Utilization and sale of berries and other non-timber

resources creates additional income for many households in Latvia, especially in rural areas. Moreover, gathering of berries is considered an important recreational activity. The total yield of the products fluctuates yearly due to early frosts, temperature and precipitation. To include non-timber resources in the evaluation of ecosystem services, information on their abundance and yield is needed, that is currently little investigated.

We analyzed frequency of occurrence and cover of each non-wood species (bilberry, cowberry, blueberry, cranberry and heather of family Ericaceae, wild strawberry, cloudberry, stone bramble, raspberry, dewberry and bramble of family Rubus) in different forest type groups.

The data were collected in 2017, 2018 in Latvian National Forest Inventory permanent sample plots. All forest types were grouped according to growing conditions – forests on dry mineral soils, forests on wet mineral soils, forests on wet peat soils, forests on drained mineral soils, forests on drained peat soils. Dwarf shrub and other plant cover was described using Braun-Blanquet method.

In Latvian forests the most common non-wood product is berries of the genus Vaccinium – bilberry and cowberry. Bilberry occurred in one third of sample plots. In forests on wet mineral soils bilberry occurred in 39% of the plots. Average cover was 10.6%. Bilberries had flowers or berries in 75% of sample plots where present, compared to 30% in the other four forest types. Similar proportions occurred for cowberry.

Raspberry and heather were also rather common and were recorded in at least 10% of the plots. Other species had high cover only in specific forest types, e.g., cranberry in one fifth of forests on wet peat soils.

Keywords: Dwarf shrubs, berries, forest ecosystems, frequency of occurrence

13. Poster abstract

B. Biome Working Group sessions: B5 Mediterranean socio-ecological systems: integration of methodological approaches to evaluate ecosystem services' dynamics

Ecosystem Emotional Types (EETs) for assessing people-nature connections

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One of the key conclusions of the IPBES global assessment report is the urgent need of incorporating the critical role that culture and identity play in understanding people-nature connections. The diversity of people-nature connections can be beneficial, for example leading to improvements in life style and human health, but also detrimental, for example evoking attitudes and behaviors towards specific types of ecosystems and based on experiences and/or learnings with/in nature negative emotions. However, yet it is not clear which factors drive and explain these beneficial and/or detrimental people-nature connections. Building on the emodiversity concept proposed by Quoidbach et al. (2014) (i.e. variety and relative abundance of the emotions that humans experience), we introduce the Ecosystem Emotional Types (EETs) concept as an interdisciplinary approach to identify and characterize the diversity of emotions and connections towards ecosystems. Using a case study in SE Spain, we conducted a random convenient sampling in 2019 with over 250 residents (including a wide range of age, level of studies and origin of provenance) in the Almeria province, the most arid extreme of Europe. Doing so, we measured people´s propensity to experience positive and/or negative emotions toward representative ecosystems of the region (i.e., high mountain, intermittent stream, wetland, Mediterranean forest, scrublands, protected and non-protected littoral, desert, traditional agriculture, and greenhouses). Results showed that gender, age, and education might drive different attitudes toward ecosystems, which might have important implications for conservation and management of arid/semiarid regions. The EETs concept can serve as a practical previously unidentified metric for assessing the emotional connections between people and nature and could have potential repercussions in the management and selection of new protected natural/cultural areas in the region.

Keywords: Spain, Almeria, nature connectedness, nature's contributions to people, social-ecological relations

14. Poster abstract

B. Biome Working Group sessions: B5 Mediterranean socio-ecological systems: integration of methodological approaches to evaluate ecosystem services' dynamics

The role of stakeholders in identifying social preferences and values: a participatory mapping method of ecosystem services.

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In the Mediterranean basin, tourism is considered one of the main consumers of water and a generator of conflicts, in a context of growing competition for its use and climate change. Most of the studies regarding water consumption by the tourism sector start from a perspective that favors the economic dimension, rarely including social and ecological preferences. The concept of socio-ecological system makes it possible to link the socio-economic dimension of tourism with the ecological dimension of the water resource, thus expressing its dependence on the environmental context. The Muga basin in Catalonia represents an example of a Mediterranean socio-ecosystem, in which the social and environmental dimensions interact continuously. The objective of this communication, therefore, is to present a methodology that allows to capture social preferences, local knowledge, improve the involvement of groups of stakeholders and try to identify potential conflicts related to the use of natural resources, especially water. Therefore, it was decided to use the PPGIS (Public Participatory Geographic Information System) method, which includes mixed techniques such as semi-structured interviews and collaborative cartography, to carry out a socio-cultural assessment of aquatic ecosystem services (ES) in the Muga basin. The cartography of the social values of the various stakeholders is presented, spatially explaining their preferences and analyzing their distribution in the territory.

The expected results make it possible to: a) explore spatially preferences and social values of the stakeholders; b) identify the most vulnerable areas subject to potential conflicts deriving

from divergent priorities among stakeholder groups; c) encourage dialogue between the parties involved in the decision-making process relating to the management of water resources.

Finally, it is highlighted that socio-cultural evaluation techniques, such as participatory mapping of the ES, are indispensable tools for understanding the complexity of ecosystems and implementing appropriate strategies for the management of the territory.

Keywords: Social-ecological systems, Public participation GIS, Ecosystem services mapping, Water, Tourism

15. Poster abstract

B. Biome Working Group sessions: B5 Mediterranean socio-ecological systems: integration of methodological approaches to evaluate ecosystem services' dynamics

Ecosystem services and socio-economic impact study: The case of 'Koshi-Pallourokampos' - a Natura 2000 site

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'Koshi-Pallourokampos', located at the south-east of Cyprus, is an area included in the Natura 2000 network as a Special Protected Area (SPA; code: CY6000009) due to its avifauna importance.

The area has a long history of man-nature interaction, where more than 15,000 people live in nearby communities. As a result, almost half of the 3720 ha of the site is cultivated, livestock facilities are established within and around the site, while more than 12% of the area is subject to extensive afforestation.

Within the framework of the LIFE-FORBIRDS project (co-funded by LIFE programme), the project's socio-economic impact on the site is assessed, and the ecosystem services (ES) are

identified and evaluated. The assessment is based on information collected through the elaboration of a social impact study, as well as data collected through the project and publicly available sources.

For the assessment of ES, the Common International Classification of Ecosystem Services (CICES) was initially used for their identification. The services have been mapped and their distribution in the area is presented in respective maps (using ArcGIS software). Furthermore, the methods proposed in the Toolkit for Ecosystem Service Site-based Assessment Tool (TESSA v.1.4) were implemented for the evaluation of carbon storage (219,959 tons of carbon stored) and global climate regulation (1,310,826 t CO2Eq y-1).

Two questionnaire surveys, with 111 and 125 respondents respectively, showed that community residents feel positively about activities aiming to improve the living conditions of fauna/avifauna. They also show that information and awareness raising campaigns are valuable for improving environmental awareness and sensitivity, while at the same time they view positively conservation activities targeting the protection of the wildlife. Long-term indirect economic benefits extend throughout the region and beyond.

The project implemented an interdisciplinary approach, that included socio-economic and ecosystem services evaluation, along with implementation of concrete conservation activities.

Keywords: ecosystem services, social impact, Koshi-Pallourokampos, Cyprus

16. Poster abstract

B. Biome Working Group sessions: B5 Mediterranean socio-ecological systems: integration of methodological approaches to evaluate ecosystem services' dynamics

Methods of identification, spatialization and evaluation of ecosystem services in the Mediterranean: Case of the Ouled Hannèche Forest (Algeria)

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Evaluation of ecosystem services (ES) requires to identify them first. The lack of prior data on the potential of forest ecosystems and the particular and complex relationship between society and the forest in Algeria led us to carry out this work to:

- Understand the relationship established between the forest and all actors in society (managers, decision-makers, users and non-users).

-Distinguish the types, spatial distribution and evolutions of the goods provided by this forest.

We have applied to the case of the Ouled Hannèche forest an approach of spatialization of ecosystem services and survey techniques. Field surveys to study forest biodiversity, will be used to map vegetation and land use using Geographic Information System tools.

The survey assessed the ecosystem services of this forest qualitatively. Questionnaires and interviews were conducted with different stakeholders to identify users, uses and products recovered from the forest. Mental maps have been used to understand how this forest is perceived by its stakeholders.

Our results show that the perception as well as the uses of the forest have evolved in space and time. We distinguish four periods:

- Before 1962: the forest, place closed and forbidden to users.

- Between 1962 and 1990: the forest, extension of the life of the residents and source of their energy and their means of subsistence.

- From 1990 to 2000: the forest, a place of insecurity

- In the end, from the 2000s: the forest, open space for new uses (tourism, recreation, hunting, studies, gathering of medicinal plants).

Today the educational, cultural and leisure roles are much more important than the traditional roles of the forest.

The cultural ecosystem services of the Ouled Hannèche Forest have only been assessed through a qualitative assessment. Their economic evaluation is yet to be studied and discussed with scientists and stakeholders.

Keywords: Mediterranean forest, mental map, qualitative assessment method, GIS, ecosystem services

17. Poster abstract

B. Biome Working Group sessions: B5 Mediterranean socio-ecological systems: integration of methodological approaches to evaluate ecosystem services' dynamics

Climate influence in primary production as indicator of Iberian ecosystems risks

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Primary production of vegetation, assessed through both net primary production and carbon use efficiency, has been used as a proxy in the assessment of a number of Ecosystem Services (ES), due to its role in the maintenance of ecosystem functions and processes which are critical to ES supply. In this frame, the use of remote sensed data can be used for monitoring at

extensive spatio-temporal scales, allowing for the quantification of changes in ecosystems and providing data to estimate their resilience capacity in future climate change scenarios.

This study aims to analyse the resilience capacity of several forest ecosystems in the Iberian Peninsula which will be affected or compromised by climate change processes, especially in Mediterranean climate areas. Such processes are analysed through several variables including annual mean value variations and extreme events such as drought or heavy precipitation. To represent forest ecosystems, a group of species with different ecological traits and strategies are selected, for which the evolution of gross primary production and net primary production, as well as the carbon use efficiency (CUE), are determined from remote sensing acquired data.

Keywords: Carbon use efficiency, Climate, Ecosystem resilience, Net primary production, Remote sensing

18. Poster abstract

B. Biome Working Group sessions: B5 Mediterranean socio-ecological systems: integration of methodological approaches to evaluate ecosystem services' dynamics

Local knowledge about the ecological sustainability of wild plant gathering in Lemnos island, Greece

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Countries surrounding the Mediterranean show rich biocultural diversity and gathering and using uncultivated, wild growing plant species is an appreciated ecosystem service and integral element of the cultures in the region. Still, wild plant gathering is heavily contested since unsustainable gathering practices and commercial gathering are blamed to degrade ecosystems. In this study, we aimed to feed this discussion through understanding how gatherers take into account ecological sustainability of plant species when gathering. The study was conducted on the island of Lemnos, Greece, in July and August 2018. After identifying sixteen harvesters knowledgeable about gathering and use of wild medicinal plants through snowball sampling, we interviewed them with semi-structured interviews and did

participant observation during seven of their harvesting walks. Data from both methods was integrated through qualitative content analysis. Local medicinal plant harvesters considered the sustainability of their practices when planning their harvests, choosing harvesting sites and when harvesting plant species. These considerations were usually no rigid rules but general guidelines that were evaluated by harvesters based on population development and maturity status of plant species or harvesting site characteristics. The harvesters reported a decreased availability for certain plant species because of increased human population density and use popularity, uprooting and overharvesting, intensified farming and changes in land use and climate. Local knowledge varies considerably between harvesters, whereas a wide range of measures for ecologically sustainable gathering were considered altogether. Harvesting is reported as detrimental especially in cases where unexperienced harvesters start harvesting as a new activity, although the most relevant factors constraining ecological sustainability of harvesting are external to harvesting practices. As a next step, integration of our results with targeted plant growth and distribution evaluations could yield comprehensive accounts about the resource status of wild medicinal plant species in the local ecosystem.

Keywords: Ethnobotany, Foraging, Medicinal and Aromatic Plants, Non-Timber Forest Products, Traditional Knowledge

19. Poster abstract

B. Biome Working Group sessions: B5 Mediterranean socio-ecological systems: integration of methodological approaches to evaluate ecosystem services' dynamics

Mapping ecosystem services for Guadalupe sub-basin, Baja California, México

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The absence of perceivable water has generated the imaginary collective thought that arid environments are not productive. In these ecosystems, aquifers are the main source of supply.

Therefore, an integral subterranean water-management approach that is inclusive of biophysical, social and economic aspects is fundamental.

The Guadalupe sub-basin is a semiarid water system within mediterranean type of climate located in the Mexican state of Baja California. Agriculture is the main economic activity, distinguishing the valleys of Guadalupe and Ojos Negros with the production of wine, olives and olive oil, vegetables, some citric fruits, fodder crops and free-range cattle. In the upper region of the sub-basin the forest is protected. Ecotourism is practiced throughout the basin, from the National Park, the chaparrales' landscape around the vineyards and in the beaches and wetlands down by the sea. Despite the fact that the middle part of the basin, the most productive one, is ruled under the guidelines of three regional planning instruments, the basin is not understood as a socio-ecological functional unit.

Dissemintion of ecosystem services could help residents, tourists and decision-makers to understand the ecosystem units links and complexity of the sub-basin itself. This research addresses the identification, location and analysis of ecosystem services in the Guadalupe sub-basin utilizing a socioecological approach. This will enable prioritization of those services and will depict the unperceived productivity of arid environments.

Keywords: semiarid basin, socioecological system, flow of ecosystem services

20. Poster abstract

B. Biome Working Group sessions: B5 Mediterranean socio-ecological systems: integration of methodological approaches to evaluate ecosystem services' dynamics

Progress in Cultural Ecosystem Services assessment in Greece's Protected Areas

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Understanding Cultural Ecosystem Services (CES) is important especially in sites where cultural landscapes dominate. CES are generally poorly inventoried, assessed or mapped in the Mediterranean; in some countries there are severe data-deficiency problems and little

incentive to promote these analyses even within protected areas (PAs). Here we present progress in our work in Greece. Since early 2018, Greece has expanded its Natura 2000 protected area network and new management measures are being developed, including new zonation schmes and reforms to the management bodies. Priorities in Natura 2000 sites concentrate on protected species and habitat types, while conserving cultural attributes, especially at the landscape scale, has lagged behind. The cultural values, benefits and services provided by these PAs should support efficient and effective management reforms. Our assessment resulted in indicator development and state-wide analyses of all terrestrial Natura 2000 sites. The indicator attributes include five categories: a) culture and heritage, b) nature-based education and scientific value, c) outdoor recreation and tourism, d) aesthetic values, and e) spiritual and religious values. Indicators range from codifying specialized interests provided by ecosystems (e.g. sacred natural sites, "mythical landscapes" etc.) and the use of characterization proxies (e.g. blue-flag beach designations, birding hotspots etc.). GIS analysis produced heat maps and hotspots complementing a prioritization procedure that assists in highlighting the cultural ecosystem services at different spatial scales. In combination with protected area characterizations that rank sites, we introduce the importance of referring both to wilderness and so-called "culturalness" values. Cultural services approaches for valuing nature and landscapes need to be better implemented in PAs especially to assist decision making at site, region and state-wide scales. Finally, the importance of CES assessments for planning and defining "future desired states" in protected areas is provided through case-study examples.

Keywords: Cultural Ecosystem Services, assessment, protected areas, Natura 2000, cultural attributes

21. Poster abstract

B. Biome Working Group sessions: B8 Scoping with global changes in mountain and arctic socio-ecological systems

What drives the future supply of ecosystem services in a mountain landscape?

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Future goods and services of mountain grassland and forests depend on their resilience facing land-use changes and accelerating climate change. Here, our objectives were (i) to quantify changes in six ecosystem services (ES) and their resilience under three socio-economic scenarios in grasslands, (ii) to quantify the future regulating service provisioning of forests and (ii) to assess the relative importance of management, climate, and natural disturbances on the future supply of ecosystem services for the Stubai valley landscape in Tyrol, Austria. Especially at high altitudes, a reduced management intensity leads to lower levels of provisioning services in grasslands but improved regulating services. Whereas land-use changes seem currently to decelerate, changes in land cover can still be expected in the future due to natural reforestation processes on abandoned grassland, causing a shift to forest-related services. Our results show that unmanaged forests are efficient in providing regulating ecosystem services. Overall, climate change had a stronger effect on the future supply of regulating services than management and natural disturbances in forests. Both climate regulation and erosion regulation were higher in unmanaged forest systems compared to systems under current best practice management. This finding highlights that ecosystem management could be severely stymied in the future if no decisive actions to mitigate climate change are taken. An improved quantitative understanding of the drivers of future ecosystem service supply is needed to more effectively combine targeted management efforts and natural ecosystem dynamics towards sustaining the benefits societies derive from mountain ecosystems in a rapidly changing world.

Keywords: land-use change, climate change, mountain grasslands and forests, socio-economic scenarios, European Alps

22. Poster abstract

B. Biome Working Group sessions: B9 Governance of ecosystem services contributing to rural-urban synergies, bridging science and decision-making

Integrating Ecosystem Services Into Regional and Urban Planning – Perceptions of Local Planners and Decision-Makers

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Regional and urban planning increasingly has to take into account the effects of climate change and biodiversity loss. For tackling the challenge of preserving biodiversity in urban regions the ecosystem services approach is recognized as an appropriate concept within the academic discourse. At present, regional and urban planning practices remain rather detached from this body of knowledge. To bridge this gap between science and practice the research project OESKKIP examines the integration of ecosystem services into cross-sectional regional and urban planning in two German case study regions: the urban region of Munich, Bavaria, and the urban region of Rostock, Mecklenburg-Western Pomerania.

The main research focus is to identify points of reference for linking the ecosystem services approach to existing formal and informal planning as well as governance processes. By collaborating with actors operating in local and regional planning, inter- and transdisciplinary communication and cooperation ensures the administrative and societal anchoring of the projects research.

This poster elaborates on results of two stakeholder workshops which were carried out within the two case study regions examining the perceptions of regional actors regarding the integration of the ecosystem services approach in regional and urban planning.

Results show that for regional stakeholders the concept of ecosystem services corresponds widely to the concept of sustainable development and can be applied as an instrument for supporting communication and awareness-raising among practitioners and the public, particularly within rural-urban functional systems. Although the connectivity of ecosystem services to existing legal planning practices is perceived as major challenge by regional

stakeholders, they evaluate the concept as suitable for an integrated and coequal consideration of diverse interests due to its objective and transparent character.

OESKKIP stands for "Ecosystem Services of Urban Regions – Mapping, Communicating, and Integrating into Planning to conserve biodiversity during a changing climate".

Keywords: ecosystem services, governance, regional planning, urban planning, perception, communication, decision-making

23. Poster abstract

B. Biome Working Group sessions: B10a Urban ecosystem services: dynamics, complexities, and challenges for sustainable urban development

Urban tree design for the cooling of cities

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Heat waves are one of the most dangerous extreme weather events, with impact on public health, and indirectly with increases in morbidity and mortality. In general, these events tend to be more severe in urban areas, due to the "island heat effect". It originates mainly because cities have a greater proportion of impermeable ground and of residual heat due to human activities. Strategies to mitigate the effect of urban heat island usually involve measures such as increasing the use of permeable pavements, or the presence of water bodies or vegetation to create shade and refresh the environment. Due to increasingly evident effects of climate change, Bilbao (Basque Country), like other cities, faces the challenge of generating knowledge that facilitates its transition to an adapted and resilient city. The aim of the study was to determine the main characteristics of the urban green areas that help to reduce the temperature in the city at the level of urban design and planning. For this, different characteristics of trees have been analyzed (structure, leaf area index (LAI), specie, distance

to buildings, tree crowns connected or unconnected, tree in soil or artificial soil) to determine their relationship with temperature reduction. The results indicate that tree LAI, the structure of the trees and the distance to the buildings showed a positive relationship with the reduction of the temperature. In addition, it was observed that tree species and the connection of their crowns also influenced the temperature of the environment. In conclusion, tree characteristics and location need to be taken into account when designing an urban tree plans and choose those that help to promote cooling in urban environments to reduce island heat effect.

Keywords: Bilbao, Temperature reduction, Tree species, LAI, Tree structure

24. Abstract

B. Biome Working Group sessions: B10a Urban ecosystem services: dynamics, complexities, and challenges for sustainable urban development

Expanding Agenda Setting of "Sustainability" in the Study of Urban Ecosystem Services

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Pressing stress of urbanization on urban ecosystem services (UES) has harnessed the attention of UN SDG 11 on sustainable city while alerting other policy makers at regional or municipality level. Yet how scientific community can support or propel cities to make critical future sustainability transition remained unclear. To provide partial answer, this study conducted a systematic literature review of 203 urban ecosystem services focused peer-reviewed papers and proposed a "transition management scale" to evaluate the performance of extant UES researches in terms of 1) new analytical tool provision, 2) ability to re-orientate problem of sustainability, 3) policy recommendation and 4) action.

The results showed an expanding agenda setting of "sustainability" in the study of UES and revealed gaps in academic landscape, in particular in area of politico-ecological approach and action research. Most importantly, the main purpose of this systematic literature review goes beyond quantitative or qualitative synthesis of existing UES studies. The paper wishes to remind future UES scholars the pivotal role of their agenda setting ability to shape and limit

how public sector, business community and general public can think what the cities can do or not do in the years to come. Boundary crossing will be essential for future UES researches to engage transdisciplinary team and non-expert to create societal learning space to furnish cities the abilities and opportunities to make real-world sustainability transition.

Keywords: urban ecosystem services, agenda setting, social-technological, social-ecological, politico-ecological

25. Poster abstract

B. Biome Working Group sessions: B10a Urban ecosystem services: dynamics, complexities, and challenges for sustainable urban development

Citizens perception of the ecosystem services provided by urban ponds across Europe

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Urban ponds are important elements of urban infrastructure. The study of these water masses from an ecological perspective must be bound to the social needs and perception of citizens. Ecosystem Service studies on urban ponds are scarce, while attention to their ecological functions is increasing. Freshwater primary producers (algae and macrophytes) play a key role by converting inorganic carbon and nutrients to organic forms and by fueling the food web.

In urban ponds, these primary producers are subject to several anthropogenic environmental stressors that affect their ecosystem functioning. Alterations in primary producers community could change the ecological status and the ecosystem service potential of the urban ponds. These alterations can change visually perceptible characteristics of urban ponds and impact the citizen´s perception of the ecosystem services that the urban ponds provide them. We hypothesize that a good ecological status of urban ponds will be reflected by a high valuation of their ecosystem services.

The Urban Algae project (FreshProject2.0) investigates the link between public perception of ecosystem services provided by urban ponds and their ecological status. FreshProject2.0 is a joint initiative by the European Federation of Freshwater Sciences board, the European Fresh and Young Researchers and representatives of the Fresh Blood for Fresh Water meetings, aiming to foster interdisciplinary collaboration among young scientists. Within the project, 56 urban ponds were sampled across Europe to assess their functioning and ecosystem services. Furthermore, an online survey was developed to assess public perception of ecosystem services of ponds. During the conference, preliminary results will be presented.

Keywords: urban ponds, public perception, urban ecosystem services, fresh water ecosystem services

26. Poster abstract

B. Biome Working Group sessions: B10a Urban ecosystem services: dynamics, complexities, and challenges for sustainable urban development

How to preserve BiodiverCities under the pressure of infill development – The cities of Helsinki, Espoo and Vantaa, Finland

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The Helsinki Metropolitan Area consists of the cities of Helsinki, Espoo, Vantaa and Kauniainen. It is located in the south coast of Finland on the shore of the Baltic Sea. The Metropolitan Area covers 772 km2 and contains a total population of approximately . million.

With about 9% of the country's population in just 0.2% of its surface area, the housing density of the area is high by Finnish standards. Despite the intensity of land use, the area also has large recreational areas and green spaces.

The main policy question in the cities of Helsinki, Espoo and Vantaa is how to accommodate to the constantly growing population and the consequential continuous need for construction in a sustainable way. The current urban development policy in the area is to avoid urban sprawl and place new construction inside the dense urban structure. This infill development often takes place in green space and thus the challenge is how to place it in a way that does not critically harm biodiversity, the condition of ecosystems, ecosystem functioning and provision of ecosystem services.

To support the spatial planners and environmental officials trying to make the optimum solutions, we collaborated with them in the European Commission's EnRoute project (Maes et al. 209) in testing the previously developed urban MAES indicators. We selected the most relevant ones and applied them in a spatially explicit way using GIS. A special focus was given to pollination potential mapping which had never been done before in Finnish cities. We tested several methods and developed one further to provide as fine-scale information as possible. Researchers specialized in pollinators supported the method development with their deep knowledge on Finnish pollinators and habitats suitable for their nesting and foraging. Close collaboration with the city stakeholders played a crucial role throughout the project.

Reference

Maes, J., Zulian, G., Günther, S., Thijssen, M., Raynal, J. 209. Enhancing Resilience Of Urban Ecosystems through Green Infrastructure (EnRoute). Final Report. JRC Technical Reports, EUR 29630 EN, Publications Office of the European Union, Luxembourg. doi:0.2760/602928, JRC5375.

Keywords: Urban biodiversity, ecosystem services, MAES, indicators, pollination

27. Abstract

B. Biome Working Group sessions: B10b Nature-based solutions for enhancing sustainability and urban ecosystem services

Ecosystem services of private gardens – the overlooked contribution to resilient and sustainable cities

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Globally cities are experiencing sustainability challenges related to increasing urbanisation and climate change. Urban green space contribute to human health and wellbeing, flood and heat mitigation and biodiversity conservation. So far, science has mainly focused on public green space (e.g. parks), overlooking the contribution of private green space (e.g. private gardens). This despite, that such space often make up a significant part of the total urban green space, and is the basis for nature experiences for many citizens.

This interdisciplinary study explores how gardens owners use and perceive their gardens (i.e. cultural ecosystem services for human health and wellbeing), and how garden characteristics influence the potential of climate change adaptation and biodiversity conservation. We used a mixed method approach, combining interviews and garden land-use mapping, including 35 gardens, in the city of Lund, Sweden. Data is analysed in relation to age, gender and garden size.

Many garden owners described their garden as an "extra room", were they could interact socially, recreate, experience nature and relax. The vegetation cover and structure, and the presence of small-scale biodiversity features were positively related to garden size. The design of the garden was governed by garden owner's plant 'trait' preferences (e.g. aesthetic and edibility) and hindering factors such as weeds, lack of time and the local condition of the garden. Promoting biodiversity conservation was not an important factor in relation to plant choice. Age and gender influenced the results.

In conclusion, private gardens are important spaces for human health and wellbeing. However, the concurrent planning ideal 'densification' may reduce the contribution of private gardens

to resilient and sustainable cities, as it leads to smaller and less green gardens. This highlight the need to better consider the potential value of private gardens in urban green space governance. This includes challenging existing norms and practises.

Keywords: Gardens, cultural ecosystem services, green space, urban planning, resilient cities

28. Poster abstract

B. Biome Working Group sessions: B10b Nature-based solutions for enhancing sustainability and urban ecosystem services

Urban green area provides refuge for native small mammal biodiversity in a rapidly expanding city in Ghana

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Urbanization is a key driver of global biodiversity loss. Although sub-Saharan African countries are experiencing unprecedented urbanization, very little is known about how this affects tropical biodiversity and its associated ecosystem services. Here, we assessed the effects of urbanization and urban green space on local small mammals in Accra, Ghana. We surveyed small mammals in the University of Ghana botanical garden, an urban green area (UGA) and adjoining built-up environment (BE) and compared the results with baseline data (BLD) collected when large areas of the current city remained mostly undeveloped. Our data showed higher small mammal diversity and abundance in the UGA than BE. The similarity of species composition was higher between UGA and BLD than between BE and BLD. The small mammal species captured in BE (the rodents Mastomys erythroleucus, Rattus rattus, and Arvicanthis rufinus, and the shrew Crocidura olivieri) are known to easily adapt to human-modified landscapes. Our results suggest that urbanization negatively influenced the abundance, diversity, and community composition of small mammals. Efforts should be directed towards the integration of urban green areas into urban land development planning in developing countries in order to conserve local wildlife and ecological services that enhance the quality of urban life.

Keywords: Accra Plains, anthropophilic species, biotic homogenization, urban biodiversity, urban green space

29. Poster abstract

B. Biome Working Group sessions: B10b Nature-based solutions for enhancing sustainability and urban ecosystem services

Communicating the ecological value of private gardens

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Private gardens make up large parts of urban green. In contrast to public green spaces, planning and management usually occurs uncoordinated and independent of municipal planning and management strategies. Therefore, the potential of private gardens for providing ecosystem services and habitat, and for functioning as corridors for wildlife, is not fully utilized. While more public knowledge on gardens would be needed for planning and management strategies that include them, gardeners could probably be nudged into improving habitat quality or managing their gardens for improved provision of ecosystem services. In order to address both issues, we developed a GIS-based web application for the city of Braunschweig, Germany: the 'GardenApp.' We used remote sensing data to delineate vegetation heights at one-meter resolution, which are the basis for calculating ecosystem services like carbon storage and cooling, as well as the vegetation structure of the garden. Users of the app have to outline their garden on a web-map and fill in a questionnaire on biodiversity-relevant management practices we derived from the literature. They are also asked about observations of well recognizable species groups in their gardens. As an output, the gardeners are provided with an estimate of the ecosystem services their garden provides, and with a biodiversity estimation. To highlight the potential role of the garden as a wildlife corridor, the gardeners are also provided with results from connectivity modelling for Red Squirrels (Sciurus vulgaris) and the European hedgehogs (Erinaceus europaeus). In return, their observations are used to assess the quality of the connectivity models. We show results in terms of what we have learned from development and application of the GardenApp and give an outlook on the potential of web-applications for urban sustainability and conservation.

Keywords: garden, urban green, connectivity, web-based GIS platform

30. Poster abstract

B. Biome Working Group sessions: B10b Nature-based solutions for enhancing sustainability and urban ecosystem services

Building scarcity pricing in urban sustainable water management

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Water management is one of the main issues in the water policy agenda. More than a quarter of the world's population will experience severe water scarcity. Although there is board agreement on the importance of incorporating the concept of scarcity into water management strategies and decision making, the lack of a standardized approach to embedding water scarcity has hindered progress in this direction. In recent years, pricing household water has been proposed as a tool for managing water scarcity in a national context. The objective of this work is to design a water pricing model that better signals the value of water scarcity by considering water supply and demand at the same time. The proposed scarcity-based pricing model focuses on the variable component of the tariff and follows an increasing block strategy. By calculating the supply, demand, and budget of water resources in northern Taiwan, this study also determines the visible spatial distribution of water scarcity. The results show that both the supply and demand of water resources changed considerably under three scenarios, namely, low rainfall, average rainfall, and extreme rainfall. This demonstration illustrates a pathway for the implementation of a proposed scarcity-based pricing policy as a signal for users to adjust their water consumption in a proactive manner.

Keywords: water price, ecosystem services, integrated valuation of ecosystem services and tradeoffs (InVEST), water scarcity, supply and demand

31. Poster abstract

B. Biome Working Group sessions: B10d Urban green infrastructure: factors shaping urban ecosystem services and disservices

Towards a Greener and more Livable Paramaribo: the role of urban green space in a tropical South American city

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Worldwide there is growing evidence on ecosystem services provided by urban green spaces (UGS). As most studies originate from developed countries in subtropical or temperate climates, further research is necessary on the role of UGS in tropical cities in low and middle income countries. Cities in the tropics not only differ in climate and ecology, but also in demography, economic development, culture and lifestyles, and hence, the demand for ecosystem services and management implications of UGS. In addition, while literature suggests there is a cooling effect from UGS, less is known about the extent of this cooling effect and how for example the urban heat island effect manifests itself in tropical cities.

This study is part of a project that aims to enhance the supply of ecosystem services from UGS in Paramaribo for a greener and more livable city. Paramaribo is the capital of Suriname, in the humid tropics of South America, and contains about three hundred thousand inhabitants. Poor policies for UGS are clearly visible by the lack of public recreational spaces and replacement of UGS by concrete and sealed soils.

The focus of the study is on) mapping different types of UGS in Paramaribo, 2) quantifying their cooling effect, and determining the urban heat island effect, 3) mapping the supply and demand of selected ecosystem services and 4) gather insights on the perceptions of urban ecosystem services considering factors such as lifestyle and socio-economic status.

The results of this study will contribute to improved understanding and awareness of local actors and policy makers on the role of UGS in Paramaribo. By involving these local actors and policy-makers through-out the project we aim to contribute to improved urban policies and planning in Paramaribo.

Keywords: Urban Green Space, Ecosystem Services, Urban Heat Island effect, Tropical Climate

32. Poster abstract

B. Biome Working Group sessions: B10d Urban green infrastructure: factors shaping urban ecosystem services and disservices

What characteristics influence the social perception about ecosystem services in green infrastructures?

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Knowing the perception that society has about the ecosystem services (ES) is fundamental to develop sustainable management strategies that benefit both society and environment. There are often disconnects between the ES defined and measured by scientists and those that are realized and appreciated by the society. The aim of this study was to analyze the perception about ES that users of the green infrastructure (GI) in the Basque Country have at different scales (Greenbelts of cities and peri-urban parks) across geographic and socio-demographic contexts and to analyze if gender influences in their perception. Surveys had been carried out in the Greenbelts of Bilbao and Vitoria-Gasteiz (and 0 interviews, respectively), and periurban parks (Salburua wetland (Vitoria-Gasteiz): 29 interviews; Ulia Mountain (Donostia): 254 interviews; Zalla (Biscay): 00 interviews), where responders were asked to identify the ES that the GI supplied to them, and subsequently, to rate them from to 5. The results indicate that in all cases cultural ES (recreation and aesthetic value) were the most identified and valued ES by users, while regulatory ES were more difficult to identify. The most identified and valued regulation ES at both scales were air quality and regulation of climate, while the value of biodiversity maintenance depends on the location of each GI. In the Greenbelt of Vitoria-

Gasteiz more users than in Bilbao identified the biodiversity maintenance ES. It is worth mentioning that at periurban park scale women valued ES more than men, especially regulation ES. In conclusion, it is necessary to enhance awareness of public perceptions regarding regulatory ES carrying out a strong environmental education campaign in these areas to put in value their importance for the well-being of people and consider gender when designing it.

Keywords: Gender, Surveys, Greenbelts, Periurban parks, Cultural ecosystem services

33. Poster abstract

B. Biome Working Group sessions: B10d Urban green infrastructure: factors shaping urban ecosystem services and disservices

A review on Urban Green and Blue Infrastructures and their Ecosystem services and Disservices – Navigating through troubled waters

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Strategically planned Urban Green and Blue Infrastructures (UGBI), which can include Nature Based Solutions (NBS), can be designed and installed in cities to deliver a wide range of Ecosystem Services (ES). Enhancing ES is particularly relevant when urban population worldwide is expected to reach almost 70% of the total population by 2050 (UN-DESA, 208).

UGBI are often designed to address specific ES, but provide a wider range of services, relevant to address urban sustainability and resilience to climate change. As different technical and scientific areas developed approaches to deal with their own specific problems and challenges, distinct concepts have emerged. In the literature, plenty of references can be found regarding to, e.g., Green Infrastructure (GI), Blue Infrastructure (BI), Green and Blue Infrastructure (GBI), Blue-Green infrastructure (BGI), Urban Green Infrastructure (UGI), or Urban Green and Blue Infrastructure (UGBI or U-GBI). Definitions of all these concepts are sometimes overlapping, or even seen as equivalent. Furthermore, the link with the ES provided by these natural and/or semi-artificial infrastructures have also been analysed by the scientific community, but usually focusing on specific ES, or on a limited set of UGBI.

Furthermore, sometimes UGBI do not provide only ES, but they can also be associated to Ecosystem Disservices (EDS), which can be understood as functions of the ecosystems that are perceived as negative by people.

This research aims to systematize and clarify the relevance of distinct UGBI and NBS to provide ES and Ecosystem Disservices (EDS), and develop a framework to systematize the knowledge. The study is based on literature review, focusing on (i) UGBIs typology in terms of morphological and functional categories, primary qualifiers and degree of naturalness; and (ii) the ability of different UGBIs to provide ES and EDS.

Keywords: Urban Green and Blue Infrastructures, Nature Based Solutions, Ecosystem Services, Ecosystem Disservices

II. General Session Posters

1. *Poster abstract*

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Climate Change effects on Introduction of Mangroves into RO Korea's Coastal Ecosystem

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A rapid change in the environment caused by climate change breaks existing ecological boundaries between regions or nations and leads to biodiversity redistribution. In particular, it is necessary to pay more attention to the changes in the marine ecosystem, as it is three times faster than in the terrestrial ecosystem. For this reason, It needs to respond to marine ecosystem changes and biological mitigation by predicting these changes and reflecting into national policies.

This study is focusing on the possibility of mangrove introduction due to climate change into Korea's coastal ecosystem, which is showing fast northward movement of its limit. We presented a possibility of mangrove dispersal into Korea using the spatial analysis from 98 to 200, integrating RCP 8.5 scenario predicted at the national or global level and climate limits on mangrove distribution. The climatic variables affecting the spread of mangrove are considered, such as annual mean minimum air temperature and annual mean sea surface temperature of the coldest month. Also, based on the above results, the rate of change of the marine ecosystem in Korea was quantified and compared with that of the global marine ecosystem.

The results of this study have a significance in terms of the study to the change patterns of the marine/coastal ecosystem in Korea caused by climate change. It hopes to be used as a basis for establishing the policy or plan on marine environment conservation and climate change adaption in Korea.

Keywords: Mangrove, Climate change, Biodiversity redistribution, Global-scale biological connectivity, Dispersal prediction

2. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Social, economic, agricultural, and individual factors shaping farmers' perceptions and willingness of compost production and use: An evidence from Wadi al-Far`a watershed-Palestine

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In Palestine, open dumping and/or burning the waste, including agricultural waste, are prevalent practices resulting in emitting leachate and acidifying greenhouse gases. Composting the agricultural waste can reduce emissions and provide 'compost' as an organic

fertilizer and soil amendment. This, in turn, contributes to food security, sustainable agriculture, and reduction in energy inputs used for production of synthetic fertilizers. Nevertheless, it has not been implemented at the Palestinian national level. To develop a local marketing strategy for compost, this study views a need to identify farmers' perceptions and willingness of compost production and use in agriculture, and examine various socioeconomic, agricultural, and individual factors shaping them. The case of Wadi al-Far`a watershed (WFW) is investigated, where farmers practice inappropriate waste disposal and overuse of agrochemicals. A semi-structured questionnaire is administered to 409 farmers through face-to-face interviews. Descriptive statistics, bivariate analyses, Chi-square test, and binary logistic regression are used for data analysis.

High acceptance level (84%) is disclosed among farmers in WFW for the hypothetical idea of producing and using compost. Farmers also have high, yet lower, willingness level (63.6%) of the more salient option of producing compost themselves and using it in agriculture. Tenure systems, large cultivated areas, rain-fed irrigation, and lack of access to training sessions inhibit farmers' acceptance of the idea of compost production (overall p-value = 0.000). Large cultivated areas and rain-fed irrigation is also associated with farmers' unwillingness to produce compost, besides high household monthly income, animal or mixed animal-plant farming, experience in compost production, and use of pesticides (overall p-value = 0.000). Subsidizing raw manure price and costs of manure production and transportation as well as providing practice-based extension services will enhance farmers' willingness to produce and use compost.

Keywords: Agricultural waste, compost, farmers' willingness, farmers' perceptions, Palestine

3. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Institutional and political impediments of public participation in planning and decision-making associated with agricultural wastewater reuse projects: A qualitative evidence from Nablus Governorate-Palestine.

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In Palestine, water shortage and poor sanitation resulting from disposal of raw wastewater (WW) into the wadis and streams necessitate treating the WW and reusing it in agriculture. Ecosystem services provided by agricultural wastewater reuse (WWR) will not only contribute to the environmental and public health protection but also provide a supplementary agricultural water supply for the Palestinian farming communities.

A research conducted by the author between 2008-203 in Wadi Al-Far`a Watershed, Nablus Governorate (NG), revealed that the issue of social acceptance of WWR is not an obstacle to success of the Palestinian reuse projects; and success is highly dependent on the local institutional and political contexts. In particular, institutional conservatism, that resists institutionalizing public participation (PP), could be what has initially contributed to social opposition to WWR. Provoked by these findings, this research seeks understanding of the institutional and political impediments of PP in planning and decision-making associated with agricultural WWR projects.

This is a qualitative single case study. The selected case is NG due to the current challenges NG and its villages face in establishing an effective public participatory process and reaching a consensus on implementing a proposed WW treatment and reuse project. In-depth interviews and focus group discussions are conducted with stakeholders, including women, from governmental and non-governmental organizations and the locals. Framework Analysis method is used to analyze the data.

The decision-making capacity of NG and its villages is found severely hindered by a significant urban-rural polemic that is perpetuated by traditional tribal affiliation and poor institutional organization and communication between all tiers of government and the locals. This study is the first in Palestine to offer a framework for operationalizing PP in the water and WW sector. The framework can be consulted to create a participatory decision-making process that contributes to creating enabling environment for achieving water security.

Keywords: public participation, governance, institutional impediment, wastewater reuse, Palestine

4. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Isolation, selection and identification of indegeneous exopolysaccharide producing bacteria, non-symbiotic N-fixation and P- soluble bacteria as potential consortium for biofertilizer production

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The use of biofertilizers in Indonesia is lacking of full recognition as potential source of nutrients, due to low their availability on market and those quality which influenced by the effectiveness of those microbe which mainly consisted of the indegeneous species.. This research aims to obtain indegeneous isolates of N-non-symbotic fixing bacteria (NFB), phosphate soluble (PSB) and hexopolysaccharide (EPS) bacteria, collected from 3 different regions in Malang-East Java. This microbe were identified, characterized as a potential bacterial consortium for producing Biofertilizer. There were 4 non-symbiotic N-fixing bacteria isolates (NFB) and 3 phosphat soluble (PSB) bacteria isolates with two EPS bacteria were indentified and characterized. The highest total bacterial population were detected at the forest area (SF) at .5 x 0 CFU / g of soil. The results of 6S rRNA analysis, showed that the NFB isolates were classified into Bacillus thuringiensis, Staphylococcus pasteur, and Bacillus licheniformis, while PSB bacteria consisted of Pantoea ananatis, Acinetobacter baumannii, and

Acinetobacter calcoaceticu. In term of EPS isolates they could grouped into Bacillus cereus and Pseudomonas plecoglossicida. The isolates did not show symptoms of pathogenicity and antagonism when they were culture cultured together as consortium bacteria. All isolates were safe and potentially as a bacterial consortium for producing liquid biofertilizer product, before being formulated and applied to the field for improving soil nutrient availability.

Keywords: consortium bacteria, isolates, biofertilizer, soil nutrients

5. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Fishers' knowledge and ecosystem services: exploring trends and gaps in the artisanal fishery of Peru

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Fishers' knowledge (FK) can complement ecological data and contribute to fisheries management, especially in data-deficient countries areas. This paper assesses the FK included in the research and management of highly migratory species and straddling stocks within the framework of marine ecosystem services in Peru. We reviewed the scientific literature, including the grey literature, and incorporated technical reports and surveys of experts. We applied a decision tree based on the following criteria: . Documents focusing on the keywords "artisanal fishery", "highly migratory species", "straddling" or "Giant squid"," Mahi-mahi" "sharks" "Chub, Jack Mackerel", "Pacific bonito" "Tunas" and "Picudos"; 2. Searching for "Peru"; 3. Documents about fisher knowledge and 4. Excluding documents not dealing with the objective of this study. The results show that most documents (67%) addressed provisioning services, represented by commercial species such as mahi-mahi and giant squid. Supporting services were the second most commonly (3%) represented by studies and dealt with megafauna bycatch. This is a major threat to biodiversity in Peru, an important marine megafauna hotspot. The potential of FK to analyse other equally important marine ecosystem services, as have been explored in land ecosystems, has been ignore. FK was obtained mainly

through extractive methods (9%), evidencing the lack of collaborative research participation among institutional groups. The researchers and managers focused their work on the fishery aspect of FK and contributed to the management of fisheries (84%). This agrees with global reviews of FK that consider this knowledge as an approach to fisheries research. Additionally, an increase of documents including FK in the last decade was observed. The interculturality of human-environment relations and a diversity of knowledge systems must be recognized through the complementary relationship between FK and scientific knowledge.

Keywords: fishers' knowledge, marine ecosystem services, artisanal fishery, mahi-mahi, giant squid, Peru

6. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Feral goats effects on ecosystems services thought soil modifications

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On Mallorca Island, the last decades, the cessation of rural activity have transformed domestic goat populations to feral ones. The negative effects of such populations on endemic flora have been studied, but nothing is known about their effect on the ecosystem services. The objective of this study is to analyze the effect of feral goat populations on soil physical, chemical and biological characteristics related to ecosystem function. Soil samples in fenced plots excluded from ungulates were compared with adjacent grazed plots in five mountain areas. Soil bulk density followed the expected trend with an increase in the pastured areas compared to those excluded, however the differences were not statistically significant. The chemical characteristics followed different patterns depending on the study area. One of the studied areas accumulated more organic carbon and nitrogen in the grazed plots while the other zones showed no difference or the opposite tendency. The pH and conductivity were not affected by grazing. Although the non-pastoral zones tended to present greater microbial activity with

greater functional diversity, measured by Biolog Ecoplate, the differences were not statistically significant. In two of the five zones, the degree of infection by arbuscular mycorrhizae of the roots was also evaluated by root stain. One of them showed a clear decrease in the degree of infection in the grazed areas. The feral goats in Mallorca tend to decrease the accumulation of C and N in the soil, reduce the capacity of water accumulation and decrease the microbial activity; decreasing the ecosystem services offered by the soil. However, because the high heterogeneity of the soil, higher effort of sampling is necessary to showed constant and clear patterns.

Keywords: Overgrazing, exclusion, soil bulk density, soil organic carbon, Biolog Ecoplate.

7. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

High-resolution mapping of riparian areas as an opportunity to improve ecosystem services in Cerrado biome, Brazil

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The Cerrado biome is a biodiversity hotspot with 200 million hectares located in central Brazil, and holds more than 2,076 species of plants and vertebrates, of which 4.800 are endemic. This region concentrates most of the production of agricultural commodities in Brazil, which is the third commodities exporter in the world. As a highly demanding activity, agriculture consumes ~70% of the country's water supply, creating an important demand on this ecosystem service.

One of the main legal mechanisms for riparian protection established by the Brazilian Law are the Areas of Permanent Preservation (APP), defined as marginal strips along rivers, lakes, reservoirs and springs, aiming to protect water resources, biodiversity and promote erosion control. Another legal component of the riparian APPs is the landowner's duty to restore its degraded areas, improving the provision of riverside ecosystem services.

Maps previously produced for this biome used low to medium resolution imagery, resulting in final scales of :00,000 or smaller, which are incompatible to riparian areas mapping. This study used for the first time high-resolution satellite images (5 meters / pixel) to map land use and land cover, hydrography and APP in the Cerrado, with a working scale of :0,000. Preliminary results indicate an environmental debt of 3,7 millions hectares of degraded forests and savannas that must be restored. The environmental debt quantification and the understanding of its spatial distribution throughout the eleven Brazilian states covered by the Cerrado biome has enormous importance to enable the restoration of degraded areas foreseen in the law, being an excellent opportunity to improve the ecosystem services related to riparian areas and the sustainable development of the region.

Keywords: riparian areas, restoration, savannah, agriculture

8. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Knowledge gaps in research of urban ecosystem services in the Central and East European countries

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The former socialist countries in the Central and East European area (CEE) shares a series of peculiarities when it comes to the planning and the management of the urban green areas (UGA): the tradition of top-down governance, limited cooperation between public institutions and non-government actors, contradictory legislation, insufficient funding, ineffective urban planning. Hence, in the last 25 years they have faced a decrease of both surface and quality of the UGA with impact on their capacity to provide ecosystem services (ES). As well, the incoherence in the governance of the urban green areas affects the manner in which the subject of urban ecosystem services (UES) is approached.

The aim of this paper is to identify the knowledge gaps in research of UES in the CEE countries based on a meta-analysis of the published literature. We examined peer-reviewed case studies taking into account: the geographical distribution of the case studies, the perspective of UES analysis, operational and conceptual models, political and social aspects approached by the authors.

The assessment reveals that the subject of UES in the CEE area is new, and the main drivers that stimulate the research in the field come rather from the outside the region, mainly from the EU policies. While the majority of case studies focus on the ecosystems' structure and services, some important elements in the ES production cycle, as institutions, public policies and stakeholders are almost neglected.

Given the context of the analyzed countries and taking into account the emerging trends of the global scientific literature in the UES, a couple of research priorities are proposed and discussed.

Keywords: ecosystem services, cities, stakeholders, top-down governance, Central and East European Countries

9. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Best management practices scenarios testing based on ecosystems services performance at the Black river catchment scale, Romania

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The actual management practices don't consider the cumulative effect from activities implemented at local scale. The impact assessment of projects, plans and policies on biological and ecological diversity does not consider ecosystem services, while it is desirable to have a clear view to reflect ecosystems structural and functional dynamics in the production of

ecosystem services. European legislative framework CAP, WFD, HD, BD, EIA and SEA directives demonstrates a unified approach to improve/maintain characteristics of actual and future state of the MS environment. The approaches of ecological systems and mass flow processes at catchment scale are important steps in the functional use of structural models to quantify the nonlinear dynamics of ecosystems, a quantitative assessment of ecosystem services such as surface and ground water resources availability, it is necessary to reflect the cumulative impact of human activities and climate change. We are proposing the innovative methodology developed in accordance with accepted conceptual document like European Biodiversity Strategy (EBS) and Millennium assessment (MA). The methodology for cumulative environmental impact assessment from local to regional level to assess the benefits of best management practices (BMP) identified by Inter-reg transnational CAMARO-D project for the Danube catchment. The methodology is based on ecosystems services evaluation, implemented for pilot site - Black river catchment.

Keywords: ecosystem services, catchment scale, SWAT, BMP, Black river

10. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Water Regulation and Water Supply Suitability Mapping of Forest Stands: a Case Study of Belgrade Forest, Turkey

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Since the Belgrade forest was of great importance for water supply to the people of Istanbul in the past, this study area has currently seven dams. However, the existence of seven dams does not mean that the forest has a high potential for water supply or regulation. The aim of this study is to provide rankings of all stands in the Belgrade Forest, Istanbul, in terms of suitability for water regulation and supply. The ranking is based on common criteria sets available in the literature and expert opinions for determining water regulation and supply suitability of forest stands (n = 8) in this area. There are three main and eighteen sub criteria sets. Weights for these criteria are determined by applying the Analytic Hierarchy Process (AHP)

and voted by experts. Finally, all the stands are sorted according to the derived weighted criteria and assigned to three classes of water regulation and supply suitability: high, moderate, or low. Based on the results of the analysis, the area with high suitability for water regulation constitutes 8.95% (849 stands) of the total area while .49 % of the total area (45 stands) have high suitability for water supply. The fact that most of the stands in the study area have the potential of water regulation will guide decision-makers in terms of scenarios that can be implemented. For instance, they can prefer a management objective, such as increasing the potential of water regulation; also define the silvicultural approach for treatment unit.

Keywords: Multi-Criteria Decision Analysis; Analytic Hierarchy Process; Suitability

11. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

A social-ecological integrated approach for the assessment of hydrological ecosystem services in the Macro Metropolitan Region of São Paulo - Brazil

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The Macro Metropolitan Region of São Paulo (MMRSP), located in Southeast Brazil, has suffered from water scarcity. MMRSP is home of 30.8 million people, 75% of São Paulo State population, and encompass an area of 52,000 Km2. This region is a conglomerated of 80 municipalities responsible for 83% of São Paulo's GDP. There are many reasons for this, as changes in rainfall patterns, water contamination, deforestation, and inappropriate water governance. In the face of climate change and urbanization growth, policies to guarantee better water management for urban areas have become urgent. The water scarcity faced by MMRSP population demand changes in the way humans interact with the environment, hence, changes in the current water governance. Therefore, this project aims to develop an integrated model to assess the Hydrological Ecosystem Services directly related to water (HES) in MMRSP, in face of climate

change, to create scenarios which can support public policies for environmental governance. For that, the approach of Ecosystem Services will be applied to identify HES, the direct and indirect drivers that influence these services, and impacts of changes in HES offer and demand for the population and ecosystems. The social-ecological system approach will be applied to integrate ecological, biophysical, economic and social indicators in a model for the HES assessment. In the ESP 0, we will present the designed project and current reaches for participants' appraisal and suggestions.

Keywords: Assessment Integrated Model; Ecosystem Services; Water; Climate Change; Urbanization

12. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

A Generically Parameterized model of Lake eutrophication (GPLake) that integrates field-, lab- and model-based knowledge

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Worldwide, eutrophication is threatening ecosystem services provided by lakes. To support lake management, numerous eutrophication models have been developed. The knowledge captured in these models is based on three key research approaches: the empirical approach that employs field surveys, the theoretical approach in which models based on first principles are tested against lab experiments, and the process-based approach that uses parameters and functions representing detailed biogeochemical processes. These approaches lead to an accumulation of field-based, lab-based and model-based knowledge, respectively. It would benefit lake management to exploit this complementary information, however, a method to integrate the knowledge is still lacking. Here we propose a Generically Parameterized Lake eutrophication model (GPLake) that integrates field-based, lab-based and model-based knowledge that crosses scales and complexity. Through this integration, GPLake enables the application of information from laboratory, model or field studies in any lake of interest. It

indicates the limiting factors, i.e. nutrient or light, of phytoplankton growth in these lakes and provides lake managers with a first diagnosis of nutrient to chlorophyll-a relations. Moreover, GPLake can assist lake managers in making a first-order assessment of measures such as decreasing residence time or changing depth, and can be used to assess the amount of effort needed in nutrient load reduction to meet water quality standards of lakes around the world. GPLake can be regarded as a versatile and cost-effective tool to estimate the trophic state of lakes and to explore solutions to mitigate loss of ecosystem services due to eutrophication.

Keywords: Water quality management; Phytoplankton Nutrient versus light limitation; Vollenweider; Consumer-Resource Interactions; PCLake

13. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Comparison of an indicator and a modelling approach to operationally quantify soil-based ecosystem services in the Saclay territory

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In view of the worldwide urban expansion, the location of urbanization could allow minimizing losses in soil-based ecosystem services. A first step, is to be able to operationally identify the most valuable or critical soils, i.e. to rank soils according to their capacity to provide a high number or level of ecosystem services. Besides direct measurements, mostly unfeasible with a sufficient spatial and temporal coverage, two main approaches may be used to infer soil-based ecosystem services from available data. The first ones, based on indicators, are relatively simple but only qualitative to semi-quantitative. The second ones, based on process-based modelling, are contrastingly quantitative but much more complex.

We thus i) propose two operational approaches of increasing technicity to quantify the capacity of soils to provide services based on indicators or on modelling and ii) compare their respective

ability to rank soils according to level of services (relative accuracy) and to match with direct measurements (absolute accuracy) when applicable. These two operational approaches were optimized for a typical soilscape of the Paris Basin and focused on the services of production of cultivated biomass and water, and of regulation of climate and water quality.

The indicator approach provides satisfactory absolute and relative quantifications concerning production services. They are however of a lower efficiency for differentiating regulation services levels among soils. The modelling provides quantifications of all of the production and regulation services closed to measurements for agro-pedo-ecological environments similar to those used to develop and calibrate crop models. It however failed to differentiate most of the soils due to a poor representation of environmental conditions (slope…) or processes (hydromorphy…) rarely encountered in cultivated soils. The two approaches tested here resulted in different soil ranking. Numerous challenges have then still to be faced to provide a ranking of soils useful for land-use planning.

Keywords: urbanization, soil services, indicator, process-based modelling

14. Poster abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Investigating people-landscape interaction through human perception: A case study of Xilin Gol League, Inner Mongolia, China

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Perceptions act as a lens through which people interpret landscapes using all of their senses. Human perceptions of the landscape can influence land-use and land-management decisions, both through the non-material interaction with landscapes and being seen in utilitarian terms. The non-material interaction is commonly recognized as cultural ecosystem services (CES) as landscape support spiritual, religious, recreational, inspirational and educational experiences and improved overall mental and physical health and well-being. While CES are greatly valued

by diverse stakeholders, the full range of CES provided by a landscape is notoriously difficult to evaluate. This may lead to the loss of the multiple non-material factors that contribute to the way a landscape is valued and experienced. Therefore, we aim to identify and analyze CES that arise from people's interaction with their surrounding landscapes, given special focus on the diversity of CES perceived by local inhabitants (i.e. not expressed in revenue or travel movements) from different landscape types. By combing the functional perception (livelihood) with CES, we applied semi-structured interviews with the residents living in Xilin Gol League, Inner Mongolia, China, taking the advantage of their diverse cultural backgrounds and different local dominant landscapes. Among all the factors tested in the analysis, ethnicity is likely to affect inspirations rather than other CES, and age play the most significant role in perceiving spiritual and religious services. The results also show that dominant landscape types play most significant role of influencing their perception of CES. Grassland is perceived as highest CES diversity, as well as most appreciated landscape type, following by the cultivated land. Surprisingly, for some landscape features, such as Ger (traditional nomadic residential form) are less perceived but perceived as with high CES diversity.

Keywords: human perceptions, cultural ecosystem services, livelihood, landscape management, household survey

15. Poster abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Variability of Agricultural innovation for Climate change resilience and mitigation in sub-Sahara Africa

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The impact of climate on agriculture has been recognized for as long as people have been farming, climate change has highlighted this dependence like never before. Temperatures are rising, rainfall is increasing in some areas and declining in others, seasonal patterns and pest

and disease distribution are changing, and extreme weather events are becoming more frequent and severe.

There is now an increasing awareness of the impact that agriculture has on climate, particularly through production of methane and nitrous oxide—potent greenhouse gases. Agriculture produces nearly half of all methane generated by human activity, and nearly 60% of nitrous oxide emissions.

Rather than dealing with short-term weather events—droughts, floods, heat waves and cold spells—farmers must now respond to climatic changes that will alter the way they farm irrevocably. Around the world, farmers urgently need innovations that will enable them to produce enough to support themselves and the ever-growing global population. Their added challenge is to do so in ways that will protect the environment, especially soil and water, and minimize agriculture's contribution to climate change. This paper presents examples of how this is already being done in sub-Sahara Africa. So, these systems of sustainable intensification bring immediate benefits to smallholder farmers in terms of increased yields, while building long-term resilience by reducing the amount of water they use, and help mitigate climate change by reducing emissions of greenhouse gases and sequestering carbon in the soil. Truly a win-win-win proposition

The paper find that Farmers were able to increase yields on their remaining land by concentrating their efforts and resources on these more fertile areas, boosting food security. Household income also increased, largely because farm workers were able to take up gainful off-farm employment, broadening their livelihoods base and

increasing resilience. With climate change bringing increasing variability of rainfall and temperature

and greater risks from pests and diseases, insurance is also invaluable in protecting the food security of farming families. This paper recommend that helping raise productivity of cropland, it also helps indirectly to mitigate climate change by reducing the pressure to bring more land under cultivation. there are still a number of issues that need to be addressed to make weather-index-based insurance more effective in Sub-Sahara Africa. Any poverty reduction, resilience, and food security strategy in these contexts requires a strong focus on agriculture and the development of food value chains. It is where most people currently find the means to support their livelihoods.

Keywords: variability,Agricultural, climate change, sub-Sahara Africa, resilience

16. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Mapping, quantifying and valuing the ecosystem services offered by Oualidia lagoon, Morocco

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In this study we have assessed, quantified and valued the ES and their flow in Oualidia lagoon, a protected area in Morocco, with the aim to characterize the landuse/landcover (LULC) classes, spatially mapping distribution of ES, identifying important ES, and compiling the opinions of experts on ES flow. Expert opinions were collected using specific questionnaires for each of the economic sectors, ES flow scores were calculated for each of the LULC classes in the study area by averaging the expert opinions on separate ES. A qualitative and quantitative assessment produced a matrix structure. The AHP model approach was used to assess the ES map using GIS, comprising three main indicators (Provisioning, regulating and cultural services) and their 5 sub-categories. The weights of each factor involved in ES are calculated and checked with calculating the consistency ratio and only if (CR) <0.. For every parameter a raster map was produced and, using the raster arithmetic, reclassified according to the scores, producing semi quantitative ES maps. Results indicated the spatial distribution of ES flow in the lagoon. The provisioning services made up to 24% of the overall ES (agricultural activities were indicated as the most important in this category, while fishery activities, located mostly in the channel accounted for 8%). Regulating services were contributing to 34% of the total (climate regulation was the leading service with 30%, followed by flood protection with 24%). Cultural services were important as well making up to 39% (recreation and aesthetic value contributed 30% each are the most important services in this class, followed by health service with 27%). This method has allowed to delineate both the spatial patterns in the distribution of the resources utilized by the communities, which, in turn

could be an important information facilitating the interaction between local communities and the decision makers.

Keywords: Ecosystem services, Coastal lagoon, GIS mapping, Spatial modelling, Protected area

17. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

The future of Southeast Asia's forests under the shared socioeconomic pathways: Consequent changes in aboveground forest carbon stock

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While Southeast Asia's forests play important roles in biodiversity conservation and global carbon (C) balance, the region is also a deforestation hotspot. In this study, we considered the five shared socioeconomic pathways (SSPs) to portray a range of plausible futures for the region's forests: SSP – the sustainability/taking the green road scenario; SSP 2 – the middle of the road scenario; SSP 3 – the regional rivalry/rocky road scenario; SSP 4 – the inequality/road divided scenario; and SSP 5 – the fossil-fuelled development/taking the highway scenario. These SSPs consider the uncertainty space in mitigation and adaptation challenges, outline different storylines of global development pathways, and focus on qualitative descriptions of likely future changes in demographics, land use and forest resources, among others. We focused on the projected future forest cover changes in Southeast Asia. However, the SSPs are primarily designed for global scale projections and analyses, and although forest cover change projections are available, they are limited to quantities and have no spatial dimension. Hence, here, we spatially allocated the projected future forest cover changes under the five baseline SSPs by employing a state-of-the-art land change modelling approach and using remotely sensed data (205-2050). We examined the potential implications of these spatially allocated forest cover changes by quantifying their consequent aboveground forest carbon stock (AFCS)

changes. Results revealed that by 2050 under the worst-case scenario, SSP 3, the region's forests would shrink by 5.2 million ha. The region's AFCS would decrease by 790 Tg C, 2% of which would be due to old-growth forest loss. Conversely, under the best-case scenario, SSP , the region is projected to gain 9.6 million ha of forests and 65 Tg C of AFCS. The choice of the pathway is thus critical for the future of the region's forests and their ecosystem functions and services.

Publication: Estoque et al. (209) The future of Southeast Asia's forests. Nature Communications 0:829.

Keywords: carbon stock, forest ecosystem services, mitigation, shared socioeconomic pathways, spatial modeling

18. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

ITTSmartSense: a cost-effective and flexible technology for ecosystem parameter monitoring

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Traditional commercial based environment and ecosystem parameter monitoring are costly, time consuming and often restricted with the tailor-made demand and less flexible in terms of choices of sensors to be deployed in the field. Wireless sensor network (WSN), in this regard, enable a new scope for application and research in ecosystem monitoring particularly in the field of agricultural, water and land management activities, due to the increased spatial, dynamic resolution and remote accessibility. However, very often this may lead to suboptimal flexibility, power consumption and therefore cost of the system. This paper presents a new flexible ecosystem monitoring solution to be used in any places in the world and reveals its usefulness by highlighting some of the key features. In comparison to typical commercial or

industrial environmental monitoring solutions, our system architecture referred to as "ITTSmartSense" provide wide range of features, such as opportunistic data dissemination, flexible choices of multiple sensors in one system, long distance deployment and localization of information to meet the requirement of most of the typical environmental and ecosystem monitoring system around the world, particularly in the developing countries. ITTSmartSense is an intelligent cloud-based system for monitoring of the different environmental parameters in the field of agricultural, weather, soil, and water. It is an end-to-end solution for intelligent, energy efficient and modernized sensing technology capable of both, real-time and offline monitoring of typical environmental and ecosystem parameters e.g., soil moisture, temperature, rainfall, water quality, solar radiation and relevant parameter. Besides describing some of the important requirements for the sensor equipment to be used in ITTSmartsense settings, we present the main features and experiments conducted using the cloud-based Internet of Things (IoT) as one of the wireless sensor deployment platforms that meet these requirements. Furthermore, building upon IoT, we present an application to forest-hydrological monitoring in the Atlantic rainforest in Brazil as one of the first steps towards building WSN in the developing world using different sensor equipment.

Keywords: ITTSmartSense, Ecosystem Monitoring, Internet of Things (IoT), Sensors, Wireless Sensor Network (WSN)

19. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Developing an atlas for urban ecosystem services of San José, Costa Rica

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The presentation showcases the development of an atlas for urban ecosystem services of San José, Costa Rica as a tool for informing decision making. The atlas combines geospatial data of biophysical and socio-economic information and aims at identifying opportunities for including ecosystem services in urban development planning. The development of the atlas

includes a participatory process, which is based in the methodology of Ecosystem Service Oportunities (ESO) (www.es-opportunities.net). The ESO methodology is used for indentifying economic and policy instruments that address local priorities and opportunities related to the sustainable use and conservation of biodiversity and ecosystem services.

Keywords: atlas, urban, policy instruments, ecosystem service oportunities

20. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Integrating Habitat Quality index to support Urban Design in urban areas. The case of study "Basse di Stura", Turin (Italy)

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There is a huge amount of bibliography that uses many land surface indexes to determine the environmental quality of urban areas, including the dense city and the surrounding open fields.

These indexes are the output of numerous data interpolations (composite indicators) or modelling (using software such as InVEST) while the need of a constant and easy-to-use indicator that aid Urban Design should be developed on a more reliable and updated information. This is particularly true in urban areas where green spaces are considered essential for many ESs and the well-being of citizens.

Nevertheless, while the capacity of urban green areas to provide multiple benefits is well-recognized, the qualitative distinction on urban green spaces in compact cities based on a detailed biophysical assessment needs to be developed delivering fine-grained results, capturing the broad range of values relevant for planning aiding urban design.

The research here conducted takes the available information of Habitat Quality model performed during the Life SAM4CP research project (204-207) comparing the results with the

NDVI index. Both indexes are distributed using the local land use plan of the city of Turin (northwest Italy) to see how the two data differs in each normative zone. The "Basse di Stura" zone (a complex area of the Turin land use plan) is here used as a proxy to detect major synergies and differences to demonstrate which index best reflects the ecological state of the environment and how the systematic utilization of the best performing index should support the definition of sustainable urban design.

Results indicates that Habitat Quality index can be better modeled if NDVI is used as a proxy of habitat condition in urban areas, shoving how the integration of information is crucial to obtain reliable decision making support system.

Keywords: Ecosystem services; Spatial planning; Urban Design; Habitat Quality

21. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Mapping and assessment of ecosystem condition and connectivity beyond protected areas to support wetland conservation.

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Wetland ecosystems outside protected areas are mainly impacted by anthropogenic pressures, although they are important biodiversity hotspots and landscape features that enhance species conservation. This challenge is addressed by the WetMainAreas project (Improving conservation effectiveness of wetlands) of the transboundary Balkan Mediterranean program, which is funded under the biodiversity specific objective (SO 2.) for ecological connectivity and transnational ecosystem's integration. The project aims to document the important role of wetlands in enhancing the structural connectivity beyond the boundaries of protected areas (PAs). The current study demonstrates a landscape level methodological approach, as applied in the continental part of Greece, which is based on combination of high resolution Earth

Observation (EO) mapping products and of EU and national datasets. At first, ecosystem condition is mapped and assessed following spatial analysis and modelling techniques. Next, in order to integrate the different PA zoning into the Ecosystem Services (ES) concept, the IUCN categories which apply at national designated areas are considered as additional human interventions that activate the supply of the habitat maintenance ES. The structural connectivity analysis of the spatial units where medium, high and very high supply is provided, reveals interesting landscape patterns of well-connected protected or unprotected natural areas. Wetlands are assessed as important landscape units that contribute to the supply of the habitat maintenance ES and to the structural connectivity of PAs, either by being located inside or beyond their boundaries. The results demonstrate how the ES concept can be used to document policy decisions for wetland protection and nature conservation.

Keywords: ecosystem condition, connectivity, wetlands, protected areas, habitat maintenance ecosystem service

22. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Dynamic analysis of sustainable urban development relying on the relationship between ecosystem service supply and demand: a case study on the Xiamen-Zhangzhou-Quanzhou urban group in China

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This study focus on zoning management that is an effective approach to reducing the spatial difference for sustainable urban development(SUD). Based on the supply and demand theory, we construct a framework for a dynamic model of the relationship between ecosystem services supply and demand, and uses this relationship to characterize the SUD pattern in the Xiamen-Zhangzhou-Quanzhou urban group in China through multiple scales and interdisciplinary method. Particularly, we integrate multiple models (e.g. the InVEST model, Fragstate model, Catastrophe model, and Value modification model, etc.) to quantify indicators on supply side

of ecosystem services (containing food production, raw material, climate regulation, air quality regulation, regulation of water flows, waste treatment, amenity services, landscape pattern, habitat quality, ecological resilience and marine environment support). Simultaneously, we integrate some socioeconomic indicators to present the demand side of ecosystem service. For explaining the factors and status, we propose the Kuznets curve of the SUD pattern. Finally, we conclude differentiated management measures for government and stakeholders according to different zoning. The four main findings are as follows:() From the perspective of sustainable urban development pattern, above half of the counties in the Xiamen-Zhangzhou-Quanzhou urban group belong to high-supply zones, especially the counties in the Zhangzhou city. High-demand zones are mainly distributed in the coastal areas of Xiamen city and Quanzhou city. And there is no county located in the sustainable urban development zone where both the supply and demand are balanced. There is a huge differences between the coastal and inland. So the analysis of supply and demand of ecosystem service can explore the gap in the process of sustainable development clearly.(2)From the Kuznets curve of SUD patterns that we constructed, it can be suggested that the whole region is still in a "dilemma state", where there is great disharmony between the ecology and economy. It helps to explain the dislocations in supply and demand, and the spatial difference.(3)We found an excellent marine environment has contributed to the promotion of the whole ecosystem service supply. Meanwhile, this paper believes that it is an urgent task to deal with the relationship between the coastal zone and inland.

Keywords: Sustainable urban development, ecosystem service supply and demand, zoning management, Kuznets curve, Xiamen-Zhangzhou-Quanzhou urban group in China

23. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Understanding the coupled impact of urbanization and climate change on watershed planning

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Watershed planning in complex and changing urban environments poses a range of technical, planning and institutional challenges. The planning process is further complicated by climate change with increased variability in weather patterns and more extreme rainfall events. Increased urbanization, which increases impervious land cover and reduces the ability of the natural environment to infiltrate and store runoff water, coupled with more extreme rainfall events yields increased flooding potential. Proactive planning to reduce flood vulnerability and increase climate change resilience will be key to mitigating the impacts and costs of floods.

The Kansas City region is using the Blue River Watershed as a test bed to better assess risks to critical transportation infrastructure, evaluate upper watershed development patterns and green infrastructure-focused mitigation strategies, and link recommendations to regional watershed, transportation, hazard mitigation and green infrastructure plans. Kansas City is using PC-SWMM, a complex hydrologic modeling software, to develop and compare different land development patterns and mitigation strategy scenarios. Each scenario will be assessed with current and predicted climate conditions. The presentation will focus on both technical modeling and planning opportunities to integrate climate resilience into watershed plans and cross-sector regional land use, transportation, hazard mitigation and other plans.

Keywords: watershed, ecosystem service valuation, hydrologic modeling, climate change impacts

24. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Participatory methodologies for ecosystem services assessment in the Soil Conservation of Mexico City

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Payment for ecosystem services (PES) constitutes an environmental policy which seeks to internalize the concept of environmental service. These policies involve local communities in the conservation strategies, which allow the economic and social development of the community, as well as the generation of environmental awareness of society. It is common for local communities to lack of established and standardized methodologies that allow the quantitative or qualitative evaluation of environmental services, especially in development countries. This paper summarizes the experience of proposing and applying participatory methodologies to evaluate ecosystem services (carbon storage, water infiltration and maintenance of biodiversity) in a PES within Mexico City. A theoretical-practical workshop with the beneficiaries and technical staff of a conservation program of environmental services was held in order to familiarize them with the proposed methodologies and test them. It is expected that through the periodic data collection the users of the methodologies will acquire skills and reflect on the activities they carry out in function of the conservation of environmental services, in such way that they can participate in the decision making and the design of public politics. The experience generated allowed us to adjust the methodologies to make them simple and feasible to apply. In addition, we provided recommendations to improve certain aspects of the program in question, which could help improve and strengthen the relationship between officials and beneficiaries in the long term.

Keywords: Payments for environmental services (PES), local communities, participatory monitoring, environmental services assessment

25. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

The Linkage between Agroecological System, Biodiversity and Ecosystem Services

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According to research, changes in land and water use, and management are the drivers that most negatively affects the regulatory and supporting functions of ecosystems, ecosystems help to regulate climate, filter air and water and safeguard soil fertility. They also support plants and animals by providing diverse habitats. These functions are all severely threatened by irresponsible changes in land and water management; fortunately agroecology can help to reverse the situation by supporting biodiversity and soil health to provide sustained ecosystem services in agriculture. Agroecology enhances the sustainability of farming and puts into relationship between agriculture, culture and society. Diversified agroecological systems have been proven to be more resilient to the changing climate, this is key, especially for smallholder farmers, who are the primary producers and yet the most vulnerable to climate change effects. Several studies have demonstrated that diversified traditional farming systems centered on agrobiodiversity exhibit higher productivity than conventional agricultural methods under changing conditions. Take Uganda's economy for example which mainly dependent on agriculture as its mainstay like many other developing countries worldwide. The sector remains critical to Uganda's economy, in that it employs approximately 69% of the labour force, 77% of who are women, and 63% are youth, mostly residing in the rural areas. Uganda's population is expected to hit 50 million marks by 2023; this puts enormous pressure on the agricultural sector to meet the food and fibre needs of the growing population, without depleting the natural resources. To this regard, agroecology need to be appreciated and adopted as a more sustainable solution to the complex challenges faced today nationally and globally, therefore, this paper will discuss about the role played, knowledge and information required in the linkage between agroecology, biodiversity and ecosystem services to achieve sustainable development.

Keywords: Agroecology,biodiversity,ecosystem services,agriculture,climate

26. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Economic Valuation of Goods and Services of Barandabhar Protected Forest, Nepal: (Case study from Panchakanya and Jaldevi Community Forest)

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Barandabhar Protected Forest has provided numerous ecosystem goods and services to the people living around the forest and its biological diversity has also acknowledged. Integration evaluation of BPF with ecology and economics is utmost requirement for the sustainable management of the resource. Actual field study was carried out in two community managed forest of Barandabhar protected forest. The economic valuation of forest goods was estimated by using Market Price Method. The contingent valuation method was adapted to estimate the non-use value of forest. Determining willingness of local users and tourists for sustainable management and conservation of natural resources as well as recreational and aesthetic services, were done through contingent valuation survey. It was administered to 42 users and 50 tourists. Multiple Regression Model was used to analyze the factor affecting on willingness to pay.

According to the household survey, Average household consumed Forest good (Timber, fodder and fuel wood) was estimated as NRs. 5,246.48(US $ 47.2) per year per household. Specific use value of forest was estimated as NRs. 4,900,003.2 (US $ 34,00.028). Similarly, the average willingness to pay value for conservation and sustainable management of forest was found to be NRs.589 (US $ 5.30) per household per year. The projected WTP for sustainable management and conservation of forest was estimated as NRs ,672,760 (US $ 5,054.84). The WTP for conservation and sustainable management of forest was found to be affect by income, gender and time to reach the forest. The average willingness to pay for Recreation and aesthetic value was found to be NRs. 48.8(US $ 0.4392) per visitor.

Keywords: Contingent Valuation Method, Economic valuation, Goods and Services, Willingness to Pay

27. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Preferences of City Residents Towards Green and Blue Infrastructure: Form Matters

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Recent development (such as demographical changes, urbanization or climate change) has caused an increasing interest in the quality of life in cities. Ecosystem services (ES) provided by green and blue infrastructure (GBI) increase residents' well-being and overall quality of life in cities. Recent studies showed people are aware of some of the benefits provided by GBI and are willing to pay (WTP) for building, extending and maintenance of these elements.

GBI elements (GBIEs) take different forms – from genuine nature form over nature-based form to semi-nature form. Individual forms of GBIEs differ not only by aesthetics, but also by the amount and quality of ES provided. It has been shown that nature and nature-based forms provide ES to a greater extent. However, implementation of nature-based forms may be opposed by decision-makers. The reason may be fear of "wilder" look of nature-based forms and consequently fear of how residents perceive the naturalization of cities. Preferences regarding individual forms of GBIEs have not been systematically studied before. Does people's WTP for nature-based forms differ from their WTP for semi-nature forms?

Residents' preferences regarding specific forms of GBIEs (urban park and stream) were studied in one German and two Czech cities using a discrete choice experiment. The results of logit model showed that residents on average strongly prefer nature-based forms of GBIEs (for both parks and streams in all cities). Their WTP for nature-based form was significantly higher than

for semi-nature. However, that does not mean that other forms of GBIEs should be ignored. As a more sophisticated latent-class model showed, non-negligible groups of residents prefer semi-nature forms of GBIEs – especially when it comes to urban parks. Nature-based form of water elements was preferred unanimously. The findings are significant for decision-makers in the field of planning new GBI or revitalization of the current ones.

Keywords: urban green and blue infrastructure, ecosystem services valuation, choice experiment, preferences, nature-based solutions

28. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Greenhouse gas (GHG) leakage and net mitigation of typical carbon sequestration practices in China's terrestrial ecosystem

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Abstract: Many management practices in cropland forest and grassland ecosystems could and were considered as promising carbon sequestration measures. However, during the implementation of carbon sequestration measures, the production and transportation of materials consumed, and processes taking place elsewhere as a result of the activities might lead to GHG budget change other than the carbon stock, and formed GHG leakage. Consequently, in order to examine the true contribution of these practices to global warming mitigation and GHG reduction, full GHG budget need to be considered rather than the impact on soil and vegetation carbon alone. We built the frame of "Carbon Accounting and Net Mitigation (CANM)" and serious of CANM methods to investigate the GHG leakage and net mitigation of typical carbon sequestration practices in China's terrestrial ecosystem, including China's national ecological restoration projects, forest cropland and grassland management. The results showed large variations in carbon contributions, GHG leakages and their counteraction effects among different practices and ecosystems. The counteraction effects of GHG leakage from forest management and some forest-related ecological restoration projects

were relatively small and could hardly exceed 25%. Meanwhile, the GHG leakage of some cropland management practice (e.g., straw return in rice paddies) could fully offset the carbon sequestration in soil. Therefore, policies and technical approaches to minimize GHG leakage is necessary to enhance the GHG mitigation effect of the ecosystem carbon sequestration practices.

Keywords: greenhouse gas (GHG) leakage, net GHG mitigation, carbon sequestration, terrestrial ecosystem, China

29. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

The effect of grazing on soil carbon and water infiltration in Miombo forests

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Soil organic carbon (SOC) hold important roles in maintaining ecosystem functions and productivity ranging from being the base for soil fertility to facilitation of soil water storage. In dry ecosystems, this phenomenon is highly threatened by sorrounding communities' economic activity dominating, which is, Agriculture. This study aim to analyse the effect of grazing on SOC and Water Infiltration Capacity (IC) in Miombo forest and adjacent agricultural land. We conducted the study in Kitulangalo Forest Reserve and its surrounding villages in Morogoro Rural District, Tanzania. The area is a Miombo vegetation zone with the surrounding communities practicing agriculture and some charcoal production. We adopted the hierarchical Land Degradation Surveillance Framework (LDSF) sampling and data collection protocol by establishing a sentinel site of 0 by 0 Kilometres with a total of 60 plots. We identified four main landuses, namely; i. Forest reserve, ii. Agricultural land, iii. Farms under fallow, iv. Disturbed forest. A total of 320 soil sample were collected in pairs from both two respective depths, the top (0-20cm) and sub-surface soil (20-50cm) from 60 sampling plots as well as Infiltratability using a single ring method. We also tested the exclusion of grazing pressure on SOC, both in and outside of two 0 years old fence enclosed plots of 30 by 90

meters having a total of 6 sample points from each, making a total of 32 samples. Preliminary results shows, there is no significant difference in both SOC and IC between land the uses. However, there was a significant (p-value= 0.005 and p =0.02), difference in SOC and IC between the inside (.62%, 442.2mmh-) and outside (0.90%, 278.6mmh-) of the fenced plots respectively. This imply the possibility of doubling the carbon content and improve water infiltration in Miombo forest but only if we successfully excluding grazing.

Keywords: Agriculture, Infiltration capacity (IC)

30. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Key landscape indicators related to ecosystem services provision at national level – example of Slovakia

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Presentation gives an overview of the determination process of key indicators related to the ES provision in Slovakia. Research builds on results of the national ES assessment, which are expressed as a relative landscape capacity for the ES provision (for more information, see the related poster).

4 individual variables (parameters) have been used for the evaluation process, representing qualitative and quantitative landscape properties mostly related to the land use, habitat quality and distribution, but also to geomorphology, climate, water, soils and selected socio-economic parameters. Input data were collected from the existing spatial and information datasets, they were pre-processed and arranged for further calculation in 25 m resolution grid. Total value of the ES capacity was expressed through a unified range 0-00, subsequently, the individual values were re-calculated for the km grid. Spatial set of approximately 49,000 points was used for further assessment, including database of the values of input parameters

and landscape capacity for the ES provision (8 individual ES, capacity for the provisioning, regulating & maintenance and cultural ES, overall ES capacity).

Ongoing stage of the research is aimed at the determination of the relationships between individual landscape features and final ES values – first represents indicators (input parameters, independent variables), latter represents final (dependent) values. We apply advanced statistical tools in this assessment – e.g. correlation analysis, regression analysis, factor analysis or canonical analysis, just to mention some from the bundle of available tools. We understand the input parameters with obvious and verified importance for the final ES as key indicators, which (in a certain simplification) could serve as proxy-indicators of the landscape capacity for ES provision not only in Slovakia, but also in other countries.

Keywords: Ecosystem services indicators, Landscape indicators, Spatial and informational database, Advanced statistical methods

31. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Effects of landscape pattern on regulating functions of urban landscapes of Lipetsk (Russia)

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Urban landscapes assessment from the perspective of the fulfilment of their regulating, supporting and cultural functions relies on the concept of ecosystem functions and services, but in application to a system of a higher order – geosystem. We consider the regulation of natural processes in the city takes place not only because of vegetation, but also by means of landforms properties, natural waters, material and non-material human creations, as well as the urban environment spatial pattern or mosaic. Urban geosystem is recognized within the same landform and characterized by the uniform type of building and the degree of greening.

The allocated urban geosystems are internally homogeneous territories and all material, energy and information flows penetrating them are accepted as homogeneous. Therefore, we consider geosystems to be the proper unit for urban landscapes mapping and assessment.

For the city of Lipetsk we draw the map of urban geosystems and studied the effect of urban geosystems pattern on regulating (local climate and air quality regulation) landscape functions. The index-based classification of landcover (based on vegetation indices NDVI for different seasons, building indices VrNIR-BI and IBI, humidity index NDWI) helped us to determine the proportion of vegetation and sealed areas in each map contour. We calculated land surface temperatures based on Landsat 8 TIRS data for different seasons of the year and linked them to urban landscapes composition. For assessing air pollution in the city we collected snow samples from undisturbed surfaces at about 70 sites across the city. Then snow samples were melted and filtered in the laboratory to determine the total dust pollution per sq.m. and pH of snow. Analysis of urban landscape metrics helped us to reveal the optimal composition of urban geosystems for better ecological and comfortable environment in the city.

Keywords: urban geosystem, landscape pattern, landscape functions, LST, air quality

32. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

RO Korea's Perspective on Marine Ecosystem Services-based Marine Spatial Planning and Management

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Concept of marine ecosystem services has been shown on policy documents of countries who want to incorporate the services into resource and environment management system. Several experimental efforts have been made to put the services into the policy system, on limited

areas of some countries. The Korean society has been following the same track, and, especially, achievements in marine and coastal areas were very limited.

In the meantime, the Korean government adopted the policy direction of ecosystem-based planning and management in Integrated Coastal Management Plan and Marine Ecosystem Conservation & Management Plan in late 2000s. Ecosystem-based approach to marine management have been functioning as a milestone for long-term strategic management of marine spaces and resources.

In line with the above, the change of societal perception on ecosystem-based marine management has driven the change of Korea's national marine policy since 2000s, undergoing very controversial events such as coastal water reclamation. Increase of marine protected areas in Korea is representing the changed public recognition on ecosystem-based management. In addition, non-market valuation on natural assets and their services were conducted in the process of decision-making for addressing some controversial issues.

Other driver toward ecosystem-based approach is the enactment of Marine Spatial Planning and Management Act in 208. Prior to the enactment of the act, governmental sectors and experts reached consensus on incorporation of marine ecosystem services into policy regime, and suggested that the new act should contribute to implementation of ecosystem-based management. Current planning system has less hired information of marine ecosystem services due to less availability of the relevant data & information. Research to develop MES-based MSP is scheduled to be incorporated into MSP decision-making support system in 202. In this presentation, the details and lessons on MSP policy evolution and the research for supporting MSP policy will be shared.

Keywords: marine spatial planning, marine ecosystem service, marine spatial decision-making

33. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

The importance of post-mining objects (former opencast mines) for urban development on the example of the Kraków agglomeration.

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For the provision of raw materials for the construction industry, mining operations are carried out in the immediate vicinity of cities - exploitation of aggregates, limestone, marls, and clay. The expansion of the city causes that the objects functioning on its periphery are inside the city tissue. The post-mining areas are characterized by certain properties that, unlike agricultural areas or wasteland in the suburban area, protect them against simple development buildings. For this reason, and due to other specific properties, they are a potential for the organization of new parks (eg in quarries), recreational areas (eg in reservoirs after gravel extraction). They are also excellent natural niches existing inside the urban tissue. Unfortunately, the potential of post-mining facilities is usually neither noticed nor properly used. The presentation will discuss the problems of developing post-mining areas on the example of numerous post-mining facilities within the Kraków agglomeration.

Keywords: Post mining areas, suburban area, new parks, recreation, natural niches

34. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

From 'recognition' to 'payments' for natures' conservation: Practice, prospects and potentials of ecosystem services in an Indian protected area

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This paper takes the case of an Indian protected area by exploring, identifying and recognising benefits derived from the ecosystem by analysing the contours of governance mechanisms of this 'commons' from colonial regimes of Mughal, Maratha, British to maintain ecosystem services in 'sanctuary and national park' in independent India. It also captures, quantifies and evaluates different ecosystem services mainly provisioning, regulating/supporting and cultural in form of recreational services of the Bhitarkanika Mangrove wetland protected area, India. The study explores the practice, prospects and potentials of ecosystem services of the protected area by conducting household surveys and applying product method in quantifying provisioning ecosystem services and also finds the factors that are responsible for predicting the dependence of the local households on the provisioning ecosystem services of the protected area. The results reveal that although poor households mainly depend most on the provisioning ecosystem services of the protected area, the very system has been perceived to be prioritized for its regulating/supporting services. This has been captured by their perception of preserving the ecosystem. It has been found that about 62 percent of the responses reveal their preferences for regulating/supporting ecosystem services; whereas only about 2 percent and 7 percent perceived value for provisioning and cultural services of the area respectively. It has also quantified recreational ecosystem services in form of ecotourism by applying travel cost method and econometric techniques in quantifying the consumers' surplus of the beneficiaries (tourists) to enable the mechanism of payment for ecosystem services to foster conservation of the very protected area ecosystem.

Keywords: Protected Area , Ecosystem Services, Ecotourism, Valuation, Payment for Ecosystem Services, Conservation

35. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Envisioning future scenarios to support environmentally sustainable livelihoods in multi-functional land use systems across the Zanzibar Archipelago

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Small islands are especially vulnerable to the impacts of land use and land cover change and climate change due to their: small size, geographical isolation and exposure. Despite their vulnerability protective ecosystems are being removed and degraded due to pressures of population increase and socio-economic development, especially in relation to tourism related infrastructure. These drivers of change put stress on limited water, energy and food resources which underpin the sustainability of local livelihoods. This threatens to impact negatively on poverty alleviation agendas, such as the sustainable development goals. Consequently, there is urgent need for research to explore how both land use and land cover change, and climate change, are impacting on the security of these resources. Considering the interrelationships across sectors, this research aims to highlight the need for a nexus approach to be applied to sustainability assessments in small islands, using the Zanzibar Archipelago as a case study. To date, nexus approaches have tended to adopt broad scale systematic approaches and have often failed to integrate insights from communities. This study uses a scenario framework named KESHO (meaning “tomorrow” or “later”) to connect diverse insights about change and form coherent and inclusive alternative scenarios to support the environmental sustainability of livelihoods in Zanzibar, using a new conceptual approach which integrates local dynamic responses to change into future land use and land cover scenarios. The study comprises of four main steps: () focus groups with the village leader and elders to develop an awareness of the cultural context; (2) workshops with mixed gender groups in ten villages across spatially diverse site to identify key drivers of land use and land cover change for 2030 and evaluate the impact of such change on water, energy and food security; (3) multi-stakeholder workshops to develop tangible alternate future scenarios which would support environmentally sustainable livelihoods; (4) synthesis workshops to present scenarios narratives and maps and respond to feedback for the final outputs. In doing so, this study

aims to generate a better understanding of how drivers of change reshape socio-ecological relationships and provide contextual insights which can be used to evaluate environmental livelihood sustainability across different scenario pathways in small islands such as Zanzibar.

Keywords: Dynamic, nexus, participatory , climate change, poverty alleviation, Sustainable Development Goals

36. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Modelling and quantifying the influence of land-use change on food and water provisioning services in a carbonated karst aquifer of Western Mountain Aquifer Basin under Mediterranean climate.

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The water demand of one-fourth of the global population relies on carbonated karst aquifers. These highly dynamic and fast reacting aquifers are limited in low storage capacity due to high hydraulic conductivity and low storage coefficient. They are vulnerable to human impact and are difficult to manage, especially in the Mediterranean climate where groundwater recharge and flow dynamics are extremely variables. The karst aquifer in the Western Mountain Basin (WMB) in the Israel-Palestine territory faces additional stress for water management due to rapid climate change and high population growth rate. High water demand from urban and agricultural use increases pressure on groundwater abstraction; on the other hand, projected climate change reduces groundwater recharge by decreasing precipitation and increasing evapotranspiration in the WMB. A hydrologic model of WMB was developed using Soil and Water Assessment Tool (SWAT) to quantify food and water (river flow and groundwater recharge) provisioning services under different land-use change scenarios. The SWAT model will be used for historical land-use change for the duration of 992-204 and for three projected land-use scenarios from 205-2030. The provisioning services will be quantified for each land-use scenario. The future land-use scenarios are the baseline scenario (Sb), which follows the

same trend as historical land-use, the nature conservation scenario (Sn), which preserves more land area for nature and the resource intensive scenario (Sr), which prioritizes more land area for urban and agricultural uses. The model result from these different scenarios will provide a useful information to improve the provisioning services in the region considering high urban and agricultural water demand under different external factors. This information will improves the current understanding of water resources in WMB and will be helpful to stakeholders for future policy making for sustainable groundwater resources management regionally.

Keywords: Carbonated karst aquifer, SWAT model, Land-use change, provisioning services, Western Aquifer Basin

37. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Assessing the role of urban agriculture to promote sustainability in cities: Theoretical framework and empirical application

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Urban agriculture is mainly recognized in European cities as a nature-based solution for social capital construction due to its value in terms of social cohesion and civic-environmental stewardships. The biophysical and social conditions needed for growing food in urban gardens (e.g. unshaded space, accessibility, availability of gardening tools, organization and facilities) attract people to engage in agricultural activities and support other place-based social dynamics such as interacting and exchanging knowledge and resources among people from different socio-economic background. However, urban agriculture has impacts on other capital assets (e.g. manufactured, natural, human and knowledge capitals) that also constitute the foundations of sustainable development of societies. This study aims to assess the variety of impacts of urban agriculture on all capital assets, by developing a theoretical framework and applying it to a case study, represented by sixteen community gardens in the city of Trento, in northern Italy. A literature review was used to identify a list of potential impacts,

and suitable indicators, associated to the different capital assets. The information required to assess such impacts was clustered in different categories (e.g., bio-physical, managerial and socio-economic aspects), and collected for both the community gardens and the surrounding areas. The impacts were evaluated using GIS data, field surveys, questionnaires and in-depth interviews with users and residents. Our theoretical framework shed light on the relationship between urban agriculture and the sustainability of cities, defined as the capability to preserve (or enhance) the different capital assets for current and future generation. Alongside, our results from the empirical case study provided evidence of the impacts of urban agriculture on a broad set of issues that are important for sustainable development of a specific urban context.

Keywords: nature-based solutions, urban agriculture, sustainable development, impact pathways, impact indicators

38. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Carbon sequestration and global warming in the São Paulo Macrometropolis

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The carbon sequestration is essential ecological processes that sustain life due to its association to the ecosystem functions of climate regulation. The analysis of global warming was based on studies that observed a consistent decrease in carbon sequestration, by tropical rainforests, with rise in atmospheric temperature.

Using the InVEST model (Natural Capital Project), we quantified and valued the carbon balance generated by predictive scenarios for the São Paulo Macrometropolis, Brazil. This extensive territory concentrates cutting-edge technology industries, diversified commerce, high complex services and productive agroindustry. Father, its challenges are also huge.

The current carbon storage is estimated in 829,905,984 Mg. However, when accounting for the temperature rise by Celsius due to global warming, the storage should be reduced in almost 36 million Mg of carbon. The monetary loss could amount to US$ 492 million.

As many pasture areas are degraded and underutilized in the region, it is suggested a predictive scenario was designed where the degraded pastures class is replacement by silviculture classes. Three growth stages of reforestation were considered: 3, 5 and 7 years. Thereby, a positive balance can be obtained in carbon sequestration through the reforestation.

Even with global warming, around 50 million Mg of carbon would be sequestered from the atmosphere in 7 years after the beginning of the reforestation. This carbon amount could reach US$ 2 billion in the voluntary carbon market. Thus, each reforested hectare can sequester up to 354 tons of carbon and trade USD 485 in REDD market.

These values reflect the reforestation and land-use planning can soften the effects of global warming on forest carbon stocks. In order to face them, the knowledge about the territory and the planning are necessary for the socioeconomic development of the region together with environmental conservation.

Keywords: carbon sequestration, ecosystem services; climate change; land-use change; Brazil

39. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

The relationship between tree diversity and it's basal are to improve carbon storage across different management on agroforestry system

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Planting more trees in terrestrial ecosystem had provided on the increasing on many ecosystem services including carbon storage, water supply and soil cover. The relationship between the impact on increasing tree density on tree diversity across various land use type are limited. Using a survey and collecting field measurement within the plot in the size of (00 m x 20 m), we investigated the effect of different type land use on tree diversity, basal area, and species composition at Bangsri Watershed-East Java landscape, comparing different agroforestry system to various young to old production forest of Mahogany (Sweitenia mahogany), Pines (Pinus merkusii) and Rekisi (Magnolia × alba (D.C.)

The result showed that seedling population under complex agroforestry system is almost twice (389.667 individu/ha) higher that those simple agroforestry system or production forest. Young Mahogany (5-0 years) provide the highest number of pole, whilst old Mahogany and Pines production forest (35-40 years) contributed the greatest tree population at (500 - 600) individu/ha providing the highest value of basal area since the average of those tree diameter within the size of (25-40 cm). Tree population of complex agroforetsry system were lower 50% than production forest. However, diversity indeks (H') of sapling, pole and tree under complex agroforestry sistem were between to 2.5, while the others plot were <, except for seedling diversity. In particular the increasing of tree population impact of greater basal area but however it reduce the diversity of, seedling, sapling, pole and tree as the consequences of the implementation of different tree and land management.

Keywords: Key word : agroforestry system, land management, tree diversity indeks

40. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Participatory monitoring: for what and for whom? Experience of a transdisciplinary collaboration in a forest ecosystem in Mexico City

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Participatory monitoring has generally been used as a strategy to simultaneously generate reflexive processes and accurate data. Ideally, these data allow communities to exercise their right to make decisions based on knowledge of socio-ecosystems.

This type of monitoring consists, like traditional monitoring, in determine through quantitative and/or qualitative measurements the significant changes in the long term and the analysis of periodic data with particular characteristics, as well as describing the trends and state of the environment. In recent years, participatory monitoring hasn't taken into account the joint participation of social actors to identify the problem, as well as to select the variables to be monitored. In addition, the data generated have not been translated into actions that would allow the causes of the problems identified to be reversed; factors that should be taken into account when working with these types of monitoring. In countries such as Mexico, where land tenure is mainly communal and/or ejidal, participatory monitoring has the potential to improve local decision making, with the dual purpose of increasing local capacities and maintaining the integrity of ecosystems. Bases on this, a joint creation monitoring has been carried out during the last 0 years in a temperate forest in the rural-urban part of the Magdalena river basin in Mexico City. The ecosystem quality of a river system, as well as the reforestation and the natural regeneration of a template forest were estimated with the objective of identifying the scope and challenges of three key aspects based on joint creation monitoring and transdisciplinary research: the inclusion of different social actors, generation of communication and collaboration networks between them and the translation of the monitoring results into actions.

Keywords: participatory monitoring, social actors, decision making, socio-ecosystems, Mexico City

41. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Looking back: retrospective evaluation of change in ecosystem services provided by a coastal lagoon

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Curonian lagoon is the largest coastal lagoon in Europe providing multiple ecosystem services for local population and beyond. We applied a combination of methods to assess the changes in the ecosystem services provision in the Curonian lagoon itself and neighboring rural territories, where human activities are affected by the lagoon between periods of 984-985 and 207-209. To assess the ecosystem services related to fish stocks official statistics was used. To assess wetland and terrestrial ecosystem services (e.g. agriculture, forestry) both statistical and landuse data derived from Landsat 5, Landsat 8 and Sentinel-2 multispectral images acquired for both periods. Semi quantitative scores for different ecosystem services were assigned to each of landuse/habitat type present in the area. To evaluate the ecosystem services relevant to the Curonian lagoon itself, we compiled a spatially distributed mass balance model coupled to the hydraulic circulation one along with environmental monitoring data that are available for the lagoon ecosystem since 984.

The observed sharp differences between two periods were due to the change in socio-economic practices (transition from social system economy to the market one) and natural changes of the ecosystem.

This contribution has received funding from European Social Fund (project No 09.3.3-LMT-K-72-0-078) under grant agreement with the Research Council of Lithuania (LMTLT).

Keywords: coastal lagoon, fishery, remote sensing, landuse changes

42. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

On dairy production and complexities of urban ecosystem services provision – Insights from Bangalore, India

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Urbanization is one of the defining trends of our current societies and, with population growth, challenges the future of food production systems. A spatially explicit survey of 337 dairy producers in and around Bangalore, India, showed the presence and socio-economic similarity of dairy units (small scale, family farm) from inner-urban (city centre) to remote rural (60km from centre) areas. Urban dairying, doorstep fresh supply of highly demanded milk and cows freely roaming the streets are striking examples of how emerging megacities in India rely on their immediate surroundings but also on inner-urban areas for food production, as a result of the interaction between several drivers of change.

Although increased competition for land is considered a major pressure on agroecosystems, increased market opportunities due to demographic drivers of change in Bangalore's urbanizing environment wield an equally strong incentive to pursue "landless" urban milk production: dairy producers compensate lack of farmland by relying on public land for pasture and forage collection while benefitting from their integration into the urban landscape. Cultural drivers such as diet change patterns with a shift toward more convenient food supply are offset by the preserved cultural importance of cows in the Indian society. However, the provisioning and cultural ecosystem services of urban milk production are opposed to disservices such as disrupted nutrient cycles due to difficult manure management and risk of water pollution via excreta. With respect to regulating ecosystem services, the high ratio of

emitted methane per litre of milk can be viewed as a further disservice. These ecosystem (dis)services and trade offs of dairy farming within emerging megacities, in India but also in West-Africa, must be acknowledged in policies for sustainable urban development, especially since they are part of a now urbanized but traditionally established social-ecological system rather than solely attached to urban green and blue infrastructures.

Keywords: Urban Ecosystem Services, Dairy production, India, Urbanization, Built ecosystem

43. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

A transition from a policy integral assessment with indicators, to socio-ecosystem's community monitoring in Mexico City. For local environmental governance and local sustainability

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The Conservation Land (CL) of Mexico City, Mexico is the area designated for the conservation and use of nine original communities as owners of the territory and a great biological, historical and cultural wealth. The Community of San Miguel and Santo Tomas Ajusco have a several socio-environmental problematics like the rest of the CL and, one of their main demands inadequate, non-inclusive and conflicting environmental policies. The objective is to show how an integral assessment of Payment of Environmental Services that provide the bases to a new community's socio- ecosystem monitoring, which Ecosystem Services (ES) are the core and at the same time provide a green employs policy. The analysis framework was Socio-Ecosystems (SES), especially in environmental governance and local sustainability around the territory and the ES. The methodology followed the establishment and operation first of the PES' integrated assessment (indicators proposal design, evaluated and applied) into the period of 202- 207; and second, the emergence, of the community brigade and environmental monitoring (interviews, surveys, participant observation, discourse analysis and documentary) in the last two years. The results show initially, the utility of the proposal of integral analysis

as a useful methodology for PES' effects evaluation in the social, economic and ecologic dimensions, as variables of the third level of SES framework. Then, the adaptation of the indicators' variables to the field work as a community monitoring shows the transition. This transition means how the bases and scientific needs can be combined with the traditional knowledge and the needs of knowledge and management of the territory of the community. Finally, the green job, must be a good quality, recognized and trained job in this case support for a new environmental public policy, through the community brigade and with tasks such as monitoring in conjunction with governmental, social and academic actors.

Keywords: PES' integral assessment, community monitoring, green job, Mexico city, peri-urban socio- ecosystems

44. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Multiple functions of agricultural landscapes for Urban Green Infrastructure

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In 203, the European Commission has adopted the Green Infrastructure Strategy (GI), to promote the deployment of GI and integration in main policy areas. Although, the understanding of Urban Green Infrastructure (UGI) has matured in past decades as a spatial planning and design concept for sustainable urban development, the contributions of agricultural landscapes – which in many European metropolitan regions provide significant spatial potential – are rarely considered, compared to other green space types.

This presentation gives an overview about the scientific evidence base about multiple functions that agricultural landscapes offer, contributing to human well-being in urban areas and help to tackle major challenges of urbanization.

Keywords: urban green infrastructure, agricultural landscape, multifunctionality, evidence

45. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Pastoralists and agro-pastoralists' indigenous knowledge on rangeland and livestock management in Miombo woodlands, Eastern Tanzania

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Indigenous rangeland management practices, forage quality and availability, and livestock production by pastoralists and agro-pastoralists in miombo woodlands were investigated in a study conducted in Kilosa district, Tanzania. The study methods comprised household interviews, key informants and focus group discussions, and forage laboratory analyses. Preferred forage species and indigenous livestock-rangeland management practices of pastoral and agro-pastoral communities in miombo were identified and nutrient content of the forages was determined. In general, rangeland management in the study area faces challenges such as unclear or disputed land tenure regime and lack of technical knowledge. Moreover, the nutritional value of some native forage species identified in miombo was found to be too low to meet the nutrient requirement of livestock. Livestock in miombo contribute greatly to household livelihoods and food security, but forage scarcity was identified as a limiting factor. Overall, it was concluded that rangeland improvement practices are poor or non-existent in allocated grazing areas in miombo woodlands.

Keywords: Dry woodlands, land use plan, rangeland condition, traditional herders

46. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

How can urban form promote green spaces in high-density residential areas? Insights from São Paulo, Brasilia and Berlin

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A current global challenge for urban planning is to achieve cities that are simultaneously compact and green. Compact cities have been widely promoted in the sustainable cities discourse, while green cities have been gaining increasing attention, being an important component for resilient cities. But existing research mainly deals with either achieving compact cities or achieving green cities, focusing less on achieving both at the same time. Moreover, the role of urban form to achieve this is seldom studied.

The aim of this research is to assess the performance of different urban form types in terms of green space quantity, composition and configuration, as well as different density metrics. We draw on a comparative analysis of São Paulo, Brasilia (both Brazil) and Berlin (Germany), which together present a wide range of urban morphological typologies at high-density level. Additionally, Berlin is considered a good example of a (developing) green city.

Results suggest that urban form plays a relevant role in conciliating high population density and greening in urban areas. Using the block, as opposed to the single plot, as minimum planning unit, seems to be an important factor to achieve high-performance typologies, as shown by the case of Berlin. More than one typology showed good performance, suggesting that alternatives to high-rise development exist. We draw lessons for urban planning from the comparative analysis of the three cities, offering morphological alternatives to support planning towards greener cities in Latin America.

Keywords: Urban form, Green space, Urban planning, Compact city, Green city

47. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Building a sustainable tropical bioeconomy: Natural Ingredientes (NI) from the local agrobiodiversity in Colombia.

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Bioactive compounds from fruits diversity can be a source of added value for sustainable biodiversity use in Valle del Cauca and the Pacific Region, in Colombia.

Worldwide trends of responsible production and consumption open growing demands for Natural Ingredients coming from local agrobiodiversity, within a sustainable tropical bioeconomy.

The dispersion of resources and efforts to produce innovative, world-class NI was identified as the main problem to solve, within a proposal intended to promote a Line of NI research, innovation, and Investment in the territory.

From the first approach it was decided to take into consideration the productive chain: crop producers, agro-industry and NI producers, and users, putting in place the concept of Sustainable high added value Agricultural systems (S.A.S.A.V.A., for the Spanish words), considering Ecosystem services challenges analysis.

Corporación Biotec with allies presented a proposal to a Science, Technology, and Innovation (STI) call to Improve capacities to produce NI from residual biomass from crops and agroindustry of tropical fruits. The proposal included three main deliverables: three prototypes of selected NI, a Model of NI production for scalability and replicability and an Agenda of research and innovation, to improve the human resources capacities and the institutional viability. The expected impact in society was oriented to respond to demands from public health, food and nutrition and cosmetic industry as an added value sector, in addition to STI

results and products as new processes and knowledge related to a sustainable use of local biodiversity, trained researchers, and publications.

The Project was approved for financiaton, through 30 months, starting in April 208. At the end of 208, three NI were selected: Soursop leaf acetogenin-rich standardized extract, Pineapple peel essential oil and Peach palm pulp and peel powder The Project is under way, as a demonstration case of sustainable tropical bioeconomy.

Keywords: Natural ingredients (NI), fruits local agrobiodiversity in Colombia, NI research, innovation and Investment, Ecosystem services challenges analysis, sustainable tropical bioeconomy

48. Poster abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Antimicrobial resistant bacteria transfer from humans and livestock: A threat to forest ecosystems

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As human populations expand, natural habitats shrink, resulting in an increase in the interactions between the human-wildlife interfaces. The overlap of interactions between these interfaces may result in conflicts. One of such conflicts is the transfer of antimicrobial resistant bacteria from humans and livestock to wildlife. For wild animal species inhabiting protected areas, contact with antimicrobial agents is considered uncommon. However, human interactions with natural environments may lead to the emergence and spread of antimicrobial resistant (AMR) bacteria in wild animals. Therefore, this study sought to investigate the prevalence of AMR in forest bird species. One Hundred and Thirty-eight cloacal swabs were collected from 20 species of birds captured from the Ankasa Conservation Area, Ghana. A total of 88 confirmed E. coli bacteria isolates were obtained from 44 individual swabs. These E. coli isolates were tested for susceptibility to colistin (one of the last resort antimicrobial agents

used for the treatment of multidrug-resistant bacteria) by the agar dilution method. Colistin-resistant E. coli isolates were further tested for susceptibility to four antimicrobial agents by the disk diffusion method. Plasmid-mediated AMR encoding genes for colistin resistance were determined by PCR. Five out of the 88 E. coli isolates showed colistin-resistant phenotypes while two of these isolates harboured resistance genes. All five colistin-resistant isolates also showed resistance phenotypes to all the other antimicrobial agents (ciprofloxacin, streptomycin, oxytetracycline, and ampicillin) tested. Colistin-resistant isolates obtained were from birds sampled from areas very close to communities surrounding the protected area, suggesting a possible transmission from humans or domestic animals. Though the prevalence of AMR was low, it may have serious implications, considering the valuable role healthy wild birds play in the forest ecosystem and services provided. Continuous surveillance in natural ecosystems is therefore important to monitor the health of wild populations.

Keywords: Conflict, wild birds, antimicrobial agents, phenotypes, plasmid-mediated

49. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Incorporating environmental costs – effects on the profitability of European winegrowers

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Bare soil management in vineyards contribute to losses in nutrients, water and overall soil biodiversity. Cultivating cover crops (CC) in inter-rows can reduce these environmental effects and can even have a positive effect on winegrower's profits in the long-term. Therefore CC should be the dominant management method. But in the short-term, additional costs arise for winegrowers and they perceive a higher risk for yield losses, due to extreme climatic conditions. This is based on the competition between CC and vines for water and nutrients as well as on the additional labour needs.

This study aims at creating a better understanding about the environmental effects and the associated cost structure of different management systems in European Vineyards and is contributing to the development of a sustainable agriculture.

In order to validate the effect of CC on the overall profitability, we used the Policy Analysis Matrix (PAM) and calculated different scenarios for two wine regions in the EU, namely Carnuntum in Austria and Montilla-Moriles in Spain. In a second step we included environmental costs of the respective managements.

Results indicate that CC indeed lead to higher management costs, but do not have a significant effect on the overall profitability. It is important to point out that the solely production of grapes is not profitable in most cases at status quo. This might be an indicator for the low adoption rate of CC in European vineyards.

However, if on-site and off-site costs of bare soil management are incorporated in farmer's budgets, CC are cost effective. CC can even lead to higher profits, if direct sellers use them as a marketing tool.

The bottom line is that the benefits of CC, especially in the long-term and for the overall society, need to be better communicated to winegrowers to reduce reluctance and increase adoption rates.

Keywords: Cover crops, vineyards, profitability, environmental costs

50. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

An urgent call to revisit ecosystem service valuations: why ES valuations should be based on thermodynamic foundations.

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Recently R. Costanza et al. (207) warned that the economic value of ecosystem services has been mostly understood too narrowly as aggregate willingness to pay for the stream of services or the cost of compensation for their loss. Such unilateral valuations would require that ecosystems and their services are infinite. Furthermore, such unilateral valuations produce misleading value relations, as the value of forest ecosystem services, as a representative of a natural landscape, is lowest compared to any anthropogenically altered ecosystems (urban lands, croplands, grasslands) (Costanza et al. 204). It is a priority to embrace the broader concept of economic value (as shown by A. Marshall and H. Daly), based on comparing human benefits from nature with the costs of the consumption of natural resources. As all life on Earth is thermodynamically driven, mainly by incoming solar energy, the costs in such calculations are mostly generated by solar energy dissipation losses caused by anthropogenic alteration of natural ecosystems. A return to Marshall's twin-blades-of-value scissors cannot be achieved by corrections in national accounting systems, but must be placed at the very heart of our search for sustainable economic activities. Economic agents should start to pay for thermodynamic losses caused by their transformation of natural ecosystems. They should at least compensate biotope losses according to the biotope valuation method and some increments can be added according to Energy-Water-Vegetation Method (Seják et al. 208). By incorporating solar energy dissipation losses as costs to ecosystems the proper value relations can be achieved, having climax forests as the most valuable ES producers, and recognizing that humans will be unable to substitute equivalently such ecosystems and their services through human technologies.

Keywords: ecosystem services, economic value, inclusion of supporting ES into economy

51. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

A comparative analysis of ecosystem services valuation in alternative agricultural systems: case of Dezful County, Khuzestan province, Iran

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This study quantified and compared the economic value of ecosystem services in three agricultural systems (conventional, healthy food production, greenhouses) in Dezful County, Khuzestan province, Iran. This quantification was based on an experimental and field method from Sandhu et al., 2008. Accordingly, the yield of agricultural products was determined through market price, and for other services, non-market valuation methods were used. The results showed that the greenhouses systems with an average of 62 million Rials/hectare/ year had the highest economic value of ecosystem services. However, more than half of amount of reported rate (425 million Rials/ ha/ year) was the market services and provisioning value of these agricultural systems which compatible with the production-driven approach in industrial agriculture. The highest non-market services are valued at the healthy production system (226 million Rials/ hectare/ year), which is greater than the total amount of production (57 million Rials/hectare/year). The major portion of the value is gained by the role of this f system in job creation which is mostly ignored in the comparative assessments of agarin systems. This system also has the highest value for services of water and soil protection. Generally, healthy production systems obtained the second highest value after industrial greenhouses systems in terms of entire evaluated ecosystem services. Citrus gardens also have the highest non-market ecosystem services in both of the healthy and conventional systems (244 and 247 million Rials/ ha/ year, respectively). In the end, developing a multifunctional agriculture approach was recommended to optimize ecosystem services through policies and institutions that facilitate multifunctional agriculture be strengthened.

Keywords: ecosystem services, agricultural systems, valuation, multifunctionality

52. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Methods for assessing supply for and demand on ecosystem services of urban green spaces through a webapp

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The provision of urban ecosystem services through urban green infrastructure depends largely on two aspects:) the importance that city dwellers attribute to the respective ecosystem services on the demand side and 2) the equipment characteristics that urban green spaces have on the supply side. Within the research project meinGrün, a webapp is currently developed as an information and decision-support tool for visiting urban green spaces, making use of their ecosystem services. Since the webapp is to be developed as user-friendly as possible and oriented to the needs of urban green space users, the project pursues intensive citizen participation from the very beginning. At different stages of the project, various formats are used to systematically survey and specify ecosystem services relevant for citizens (e.g., recreation and aesthetics) as well as corresponding equipment characteristics on the demand side (e.g., benches and green volume). On the supply side, information on urban green spaces is derived from open geodata, freely available remote sensing data, etc. Social media data are considered as well providing additional information on qualities of green spaces that are difficult to quantify, such as the aesthetics or frequency of a green space. The decision-support system of the webapp for visiting urban green spaces in the two pilot cities Dresden and Heidelberg (Germany) is based on a combination of supply and demand. This multi-criteria decision analysis is intended to support city dwellers and tourists to find their individually suitable green spaces according to their usage preferences and equipment requirements. The information elaborated can also support city planners in identifying deficit areas in the city, insufficiently equipped with green spaces according to the demand of the city dwellers.

Keywords: Urban ecosystem services, Open Data, green space qualities, user preferences, webapp

53. Poster abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Improving carbon storage estimation for urban trees step by step

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Above ground carbon is relatively easy to estimate, because it requires little more than a tape measure and a suitable allometric equation to calculate biomass from measured diameter at breast height (DBH). When it comes to urban trees, there are two problems related to this method. First, most allometric equations have been derived from forest trees that have very different growth conditions than urban trees. Second, allometric equations usually only exist for common and commercially interesting tree species. Terrestrial laser scanners (TLS) can help to overcome these problems, because they allow estimating the volume of trees in a non-invasive way. If trees of different diameters are measured and density values exist, new allometric equations can be created. Here, we present allometric equations for Liquidambar styraciflua, Quercus robur "Fastigiata," Ostrya carpinifolia, Quercus cerris, Tilia tomentosa, and Malus spec. derived from trees in Braunschweig, Germany. We used the Riegl VX400i TLS for measuring point clouds and Quantitative Structure Models for estimating volumes. Because of climate change, pests and pathogens, many cities have started planting species that are expected to be more robust and resistant. This creates a new problem: often, there are too few individuals of different diameters of these new species in a city. This was also the case for the species mentioned above. In order to improve the quality and diameter range of the equations, the raw point clouds will be uploaded to a data repository so that they can be combined with additional scans from other cities in the future.

Keywords: Allometric equations, terrestrial laser scans, urban trees, open data

54. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Watershed Hydrology Modelling for Climate Resilience: Do the Regional Land Uses Planning support better hydrology environmental service on Volcanic Slopes in the Rejoso Watershed, East Java, Indonesia?

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In an era of climate change, forest or agroforestry conversion to arable agriculture and other land-use may increase risks of loss of hydrological functions. The regional land use planning theoretically will improve environmental service in watershed. The purpose of this research is () to study the indicators and criteria of Rejoso watershed hydrology based on changes in land use, (2) analyzing the conditions of the criteria and indicators of Rejoso watershed hydrology based on the regional spatial Plan and compared with implementing land capability scenario land use.The research location is Rejoso watershed with total area of 63,359 Ha. Research conducted using the modeling Generic River Flow (GenRiver) developed by World Agroforestry Center. To know the hydrological degradation of watershed is carried out two scenarios of land use change in the years 2005 and 2009. The others scenario is based on the plan of Regional Spatial Planning and also compared with land capability scenario land-use. The result of the study indicated that the GenRiver is valid to predict the river discharge. Within 4 years, the forest cover reduced % of total area of watershed converted as arable land. Based on the GenRiver simulation, the impact of this forest conversion, the river discharge is increased 6% and the base flow and evapotranspiration decreased 2% and 4% respectively. The regional planning is more emphasized for development then to support environment service. The forest land cover is planned to reduce 6% to become arable land and the existing arable land is planned to convert as settlement and industrial area which increased 22% compared with land use in 2005. The impact of land use planning is predicted will be increasing the river discharge to become %. The implementing land capability scenario land use is predicted give better hydrological functions for Climate Resilience.

Keywords: Land use change, land use spatial planning, modeling GenRiver, watershed hydrology indicator

55. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Natural ecosystem services and local populations

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Located at the northwest corner of the African continent between 2 ° and 36 ° north latitude and between the st and the 7th degree of west longitude, Morocco with a total area of 75,000 km2 enjoys a privileged position with a coastline of 3 446 km long opening to the Mediterranean and the Atlantic Ocean.

Its privileged location with a double coastline and its diverse mountain with four major mountain ranges: the Rif, Middle Atlas, High Atlas and Anti Atlas with altitudes exceeding 2000 m in the Rif, 3000 m in the Middle Atlas and 4000 m in the High Atlas.

Morocco is characterized by an important forest genetic diversity represented by a rich and varied flora and many ecosystems: forest, preforest, presteppe, steppe, Sahara that spans a range of bioclimatic zones: arid, semiarid, subhumid, and humid.

The vascular flora of Morocco has 393 species and subspecies in 298 (including 426 sub-species types), distributed among 55 families and 98 genera. The number of endemic species amounted to 640 (6%) and 280 subspecies (32%). The rare or endangered flora species is estimated to be 463 and 284 subspecies.

Natural flora and ecosystems provide important services to populations represented by grazing, timber harvest, harvesting of medicinal and aromatic plants.

This presentation will be focused on the natural ecosystem services and on the interaction between local populations and ecosystems.

Keywords: Morocco, ecosystem, services, population

56. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Relations between land use and ecosystem services and the impact of climate change

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Adaptation to inevitable climate change makes it necessary to re-think land use management paradigms and strategies and to suggest modifications to existing practices to render them functional in future environmental conditions.

In the present study, we do so, by combining (i) quantitative indicator based assessments and cartographic representations of important ecosystem services in Austria and (ii) an agent-based model (ABM) for fine scale climate change driven land use changes. We use for this purpose two case study areas in Central and Eastern Austria, each of them consisting of land use mosaics following a gradient from alpine meadows to forest landscapes, meadows and arable land.

Using results and data from a recent study conducted under the Austrian program on rural development, we assess and map ecosystem services (ESSs) related to high nature value farmland, habitats and species, fragmentation of habitat types, soil protection, insect pollination, C sequestration in soil, soil fertility, agricultural production (plants), and drinking

water. The ABM "SECLAND", developed in the frame of a project under the Earth System Science Program of the Austrian Academy of Science relies primarily on land managers such as farmers, that make land-use decisions dependent on framework conditions such as market prices and subsidies for agricultural products as well as intrinsic preferences and societal norms that may change over time.

We develop three scenarios considering changes in socio-economic development and climate and use the ABM for predicting land use change at the resolution of land parcels and can therefore assess fine scale changes in the supply of ESSs. Engaging local stakeholders, we identify key challenges and relevant policies to derive land use management recommendations that increase system resilience and counteract the loss of ESSs.

57. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Towards the Application of Ecosystem Services' Concept in the Republic of North Macedonia

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In 208, the Republic of North Macedonia, as an EU candidate country and in view of its main strategic documents for nature protection – National Strategy for Nature Protection with Action Plan (207-2027) and National Biodiversity Strategy with Action Plan (208-2023) began establishing knowledge and practical base for ecosystem services on a national level. The activities have been conducted by the Ministry of Environment and Physical Planning with national expert support within the framework of the Nature Conservation Programme, a project of the Swiss Agency for Development and Cooperation.

The working team, consisting of 20 national and regional experts, follows the official Mapping and Assessment of Ecosystems and their Services guidelines in order to identify, map and assess ecosystems' condition. Mapping process has been conducted by application of Corine land cover, EUNIS classification, Copernicus and national digitalized habitats and ecosystems. In total eight types of ecosystems divided into 27 subtypes have been identified and mapped. Currently, the team is working on assessment of the ecosystems' condition by selecting appropriate indicators. The final number of indicators and parameters will depend on the available data, which are now in the process of collection. The map of ecosystems' condition on the national level is expected to be completed by 209 yearend. Afterwards, the team is to identify ecosystem services by using the Common International Classification of Ecosystem Services. Next, the Ministry and key stakeholders will select important ecosystem services, which later will be evaluated and assessed.

The final output is elaboration of a mechanism for payment of ecosystem services, as a tool for improvement of the connection of the management bodies of protected areas with the other stakeholders, and supporting their financial sustainability.

Additionally, transfer of knowledge and international practices concerning ecosystem and ecosystem services to the Ministry and key stakeholders is enabled.

Keywords: North Macedonia, national level, ecosystem services

58. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

A practical approach to hedgerow management for improving the provision of ecosystem services

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Assessment of ecosystem services is usually conducted at the landscape scale. However, to improve the provision of ecosystem services in agricultural landscapes, hedgerow management should take into account the site conditions and local objectives. The aim of this study was to test a practical approach to hedgerow management, by using a simple methodology to assess relevant ecosystem services provided by hedgerows. The study area, located in the northern part of the federal state of Brandenburg in Germany, amounts to approximately 50 km2. In 209, the hedgerows located within agricultural fields in this area were mapped in QGIS by using Bing Maps aerial imagery. Subsequently, they were classified on site into 5 main types, i.e., tree hedgerow, predominantly tree hedgerow, equal proportion of trees and shrubs hedgerow, predominantly shrub hedgerow, and shrub hedgerow. The preliminary results revealed a very strong dominance of tree and predominantly tree hedgerows. In the past, windbreaks, composed mainly of fast-growing trees, such as hybrid poplar (Populus × canadensis Moench) were widely established in this area. However, the very small proportion of shrubs can be also related to the current lack of hedgerow management. Structurally complex hedgerows consisting of trees and shrubs are particularly important for the provision of ecosystem services, such as protection from wind erosion and provision of habitat for biodiversity. To improve these services, restoration activities in several hedgerows of different types are being planned in agreement with the objectives of the farmer. The actions focus on increasing the proportion of shrub species and replacing the exotic tree species such as hybrid poplar and ash-leaved maple (Acer negundo L.). The selection of species to be planted includes these native to the area and takes into account possibilities for marketing the wood.

Keywords: assessment methodology, hedgerow classification, mapping, windbreaks

59. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Agricultural Management Practices and Soil Ecosystem Services: Social learning by participative multistakeholder processes for strategy development to stabilize Food Security in Africa

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Food security is a function of food availability, food accessibility, food stability and food utilization. Different types of processes can impact food security at different spatial levels, for instance: loss of soil fertility (local), urbanization (regional, national), and global climate change (international). Regarding local scales, initiatives that enhancing the soil ecosystem services thought agricultural soil managements are strategic to improve the resilience of agricultural production systems and stabilize food security in Africa countries. This study will present two different participatory methodologies applied in two African countries: The Participatory Knowledge Integration on Indicators of Soil Quality (INPAC-S) methodology applied in Uganda and the ZALF-GIZ Tool ScalA applied in Tanzania. Both methodologies were able to evidence the local knowledge on site conditions, for instance on resource conservation, food production, processing and markets/society; the level of the communities' participation and engagement were high in the study areas. We can also highlight that the main result was the demonstration that methodologies that consider the social learning perspective can effectively capture and disseminate the communities' visions and beliefs about agricultural production and sustainable options to produce food, fiber and energy while at the same time providing and enhancing ecosystem services to society in Africa. Since those initiatives were led by Brazilian and Germany institutions, in cooperation with research institutions and universities from Uganda and Tanzania, the network established represents an outcome to promote joint solutions to stabilize food security thought the strength of sustainable agriculture productions system.

Keywords: food security; soil ecosystem services; learning processes; participatory methodologies

60. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Searching for practical ESS handles for realising green-blue infrastructure

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To realise part of the green-blue infrastructure in peri-urban areas in Flanders (Belgium) the Flemish Land Agency (VLM) works together with different administrative and local partners (https://www.vlm.be/en). To build up more integrated visions and plans, VLM experimented with the application of the concepts 'quality of place' (QP) and ecosystems services (ESS). While the concepts are straightforward, it resulted in only few spontaneous application by VLM project developers. Therefore researchers were asked to develop tailor-made approaches/processes in 3 VLM-cases, combining local needs with the practical application of QP and ESS concepts. Based on these 3 cases, challenges and knowledge gaps were identified and translated into recommendations for implementation.

A very important first step to address complex multilevel & multi-governance situations (such as realising green-blue infrastructure) is a systematic stakeholder analysis starting from a strong mandate. This helps to identify missing partners and can be used as a base to design a participatory planning process. Participatory processes that focus on the people's needs related to their surroundings provide important opportunities for social learning and co-creation. This augments the quality of a project, improve public support and the likelihood for impact. Furthermore project developers working with the ESS and QP concepts need to increase their knowledge about these concepts, as well as self-confidence to apply them. However, an important underlying skill to work effectively with ESS and QP is 'systems thinking'.

Showing concrete good practices of projects showing the possible win-wins between QP and/or ESS can help to win over sceptical actors. One risk is that by applying the concepts is that more interlinkages between actors and/or landscape elements will become apparent, and that the scope of a project can increase. Keeping a balance between complexity and feasibility is therefore important.

Keywords: green-blue infrastructure, participatory process, knowledge needs, system thinking, complexity

61. Abstract

G. General sessions: G0 Open session: This is an Open Session for abstracts that do not fit in any of the other sessions

Urban street trees detection using Google Street View and computer vision

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Street trees, has long been recognized for its importance in providing ecosystem services value. However, traditional approaches conducted urban trees investigation (e.g. aerial photos and LiDAR) isn't suitable for urban planners to update inventories timely. In this study, we propose an approach to detect urban street trees at high resolution, using openly available panoramas at street-level and deep learning based algorithm. With street map as input, the proposed method shows a promise to generate a detailed street trees distribution in automated way. In order to improve the detection performance of occluded or relatively small street trees, for the first time, we proposed the step of extraction of detection region before detect street trees using Google Street View. Results show that the newly added extraction of detection region is effective to improve the street trees detection. This study comprehensively evaluates the detection result of proposed method in three scale, and shows it's possible to estimate the street number overall (99.3%), in street-level (90.2%) or in each GSV sample sites (73.2%). Besides, a detailed failure detection examples are listed and analyzed with a manual selected 0% GSV panoramas via visual inspection. Result shows our proposed method is satisfied to help street trees inventories, and it would provide a huge impetus to fulfill the urban trees investigation in a reliable, high-resolution and automated way.

Keywords: street trees, Google Street View, deep learning, image interpretation, very high resolution

62. Poster abstract

G. General sessions: G5 Guidelines, toolkits, databases and standards for implementing integrated ecosystem services assessments

National ecosystem services assessment in Slovakia

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Poster gives an overview of the national ecosystem services assessment in Slovakia based on the results of MAES process, previous ES research in Slovakia, but mainly on the original research methodology using spatial and statistical data.

First step of the national ecosystem services (ES) assessment was realised during the Slovak MAES process, which has resulted in a selection of important ES for the evaluation process. 8 ES were finally selected fora pilot national ES assessment (5 provisioning, 0 regulating & maintenance and 3 cultural). Next, the theoretical and methodological framework for the national ES assessment has been established – a comprehensive conceptual model of ES assessment has been designed, inspired also by other studies on a national level. Assessment of the landscape capacity for ES provisioning is the first result, based on the evaluation of landscape units, features and indicators at the level of ecosystems (habitat types, watersheds), administrative units (municipalities, districts), natural features (topology, geology, soils, climate, water, biota) and on the selected socio-economic parameters (population, human activities, resources use). ES capacity models have been created and evaluated for each of the 8 ES, for 3 main groups, and finally for the overall ES provision. All findings were combined in a comprehensive publication issued as “Catalogue of ES in Slovakia”.

A following research on ES demand and real ES flows evaluation is based on the socio-economic indicators at the level of administrative and landscape units. An integrated ES

assessment will be implemented as a final step of our research, based on the evaluation of the balance of different ES groups (provisioning, regulation & maintenance, cultural); and also on the evaluation of the spatial / functional mismatches for the whole territory of Slovakia, expressed in detailed spatial grid.

Keywords: National ES assessment, MAES process, ES capacity, ES demand, Slovakia

63. Poster abstract

G. General sessions: G6a Effective teaching strategies for making the ecosystem services concept relevant to society

Assessing recreational potential and species conservation value provided by zoos in partnership with stakeholders

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Zoos play an important role in society by providing ecosystem services to the region. With the unprecedented loss of biodiversity, they function as green spaces within urban surroundings. Zoos also serve as important centers of education through raising awareness about the need for conservation activities and providing a pool for scientific research. For the module "Ecosystem Services: Case Studies", within the Master's program Ecosystem Services, students conducted a project aimed at understanding people's perceptions regarding the recreational potential and awareness of species conservation value provided by two zoos in Saxony, Germany. In order to highlight the different ecosystem services that zoos can provide, study sites were selected in the cities of Zittau and Görlitz. The Zittau zoo resembles more of a park with animals, while the one in Görlitz is more comparable to a conventional zoo. A survey was conducted in the form of a questionnaire distributed to visitors and non-visitors of the case study areas. Questions about recreational potential covered four categories: aesthetic enjoyment, environmental amenities, maintenance, and education. Likewise, species conservation value focused on three categories: emotional value, maintenance, and education. Qualitative analysis of the results confirms the hypothesis that respondents visit Zittau zoo mainly for recreational value due to the presence of landscape diversity, while Görlitz zoo

attracts families seeking to entertain children and serves as a medium for biodiversity education. To conclude the project, the perceptions of the respondents were presented and discussed with the stakeholders, zoo management, to enhance visitor experience at the zoos. By carrying out a project for this module, we gained experience working with stakeholders, and were able to apply our knowledge of ecosystem services in the real world.

Keywords: ecosystem services, stakeholders, project management, questionnaire, zoo

64. Poster abstract

G. General sessions: G6a Effective teaching strategies for making the ecosystem services concept relevant to society

Assessing Ecosystem Services through Public Participation

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People have a high access to and use of ecological assets. It is meaningful to identify ecological assets and analyze the ecosystem services through public participation. These activities lead to citizens' ecological knowledge, which enables them to gain ecological information. In addition, public participation in ecological asset assessment brings educational and awareness-enhancing effects of ecosystem services to local residents. It also reflect citizen's opinions on the local environmental plan. We have recruited local conservationists and conducted a rapid assessment on ecosystem services followed by the basic statistics analysis, correlation analysis, and factor analysis of ecosystem services. We also had the opportunity to hold workshops for local conservationists and civil servants to share these results and discuss ways to utilize them. Through this, we were able to identify ecosystem services that are closely related to citizens' lives by establishing a list of ecological assets by region. It also showed that a series of processes for ecological asset selection and evaluation can be linked to ecosystem services awareness promotion, environmental education programs and ecotourism. Public participation, together with local conservationists, has the advantage of monitoring ecosystems at a lower cost and in a shorter period of time. Furthermore, in sharing and discussing the results, they said it was an opportunity to learn about local ecological assets.

We also hope that more people will be able to engage with the local ecosystem in the future, and there is a request to use this result in local government. Also, in the questionnaire, it was confirmed that public participation in ecosystem service increased their interest and understanding level, and the preference, reflection opinions, and satisfaction of ecosystem service evaluation were also high.

Keywords: Eco-education, public participation, ecological asset, rapid assessment, regional assessment

65. Poster abstract

G. General sessions: G6a Effective teaching strategies for making the ecosystem services concept relevant to society

Learning and transferring the Ecosystem Services concept through stakeholders' involvement: Tourism in the Zittau Mountains Nature Park (DE)

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The Ecosystem Services concept is recognized as facilitating tool to help stakeholders recognize the importance of well-preserved ecosystems for their activities. Given the dependence of tourism on the provision of ecosystems services, understanding their role can be a good way to influence the stakeholders' perception and support more sustainable management decisions. In the context of effective teaching strategies, students of the Master´s Ecosystem Services, designed, implemented and assessed a research project. This project aimed at assessing the perception of relevant stakeholders about the ecosystem services provided by the Zittau Mountains Nature Park to tourism in the Upper Lusatia region. In addition, it tried to raise awareness among them on the important role of the ecosystem services provided by the area. For the active involvement of stakeholders a focus group was chosen as method. . Different activities like questionnaires and participatory mapping guided the stakeholders through the understanding and assessment of the relation between ecosystem services and tourism in the Zittau Mountain Nature Park. The ecosystem services concept was overall regarded as an important and useful tool to highlight the role of the

natural environment for the development of tourism in areas like the Zittau mountains. Cultural and regulating services were identified as the most important ecosystem service categories offered by the park with respect to touristic activities. Stakeholders involved in the project showed a change in their perception and deeper understanding of the concept of ecosystem services. The different phases of project implementation provided relevant results to achieve the project aims, but also a learning process for young researchers to understand how to apply the methods to engage stakeholders with the ecosystem services concept.

Keywords: stakeholders' involvement, participatory mapping, learning ecosystem services, project management

66. Poster abstract

G. General sessions: G7a YESS: placing early career research on the ecosystem services landscape

Insights of use of cultural-spiritual ecosystem services provided by mangroves in prehispanic times. A case study in La Paz Bay, Gulf of California, Mexico

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The topic of ecosystem services (ES) is considered by a large sector of society as a new issue. However, the use of ES can be deemed to have started from the beginning of humanity. Various archaeological and historical studies have shown this critical link between human being and nature. In the case of the mangrove ecosystem, the concurrent use of these services varies from the purpose for food and carbon capture to the protection against tsunamis and storms; Its primary beneficiaries are people mainly settled in tropical coastal areas around the world. In Mexico, indigenous groups such as the Mayan people have used mangrove forests as a source of timber, food, and medicine. On the other hand, prehispanic cultures settled in northwestern Mexico, composed of hunters, fishers, and gatherers, who, not practicing agriculture, needed to obtain their food mainly from wetlands and other coastal ecosystems, including mangrove forests. The objective of the research is to demonstrate the use of the ES provided by the mangroves to the indigenous peoples settled in the Bay of La Paz, Gulf of California, Mexico before the arrival of the Spanish conquerors (533 AD). For this, a literature review of historical documents published articles, and interviews with archaeologists with

experience in the study area were carried out. The results show the use of shells of bivalve mollusks extracted from the mangroves as offerings in ceremonial burials during the period 800 AD until the arrival of the Spaniards.

Keywords: Baja California Sur, Burial practices, Californios, Indigenous peoples, Wetlands

67. Poster abstract

G. General sessions: G7a YESS: placing early career research on the ecosystem services landscape

Conflicting ecosystem services and their relationship to frugivorous mammals in the Peruvian Amazon

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In one of the most biodiverse regions in the world, the Southeastern Peruvian Amazon, frugivorous mammals play an essential role in dispersing seeds, contributing to the survival of many utilitarian plant species. Indigenous communities rely on them as food and on some plants they disperse for a variety of uses such as sustenance, construction, and crafts. However, the relationship between mammal diversity and the benefits they provide is not well known. Trade-offs between ecosystem services (ES) from direct consumption of these animals to wild fruits and raw material provision have not yet been studied in the field. My research aim is to highlight the importance of the diversity of frugivorous mammals in relation to the provision of ES relevant to local communities in the Peruvian Amazon forest, as well as to analyze the trade-offs between conflicting ES. To accomplish this, I identified plant species that are both used by indigenous communities and mainly dispersed by terrestrial and arboreal frugivorous mammals, and I will focus my study in those. I will measure the species abundance, richness, diversity, and functional diversity of terrestrial and arboreal frugivorous mammals in the surroundings of three indigenous communities and inside protected areas in the Madre de Dios department, Peru. Then, I will assess the provision of wild meat, wild fruits, and raw materials and will identify the relationship between them and the mammal community structure. Finally, I will evaluate trade-offs between benefits from hunting to wild fruit and raw material collection and provide recommendations to balance these trade-offs. This research will contribute to the increasing efforts to identify the relationship between

biodiversity and ecosystem services in a megadiverse ecosystem and with high trophic-level organisms. The trade-offs analysis between competing ecosystem services at the local scale increases the significance and adds novelty to this research.

Keywords: indigenous communities, hunting, seed dispersion, trade-offs, provision ecosystem services

68. Poster abstract

G. General sessions: G7a YESS: placing early career research on the ecosystem services landscape

Cultural Ecosystem Services and Cyanobacteria: Exploring Impacts as Framed by Individuals and the Media in St. Albans, Vermont, U.S.A.

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Cultural ecosystem services (CES) meaningfully contribute to human well-being and may play a key role in motivating people to act to protect their environments. Despite growing interest in documenting and evaluating CES, few studies have focused on how environmental degradation may alter these benefits and how people perceive those changes. Cyanobacteria blooms, a type of harmful algal bloom (HAB), pose a serious global threat to freshwater ecosystems, economies, and human well-being. This study explores the impacts to CES of persistent cyanobacteria blooms in St. Albans Bay, Lake Champlain on the surrounding communities in Vermont, U.S.A. by analyzing interviews and local media. This research also looks more broadly at how CES are framed and communicated by the media. I conducted semi-structured interviews with 30 community members chosen based on their relationship to the bay – such as waterfront property owners, businesspeople, and fishermen – to understand CES associated with the bay and impacts caused by the blooms. A selection of articles from the local newspaper was examined to obtain more information on bay-related CES and the bloom's effect on connected benefits. I also analyzed how the articles frame CES in relation to other potential bloom impacts, such as public health risks and economic losses. Preliminary results have revealed losses of CES, including aesthetic, recreation, sense of place, and social relations services. However, many of values derived from CES remain intact and are framed as motivation for people to act. This research will further our understanding of how ecosystem

changes, such as HABs, impact CES, as well as how those changes are perceived by individuals and communicated in media coverage. Identifying these connections between ecosystem change and human well-being could inform strategies for communicating with the public.

Keywords: Cultural ecosystem services, water quality, framing, communication

69. Poster abstract

G. General sessions: G7a YESS: placing early career research on the ecosystem services landscape

GIS based modelling of water regulation services in support of ecosystem accounting

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Water regulation is considered as one of the main regulating ecosystem services by SEEA-EEA. It includes water retention, storm and high water protection (including flood control) and it is also closely related to erosion and sedimentation control as well as water purification. An important characteristic is that all of them can be regarded as both final and intermediate services i.e. it is usually not possible to distinguish between flow and potential. Although, there is some progress in the accounting of water related regulating services, Vardon (204) notes that SEEA-EEA needs further development in this area. GIS-based modelling of water regulation could provide the much needed information for different aspects of the water cycle that cannot be extracted through direct measurements. Applications of different GIS based modelling tools have been applied for flood regulation mapping and assessment. The tools for modelling freshwater ecosystem services which include some widely used hydrological models such as SWAT and VIC as well as tools specifically designed for ecosystem services such as InVEST and ARIES (Vigerstol and Aukena 20). The main objectives of this work are to examine how water regulation can be quantified at different scales and define the appropriate mapping units for such quantification appropriate for the need of ecosystem accounting. The methodological approach is based on process-based biophysical modelling with GIS based hydrologic tool ArcSWAT. This kind of modelling requires particular dataset including DEM, land cover, soil and hydro-climatic data which are not usually not available at national level

therefore the testing is planned in case study areas at watershed level. The implementation of this work will contribute for identification of appropriate parameters to be used in the accounting of water regulation ecosystem services.

70. Poster abstract

G. General sessions: G7a YESS: placing early career research on the ecosystem services landscape

Capacity of the landscapes to provide recreation and ecotourism ecosystem services: a case study of the Central Predbalkan Region, Bulgaria

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The importance of the landscapes for development of recreation and tourism is significant. Hereby, ecosystem services assessment can be used as an approach for determining the capacity of the landscapes to provide recreation and tourism. For this study we choose a case study area which is part of the inner Predbalkan Region, located in North-Central Bulgaria. The area represents a scientific interest in terms of its transitional position between the Stara Planina Mountain and the Danube Plain, from natural to very high anthropogenic landscapes. The aim of the study is to assess the capacity of the contemporary landscapes in the Strazhata syncline upland and Melovete Hills to provide cultural ecosystem services – recreation and ecotourism.

The assessment of the landscapes to provide services has been achieved using the matrix method. As spatial units for the assessment at the matrix we used the 4 contemporary landscapes in the area, classified and delineated in GIS database. They have been rated by expert assessment on a scale of 0 to 5 for both cultural ecosystem services, where 0 is “no relevant capacity” and 5 “very high relevant capacity”. We carried out two assessment maps showing the capacity of the landscapes to provide recreation and ecotourism services.

The results show that more than 70% of the area has medium relevant or higher capacity to provide such services. We explain that with the specific karst relief, forests and rivers, which give high value to the landscapes and can provide different cultural services. Furthermore, low human pressure on the environment in the last 2 decades, due to the depopulation of the villages and abandoning of the agricultural lands, is the reason for self-restoration of the landscapes and transition to more natural environment. There are several protected areas which cover 24,8% of the area and most of them are located in the karst territory of Strazhata syncline upland.

Keywords: ecosystem services assessment, recreation, matrix method, GIS analysis

71. Poster abstract

G. General sessions: G8 ESP Asia Forum: Connecting science and policy to implement ecosystem services approaches in Asia

Evaluation of ecosystem services for water quality regulation in South Korea

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The healthy watershed ecosystem plays an important role to supply clean water for human wellbeing. Forests retain and degrade pollutants and wetlands can act as natural barriers before pollutants enter streams and rivers. However, ecosystems have been degraded gradually losing their function and services due to urbanization, population growth, and climate change. To secure sustainable fresh water supply, an ecosystem-based approach combining both watershed and river systems together is necessary. In this study, First, InVEST Nutrient Delivery Ratio model was used to evaluate Nitrogen (N) and Phosphorus (P) retention capacity of ecosystems due to land use and land cover (LULC) changes in South Korea over last 20 years. Second, we examined how the changes of water quality regulation services of watershed can affect to the water quality in the downstream of Han River using EFDC-NIER (National Institute of Environmental Research) model. Third, we estimated the economic loss of the water quality regulation service derived from the LULC changes. The results show that

the ability of nutrient retention services of the watershed decreased due to LULC changes over the past 20 years, which results in increasing nutrient (N and P) loading to Han River and decreasing the river water quality.

The benefit loss due to the increases in T-P concentration in Paldang River was about 2 million $/year. These results can provide spatially explicit information for sustainable management of clean water in South Korea.

Keywords: Water quality regulation service, InVEST NDR model, EFDC model, South Korea, nutrient retention

72. Poster abstract

G. General sessions: G10a The concept of ecosystem services in the knowledge of the Nature-Societies relationships

Horizon Scanning on the sustainable provision of ecosystem services in Germany

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The concept of ecosystem services enables an integrative consideration of environmental problems and socio-ecological systems and thus represents an important instrument for the sustainable use of natural resources. Numerous research and development projects are already underway in Germany, but their focus has so far been increasingly on current environmental policy problems and challenges. Long-term perspectives often cannot be sufficiently taken into account. Therefore, the Helmholtz Centre for Environmental Research (UFZ) and the German Ecosystem Services Innovation Network (ESP-DE) have carried out a Germany-wide horizon scanning with the aim of predicting potentials and challenges for the future provision of ecosystem services. Horizon scanning is an established method for the systematic search and investigation of potentially significant challenges and opportunities in a specific field for the future. The Horizon Scanning procedure consists of four steps: in a first

step, the framework and objectives were defined () and focused on the following key question: Which potentials and challenges arise for practice and research for a sustainable provision of ecosystem services in Germany by the year 2030? Based on this, an online questionnaire was used to collect questions and suggestions from various stakeholders from a variety of disciplines in science, policy and society in order to identify potential developments (2). In a next step, in two consecutive synthesis workshops, these questions were summarised together with about 30-40 experts from all over Germany and the major insights have been condensed to 9 core "horizon questions" (3). The results of this synthesis are finally fed back to science, policy and society and can serve as a basis for decision-making processes (4).

Keywords: ecosystem services provision, horizon scanning, Germany, science-policy

73. Poster abstract

G. General sessions: G10a The concept of ecosystem services in the knowledge of the Nature-Societies relationships

Adoption of the ecosystem services concept in hydropower development policies: A case study of Nepal

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A signatory to the Sustainable Development Goals, Nepal sets an ambitious target to generate ten thousand-megawatt electricity by 2030, to solve a perpetual energy crisis and to trigger economic development. There are different social and environmental impacts associated with hydropower and its contribution to local development is contested. Hydropower development has threatened the rivers of Nepal and posed challenges to achieving ecologically sustainable economic development. Rivers provide multiple ecosystem services (ES) to a wide range of stakeholders distributed spatially and temporally at multiple scales. Hence, decisions regarding the development and management of water resource demands thinking from multi-objective and multi-stakeholder perspectives. The concept of ES acknowledges tangible and intangible benefits and services that a river provides, enabling identification of direct and indirect stakeholders. Furthermore, the acknowledgement of ES sets social and environmental costs and benefits on a level playing field with the economic in evaluating the costs and

benefits of any development intervention. This allows for an analysis of synergies and trade-offs between different policy alternatives. While adoption of Payment for Ecosystem Services for water-based ES is gaining momentum in Nepal, not much is known about the legislative underpinnings of the ES concept. In this context, I analyse 27 policy documents related to hydropower development to assess coherence with the ES concept in terms of definition, objectives and implementation to understand if and how the concept is integrated in policies and what are its implications for practice.

Keywords: Sustainable development, ecosystem services, decision-making, hydropower, policy

74. Poster abstract

G. General sessions: G10a The concept of ecosystem services in the knowledge of the Nature-Societies relationships

Localized Payment for Ecosystem Services mechanism: A case study of Begnas and Rupa Watershed in Kaski, Nepal

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Begnas (~300 ha) and Rupa (~20 ha) are two of the nine lakes comprising the Lake Cluster of Pokhara Valley (LCPV) is a Ramsar Site. The LCPV provide a wide range of ecosystem services to the farming communities for their livelihood. The Begnas and Rupa lake watershed is a beautiful agricultural landscape with lakes, streams, rice terraces, community forests, and cultural sites against the backdrop of the scenic Annapurna Range to the north. Agricultural land, forest land and wetland are the three main land types here. To maintain the benefit across the watershed, a localized payment mechanism was piloted by LI-BIRD in the Begnas Watershed. In the payment mechanism, upstream and downstream stakeholders (hotel and restaurant association, boater's association, fisheries group, irrigation group, community forest users groups and view tower) have committed to contribute in the conservation fund. A community managed view tower and information centre built from collaborative cash and in-kind contribution is visited by over 30,000 people in last three years. In average USD 3000 is

generated annually from entrance fee, 40% of which is contributed in Begnas Lake Conservation Fund as payment for aesthetic services received from the lake. Farmer's products cultivated in the land of Begnas and Rupa watershed are promoted through landscape label. In last two years approximately USD 8000 income is made by selling the products of Begnas and Rupa. Hence, the paper provides a framework of localized PES mechanism for the well-defined ecosystem services from lake. This case highlights conservation fund generation from service buyers and operational mechanism to disburse funds for conservation. An institutional arrangement to provide economic incentives for upstream communities for sustainable watershed management is discussed. The paper also provides the challenges experienced and way forward for implementation of PES mechanism in similar lake system in Nepal and beyond.

Keywords: Ecosystem Services, localized, conservation fund and landscape label

75. Poster abstract

G. General sessions: G10a The concept of ecosystem services in the knowledge of the Nature-Societies relationships

Ecosystem service associated with residential gardens in a rural-urban gradient in south-central Chile

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High levels of urbanization limited people access to green natural spaces, especially in Latin America, where cities have grown rapidly with little urban planning. Green urban areas provide several benefits for human well-being, and a large proportion of green areas in cities consist in residential private gardens. These gardens provide benefits that can be conceptualized as ecosystem services, both at local scale (i.e., benefits for the resident) and at larger scales, benefiting the community. Our objective was to determine the impact of residential gardens for human well-being under different landscape context (urban vs. rural spaces) based on three main ecosystem services: food production, recreation, and pollination.

Food production and recreation services in 67 residential gardens were determined using a questionnaire that was applied to the main manager of these gardens. To measure the relevance of residential gardens for pollination, during 208-209 season we sampled pollinator species (represented by bees and syrphids) in 34 residential gardens. Both the application of the questionnaire and pollinators sampling were conducted in an urban-rural gradient from Temuco city in south-central Chile (38.4°S) and its rural surroundings.

Garden managers value their gardens in three different dimensions: recreational, social interactions and food production. Residents spent most of their leisure time in gardens performing gardening and contemplation activities, followed by social interaction and food gardening (huerta). Food production was present in 54% of the urban gardens and 94% of rural gardens.

Regarding pollinators, urban gardens had less abundance and diversity of bees and syrphids compared to rural gardens.

Residential gardens provide benefits for their residents and can also act as relevant habitat for pollinators. Key aspects that can increase these benefits are discussed. (Financial support from FONDECYT-Chile Grant 60644)

Keywords: Domest ic garden, food production, human well-being, pollination, recreation

76. Poster abstract

G. General sessions: G10b Systematic maps and reviews: describing the state of knowledge and identifying gaps for science and decision making

Methods and first results for the implementation of MAES at a national scale: the LIFE IP 4 NATURA project (Greece)

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Life IP 4 Natura is an integrated project (IP), the first Life IP commissioned to Greece, mainly dealing with actions related to (a) habitats and species of Community Importance at the national and multiregional scale, (b) enhancement of the effectiveness of National and local authorities by developing appropriate tools, (c) stakeholder involvement and (d) study and acquisition of the necessary knowledge on ecosystem services and their provisions at national, regional and local level, by applying the MAES approach. In this communication, we are presenting the national scale assessment methodology and first results on mapping and assessment of ecosystems and their services at the national scale. Using the 0x0 Km EEA reference grid, terrestrial and marine areas of Greece have been partitioned and each cell is used as reference assessment unit. For assessing ecosystem condition and record current flows of ecosystem services, at least one plot per ecosystem type in each cell has been set as a threshold. The assessment is conducted by field surveys, using a standardized assessment protocol for the condition of ecosystems and their services (provisioning, regulating and maintenance, cultural) based on the guidelines of the relevant MAES reports. Sampling plot data have been collected and registered in a database developed for the project and will be used for further analysis and interpretation. Field data from the plots are also exploited for the training and validation of the remote-sensing model developed for ecosystem types' mapping at national scale. Gradient maps and hotspots for ecosystem condition and services are depicting the current progress of the project.

Keywords: ecosystem condition, ecosystem services, mapping ecosystem types, remote-sensing, MAES field protocol

77. Poster abstract

G. General sessions: G10b Systematic maps and reviews: describing the state of knowledge and identifying gaps for science and decision making

What ecosystem services do dry rivers provide? A method of bibliographic review

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Dry rivers (DR) are channels permanently dry except when it rains intensely. The absence of surface water in these rivers led the scientific community to consider them as poor systems in terms of ES, unlike perennial (PR) and intermittent rivers (IR). However, recent studies have shown that DR are suppliers of ES, especially when they are studied from a terrestrial approach. According to climate change scenarios, during the coming decades DR will increase considerably in the Mediterranean region. Therefore, it will be necessary to know what ES they provide us for sustainable management. The objective of this poster is to present a method of systematic review to define a state of the art and identify gaps of knowledge about DR and ES. The review method has a general phase and a specific phase. Both phases follow the same work scheme: data import, statistical analysis and graphics and maps. The purpose of the general phase is to compare the groups and lines of research between PR, IR and DR. First, we use Scopus data base to select articles of interest. Secondly, we use Scopus analysis tool to extract variables such as articles, authors, countries, journals, subjects and keywords. Finally, we used R software to generate a data frame and do statistical analysis and graphs. The purpose of the specific phase is to identify how many ES, drivers of change, assessments and valuations are been studied until now in DR. We create a table of variables in a spreadsheet of Office Calc. We complete the table extracting information from bibliography. Finally, we use R to do statistical analysis and the package of R 'Bibliometrix' to analyse and map some variables. The preliminary results after testing this method show large knowledge gaps in DR in terms of ES. Project CGL207-84625-C2-2-R (MINECO/AEI/FEDER, UE).

Keywords: ephemeral stream, ecosystem services, bibliometrics, Mediterranean region, Scopus

78. Poster abstract

G. General sessions: G10b Systematic maps and reviews: describing the state of knowledge and identifying gaps for science and decision making

Adapting the IPBES conceptual framework to a local scale: Insights to its operationalization

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To understand the dynamics and interlinkages between humans and nature, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) designed a conceptual integrative framework that has been used to guide the science-policy interface assessments at the global and regional scales. The framework was in fact designed for its application across spatial scales, yet its application at local scale remains underexplored. In this research, we aim to provide insights to operationalize the IPBES conceptual framework at the local scale.

By conducting a systematic review of the scientific literature that deals with social-ecological dynamics in Chamela (Mexico), we identified social-ecological essential variables that represent the main components of the IPBES conceptual framework in the Chamela social-ecological system. These essential social-ecological variables include specific indicators of the status and trends of: () nature, (2) potential supply of nature's contributions to people (NCP), (3) NCP, (4) NCP demand, (5) Good quality of life, (6) Anthropogenic assets and their contribution to co-produce NCP, (7) Institutions, governance and valuation systems, (8) Anthropogenic direct drivers, and (9) Management strategies. We also found that the essential social-ecological variables that represent the components of the IPBES conceptual framework vary at different local scales: from "ejido" (communal land tenure), to "ejidal plot" and "ejidatario" (smallholder belonging to the ejido).

The systematic review of scientific literature on social-ecological dynamics taking into account the components of the IPBES conceptual framework offers a new step forward to adopt the IPBES framework at different local scales and provides a rigorous analytical procedure that can be used in different social-ecological contexts.

Keywords: IPBES, conceptual framework, social-ecological systems, supply, demand

III. Sectoral Working Group Posters

1. *Poster abstract*

S. Sectoral Working Group sessions: S1 Agroecology: managing biodiversity and soil health for the sustained provision of ecosystem services in agriculture

Translating knowledge for legume-based farming for feed and food systems (Legumes Translated): a Horizon 2020 thematic network

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The cultivation of legumes such as soybean, faba bean and pea makes an essential contribution to food supply worldwide, especially due to their high protein content. However, only 3% of arable land in Europe is cultivated with legumes. This, combined with large meat and dairy sectors, results in a deficit of plant protein in Europe, especially for feeding livestock. The challenges and opportunities affecting legume cultivation in Europe include the imbalance in European cropping systems now dominated by cereal crops, the growing demand for alternative sources of plant protein, the increasing consumer interest in the environmental impact and resource efficiency of value chains, as well as the demand for GMO-free value chains and grain legume-based foods.

Legumes Translated promotes innovation in grain legume cultivation systems and the associated value chains by linking end users (farmers, policy makers) with sources of quality-assured knowledge. Innovations within these systems are examined for their stability and feasibility to practice, especially with regard to best-practice, economic and environmental

aspects, and then summarized in outputs targeted at practitioners. The consortium compromises an existing innovation community represented by 7 project partners and 5 actor groups from 9 different European countries. They work within 7 transition networks. In the Thünen Institute, we will compile existing knowledge on biodiversity, ecosystem services and environmental impact of legume-based farming systems with a focus on:

i) legume-specific collection of ecosystem services and impacts on biodiversity, in particular with regard to insects, wild herbs and soil organisms;

ii) identification of restrictions that influence the provision of ecosystem services, as well as options for increasing them, in legume-based cultivation systems;

iii) development of an assessment methodology or tool for environmental impacts and ecosystem services in this cultivation systems; and

iv) life cycle assessment (LCA) of legume based cropping systems mainly for the categories land use and ecotoxicity.

Keywords: Thematic network, legume cultivation, biological diversity, crop diversification, ecosystem services

2. Poster abstract

S. Sectoral Working Group sessions: S1 Agroecology: managing biodiversity and soil health for the sustained provision of ecosystem services in agriculture

Linking ecosystem characteristics to the chemical composition of honey samples in four EU countries

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Honey is in the top list of the most adulterated products in the world, and action should be taken to support EU apiculture sector. The main types of fraud found are (a) products declared or presented as honey although containing exogenous sugars or sugar products and (b) honey mislabelled regarding its geographical and/or botanical origin. Various analytical techniques to identify fraud in honey samples have been applied, and more are being developed. Ecosystem service assessment techniques have the potential to assist honey food safety policy in detecting honey fraud. Most importantly, honeybees foraging in areas short of suitable floral resources are likely to produce less honey. This, in principle, makes these areas more susceptible to fraud.

The recently started MAHONEY project applies a case study approach for landscape suitability mapping and honey sample collection and analysis. Case study areas were selected in four European countries (Belgium, Hungary, Malta, Romania), which together characterise the environmental and socio-economic heterogeneity in honey producing EU countries. Habitat suitability for honeybees will be modelled and mapped using a consistent approach based on expert knowledge and best available regional environmental data. Anonymized honey samples will be analysed using advanced analytical methods.

The outcomes will help to understand the contribution of habitat suitability to the probability of honey fraud, and to explore the connections between the chemical characteristics of honey samples and the landscape from which samples come. This can potentially help the implementation of the EU Honey Directive with valuable lessons for fine-tuning relevant

standards, protocols, and quantitative parameters, thus improving the efficiency of honey fraud detection and prevention.

Keywords: Honey fraud, pollination capacity, EU Honey Directive, honeybee, Apis mellifera

3. Poster abstract

S. Sectoral Working Group sessions: S1 Agroecology: managing biodiversity and soil health for the sustained provision of ecosystem services in agriculture

Participatory modelling the effects of global change on biodiversity and multiple ecosystem services in viticultural landscapes across Europe

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In agroecosystems, multiple ecosystem services such as soil fertility, pest regulation, crop production and biodiversity conservation need to be balanced to achieve both sustainable development goals and biodiversity targets. The main global change drivers of biodiversity and ecosystem services in viticultural landscapes are climate change, the invasion of alien (pest) species, land management changes, wine markets and policies. These drivers influence land use decisions at the local and regional level which affect multiple dimensions of biodiversity and the delivery of ecosystem services (ES). We will develop and test model frameworks which integrate different scenarios of land use across spatial scales for future management in viticultural regions from Spain, to France, Germany, Austria and Romania. First, we will organise workshops in each project region to develop stakeholder-driven scenarios which will be used as input for the agent-based models. Second, we will utilize existing knowledge from different European countries to build a predictive model for ES provision in viticulture. Third, the model will be validated using field measurements of above- and below-ground biodiversity plus the multiple ecosystem services that it provides. This will

be done along gradients of landscape complexity and management options in five European case-study regions. The outcomes of the project will be (i) a conceptual model of the tradeoffs and synergies between multiple biodiversity-related ES in viticulture in relation to local and regional management and landscape structure which informs (ii) a spatially-explicit model integrating winegrowers as agents which influence land use decisions and consequently ES provision in response to different land-use scenarios and (iii) a software decision-support tool for stakeholders in viticulture that provides information on how to manage their crop to enhance biodiversity and multiple ES.

Keywords: viticulture, biodiversity, ecosystem services, scenarios

4. Poster abstract

S. Sectoral Working Group sessions: S1 Agroecology: managing biodiversity and soil health for the sustained provision of ecosystem services in agriculture

Smart Nutrient Retention Networks for good water quality and sustainable nutrient use

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Society heavily depends on fertilizers to feed a growing world population. Part of the valuable nutrients in these fertilizers end up in surface waters, causing severe water quality problems, and are eventually lost into the oceans. With global change, these problems are expected to increase further. Here, I propose Smart Nutrient Retention Networks (SNRNs) to tackle these challenges by employing the positive feedback loop between nutrient loading, water quality and nutrient retention in hydrological networks. SNRNs utilize the higher nutrient retention of clear, vegetated states over turbid, algae dominated states, to simultaneously improve water quality and recycle valuable nutrients. The project aims to result in a modelling tool for water quality managers and to contribute to achieving sustainable development goals at local and global scales.

Keywords: Closing nutrient cycles, eutrophication management, nutrient retention, hydrological networks, sustainable development

5. Poster abstract

S. Sectoral Working Group sessions: S1 Agroecology: managing biodiversity and soil health for the sustained provision of ecosystem services in agriculture

Oasis Farmland Ecosystem Service Value Based on Water Footprint Cost

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The farmland ecosystem has many ecological service functions such as provisioning, regulation, culture and supporting services, while agriculture is a large water user in arid regions. This study take the Manas River Basin in the arid region of northwest China as a case, and measured the cost-effectiveness of different services in agro-ecosystems from the perspective of water footprint. The results show that: () The supporting services of oasis farmland ecosystem including soil conservation, nutrient cycling and biodiversity take the largest (99%), followed by Provisioning services (0.62%).), and then regulation services including carbon sequestration and oxygen release and air purification (0.33%); Cultural services are minimal and negligible. (2) The average farmland of m2 area needs 0.72m3 of water, which can produce .47 yuan of supply service, 0.79 yuan of adjustment service, and 236.28 yuan of support service. (3) In terms of total service, cotton land provides the highest value of ecological services, followed by corn and wheat. However, in terms of ecological service value per unit area, cornfields provide the highest efficiency of ecological services (732 ￥/m2) , followed by wheat (402￥/ m2), and finally cotton (57￥/ m2). (3) Since 2000, with the adjustment of local planting structure and the continuous expansion of cultivated land, the value of various services has been continuously improved, while the water footprint has been expanding rapaidly, and agriculture has reached into a bottleneck, while cotton consumes the most water, although cotton has a high economic added value, but the service added value is low, so it is necessary to readjust the planting structure.

Keywords: Ecosystem Services, Water Footprint, Oasis Farmland, Cost and Value

6. Poster abstract

S. Sectoral Working Group sessions: S8a Ecosystem services for nature conservation and protected areas

Troodos National Forest Park: Promoting natural values and Ecosystem Services

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Troodos National Forest Park (TNFP) is located in the centre of Troodos mountain range and it is one of the most important natural environments of Cyprus. TNFP has been included to the Natura 2000 network of the island due to its important natural ecosystems and its great biodiversity. The project iLIFE-TROODOS (co-funded by the European Commission and the LIFE programme) aims to increase public awareness on the natural values of TNFP, for which it was included in the Natura 2000 network, and the Ecosystem Services (ES) it provides. The current work presents selected ES of TNFP, based on the Common International Classification of Ecosystem Services (CICES - three ES categories: Provisioning services, Regulating and Maintenance services, Cultural services), which have been identified through this project. Specifically, this work graphically presents the ES mapped through CICES, as well as a more detailed presentation of the water related services of the area. The services have been mapped and their distribution in the area is presented in respective maps (using ArcGIS software), while their economic importance has also been evaluated. Most of the data used was acquired from the databases of the Cyprus Department of Forests, while information relating to the use of the area was obtained through surveys carried out by the project's personnel. Further information was collected from publicly available sources and the Water Development Department, whereas the TESSA toolkit (207 v. 2.0) was utilized for the evaluation of water-related services and global climate regulation (including carbon storage). The data derived on these ES is being used for the awareness purposes of the project iLIFE-TROODOS.

Keywords: ecosystem services, Troodos National Forest Park, Cyprus, iLIFE-TROODOS

7. Abstract

S. Sectoral Working Group sessions: S8a Ecosystem services for nature conservation and protected areas

Valuing ecosystem services: an essential tool to assess land use trade-offs in China's protected areas

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Protected areas (PAs) are a key source of ecosystem services (ESs), and so are crucial to human wellbeing and sustainable development. The Chinese government is now improving management on PAs, but is faced with several land use trade-offs, including whether or not it should expand PAs, and how to balance conservation with tourism and local livelihoods development. Addressing these trade-offs can benefit from a better understanding of the production and value of ESs provided by PAs. Currently, it is unclear whether or not conservation generates greater benefits than costs, since the environmental, economic and social benefits and costs of conservation have not been comprehensively weighed up. Moreover, payment for ecosystem services schemes have been developed to address the trade-off between conservation and local livelihoods, but current schemes offer no financial compensation for local people's loss of non-marketable cultural ESs. Research is needed to estimate what the value of PAs' non-marketable cultural ESs to local people is, and comprehensively assess whether it is cost-effective to enhance tourism development in PAs and improve the coverage of China's nationwide PAs. Valuing ESs is an essential component toward answering these questions.

Keywords: protected area, ecosystem service, trade-off, conservation, development

8. Poster abstract

S. Sectoral Working Group sessions: S8a Ecosystem services for nature conservation and protected areas

Ecosystem services and community-based management in protected areas: understanding the perceptions of boundaries communities for management and conservation

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Protected areas (PAs) are complex socio-ecological systems that require adaptive management. In order to go towards this direction, knowing the local people's perception of PA landscapes is a key factor for management effectiveness. Thus, the objective of this study was to associate the perception of community residents around the Cunhambebe State Park (CSP), Southeast Brazil, regarding ecosystem services and the function of PAs in providing benefits that sustain human well-being. The CSP represents a significant fragment of the Atlantic Forest, in addition to its water resources providing water to a large region of Rio de Janeiro. Semi-structured interviews with 75 random residents were used. The responses were associated with ecosystem services according to the Millennium Ecosystem Assessment (MEA). More than 80% of cultural ecosystem services were identified by the interviewees, three of which were not included in the MEA: "Body, mind and spirit"; "Ecological values"; and "Values of economic incentive". Subsequently, the services of regulation (2.0%) and provision (8.0%) were observed. The use of the ecosystem services approach for CSP's management enables the valuation of priority areas for conservation and dialogue with the communities. The CSP represents an excellent opportunity for people to connect with the Atlantic Forest, experiencing experiences that can bring psychological, spiritual and social benefits, attested by the perception of "ES Body, mind and spirit". The "ES Values of economic incentive" shows the positive perception about the presence of the park by generating income and adding value to the property and agricultural production. Therefore, due to the proximity to a protected ecosystem, we consider the immaterial benefits brought as a strategy for the management of land use and occupation. Positive perceptions in relation to the CSP favor attitudes pro-conservation of biodiversity and benefits for human well-being.

Keywords: protected area management, environmental perception, stakeholders' perception, social participation, conversation planning

9. Poster abstract

S. Sectoral Working Group sessions: S8a Ecosystem services for nature conservation and protected areas

Mapping and assessing ecosystem services to ensure the long-term preservation of a mountainous protected area: the case of Koilada Kedron-Kampos in Cyprus

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The current study is implemented within the frame of LIFE-KEDROS project (LIFE5 NAT/CY/000850) and aims to ensure the medium and long-term preservation of the priority habitat type 9590* in good conservation status, at the only Natura 2000 site where this habitat exists, in Cyprus and Europe. The habitat 9590* Cedrus brevifolia forest is an endemic priority habitat type of Annex I of the Directive 92/43/EEC, found in Cyprus. This study focuses on understanding the spatial and temporal dynamics of Ecosystem Services' (ES) supply across the Natura 2000 site "Koilada Kedron-Kampos", and on optimizing future ES provision, along with mitigating current trade-offs within the habitat 9590*.

Five ES were quantified covering all ES sections of the CICES. These ES are "biomass-based energy resources", "climate regulation", "soil erosion prevention", "maintenance of nursery populations and habitats" and "recreation". The results revealed similar spatial patterns among the ecosystem services, where the northern part of the site has a lower ES provision than the southern part. Forested regions presented higher ES supply except for some ecosystem services, which showed lower supply in less diverse areas. The pattern of correlations remained the same between the two studied years (in 997 & in 207) for most pairs of ecosystem services. However, while in 997, "biomass-based energy resources" and "maintenance of nursery populations and habitats" showed no correlation, in 207 this specific ES pair presented a significantly strong trade-off relationship. This study showed that in 207

regions with multiple ES provisions decreased compared to those in 997, followed by an increase of areas with low ES provision. The spatial dynamics and interactions among ES could provide information for stakeholders and decision-making processes to develop an appropriate sustainable management of the ecosystems on the targeted protected site to secure ecological, social, and economic resilience.

Keywords: Cedrus brevifolia, habitat type 9590*, spatial dynamics and interactions among ES

10. Poster abstract

S. Sectoral Working Group sessions: S8a Ecosystem services for nature conservation and protected areas

Investigating supply and demand differences of cultural ecosystem services in the Bavarian Forest National Park: An application of the international ECOPOTENTIAL participatory mapping and survey framework to Germany

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Conflicts in the management of protected areas arise when its objectives are contradicting such as nature protection versus tourism. The integration of the concept of cultural ecosystem services to the context of nature conservation in protected areas offers a broad spectrum of applied areas. The Bavarian Forest National Park (BFNP) identifies under the IUCN protected area category II and therefore is also to implement plans for education and recreation. Promotion of tourism and the significance of protected areas in their function as regional attractions can play a crucial role for their acceptance by the local population. However, the ongoing increase of visitors entering the park arise questions on what the adverse effects of that increase of people, using the park in diverse ways, will be. Therefore, it is important to investigate whether the supply and realized demand of ecosystem services overlaps to adapt management strategies, and whether there are differences in the demand of cultural services from local versus tourists. It is expected that locals who visit BFNP use a more diverse range of ecosystem services whereas tourists are expected to use a smaller number of services, generally related to the main attractions suggested by the park. We conducted more than 200 questionnaires (ongoing survey) with both local and tourist visitors in the BFNP. We asked

visitors to grade several cultural ecosystem services and to map their location including a 0 km buffer around the BFNP. Our results will provide key information regarding the determinants and constraints for the use of cultural ecosystem services and will contribute to the sustainable management of tourist flows in protected areas.

Keywords: participatory mapping, cultural ecosystem services, national park, realized provision

11. Poster abstract

S. Sectoral Working Group sessions: S8a Ecosystem services for nature conservation and protected areas

Evaluation of Green Infrastructure elements in rural-urban landscapes: a case study in North-East of Italy

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Green Infrastructures (GIs) are defined as strategically planned networks of natural and semi-natural areas designed and managed to deliver a wide range of ecosystem services. GIs are identified as one of the priorities in EU policies (e.g., the EU Biodiversity Strategy to 2020 or the new Common Agricultural Policy strategy). This imply the develop of effective approaches for planning and mapping GIs.

In this framework we present the preliminary results of a study aimed to identify and to prioritize GI elements in rural landscapes of North-East of Italy. Two are the main project achievements: i) to identify the most important areas for natural stock and for ecological connectivity and ii) to evaluate multi-functionality by mapping a set of ecosystem services. In the first phase of this project, habitat suitability, least cost path analysis, spatial graphs and connectivity indices were combined to model a composite multi-species network (flora and fauna species) as expression of ecological connectivity for biodiversity at the landscape scale. As a result, almost 2000 ha of core areas and more than 4000 ha of ecological corridors, connecting 8 Special Area of Conservation (Habitats Directive 92/43/EEC) and several regional protected areas, were mapped allowing to identify the most relevant green areas to support biodiversity both in the protected and non-protected areas. In order to evaluate biodiversity

within the core areas, sampling field activities were carried out: 50 plots were collected using a stratified random sampling (based on habitats within core areas) and diversity elements evaluated. Furthermore, we observed that the probability of connectivity (PC) was affected by both the extension of the target habitats considered and the species behavior. Results provide a good approximation to identify important areas for biodiversity conservation.

Keywords: Ecological networks, Biodiversity conservation, Green Infrastructure, Mapping ecosystem services, Connectivity indices

12. Poster abstract

S. Sectoral Working Group sessions: S8b Linking nature-based solutions and ecosystem services

Measuring water regulation functions in Upstream Depressional Wetlands

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Water regulating functions will become more crucial in the future to deal with climate change. Climate projections point towards drier and warmer summers with more extreme precipitation, and more total rainfall during winter. Furthermore, there is still much water lost because of drainage, soil sealing, water abstraction and river normalization. These pressures lead to a decreased water infiltration capacity and a lowering of the groundwater table. Therefore, a big challenge will be to make more efficient use of (temporary) surpluses on water balances and to keep it upstream so that it remains available to compensate for shortages during drought episodes (summer).

My research focuses on the topographical and hydrological potential for deferred infiltration of upstream depressional wetlands (UDW), which are proven to be important for regulating hydrology and for provision of numerous environmental functions. The general objective is to investigate the impact of drainage on their water regulation functions. The best locations to implement retention measures are identified based on the Topographical Position Index, which describes the elevation of a pixel relative to the average elevation of the surrounding pixels, combined with visual interpretation of orthophotos. The hydrological functioning and nutrient

fluxes of several drained and undrained UDWs will be monitored during three years using a grid of piezometers for measuring water level and groundwater flux, combined with measuring drainage discharge, rainfall and evaporation. Infiltration is derived from the deficit in the water balance.

Afterwards the impact of measures in terms of groundwater recharge on the regional scale will be analysed. To evaluate the strategic importance of my research, I will assess restoration scenarios for UDWs in the Campine Region (Belgium). The development of new measures to strengthen water regulating functions are especially relevant to the water sector to address current and future challenges in maintaining a good water balance.

Keywords: Ecosystem Based Adaptation, Groundwater recharge, Wetland hydrology

IV. Thematic Working Group Posters

1. *Abstract*

T. Thematic Working Group sessions: T2 Quantifying the relationship between biodiversity and ecosystem services across landscape / seascape management intensification gradients

How does functional diversity relate to ecosystem functions in European near-natural forests?

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Within the last decades, biodiversity has been intensively discussed as a stabilizing component for ecosystem functioning under changing conditions. In addition, hundreds of studies show, that ecosystem functions (EFs) such as productivity (GPP) and biomass enhance in species diverse environments. However, it is not yet clear how these so called biodiversity-ecosystem-function relations (BEF relations) change along large climatic gradients. Especially functional diversity (FD) is increasingly gaining interest in the research community, because of being based on functional traits (e.g. specific leaf area, tree height), which are linked to ecosystem functions more directly. In this context, approaches based on remote sensing aim to quantify

FD on large scales. Nevertheless, these approaches seem to be limited, since remote sensing only accounts for the highest trees of the forest community. Here, flexible trait Dynamic Global Vegetation Models can help to investigate BEF relations, such as the role of biodiversity to support carbon sequestration or carbon storage and its limits under climate change from local to continental scales.

We apply the flexible trait model LPJmL-FIT to European near natural forests in order to investigate how the functional diversity of forests is linked ecosystem functions on a continental scale. In order to bridge the gap between RS and grounded measurements of FD, we compare the FD of the 0%-highest trees to the FD of the whole community.

We come up with partial correlation networks illustrating linkages between different components of functional diversity (functional richness, divergence and evenness), local climate (annual temperature & water availability) and ecosystem functions (gross primary productivity, biomass). These ecosystem functions enable the provision of important productive and supporting ecosystem services.

Keywords: ecosystem functioning, functional diversity, European forests, trait based modeling, remote sensing

2. *Poster abstract*

T. Thematic Working Group sessions: T2 Quantifying the relationship between biodiversity and ecosystem services across landscape / seascape management intensification gradients

Commune land use planning in the context of biodiversity and ecosystem in Cambodia

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The commune land use planning refers to the planning of land uses for all land in the commune/Sangkat, including state land and private land of private persons. The purposes of the commune land use planning include: provide competency to commune/Sangkat councils

in preparing effective land and natural resources use and management. Support equitable and sustainable socio-economic development. Contribute to the people poverty reduction. Help to achieve high productivity of land use in the commune/Sangkat based on the actual conditions and natural potential of the land. Respond to the land need of authorities and commune/Sangkat residents. Help prevent degradation and inappropriate use of land and natural resources. Facilitate better fulfillment of commune/Sangkat council role as state representatives in determining and managing state land in the commune/Sangkat. And seek supplementary technical support from various institutions and units as well as from the private sector for preparation of commune/Sangkat development plan and investment program.

Keywords: commune land use planning, state land, natural resource management

3. Abstract

T. Thematic Working Group sessions: T2 Quantifying the relationship between biodiversity and ecosystem services across landscape / seascape management intensification gradients

The deteriorating ecological health of the Sakumo Ramsar Site: implications for wetland ecosystem services provision

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Wetlands are one of the world's most productive ecosystems. Healthy wetland ecosystems provide functions and services such as flood control, nutrient recycling, shoreline stabilization, filtration, ground water recharge and habitat for aquatic flora and fauna. Humans may also derive direct benefits such as food, raw materials for building and livelihoods from wetlands. The Sakumo Ramsar Site, a small urban wetland in coastal Ghana, is ecologically important for waterbirds and lagoon fishery and socio-economically and culturally important for surrounding communities. For example, in the 990s, income from fisheries in the Sakumo lagoon was 3-4 times higher than the minimum government wage for an 8-hour working day. Shells collected from the Sakumo wetland was important for the building industry and a source of calcium for animal feed, and the banks of the in-flowing rivers supported extensive farming activities. Using waterbird counts, lagoon fishery productivity and vegetation cover changes, we provide a rapid assessment of the ecological health of the wetland and explore how the

changes in the ecological health influence the wetland's capability to provide ecosystem benefits. Available data over four decades show a 32.7% reduction in the size of the open water body (959.42ha to 646.ha) and ca. 82.5% increase in built-up areas (9744.79ha to 7787.0ha). Trend analysis of shorebird populations show a general decline and disappearance of some species. The mean size of the most important tilapia species Sarotherondon melanotheron harvested from the lagoon declined from 0.5 cm to 6.87 cm. The observed changes show that the ecological character of the Sakumo wetland has been affected adversely due to degradation of the habitat. We discuss the impacts of the deteriorating ecological integrity of the Sakumo wetland on ecosystem services and benefits derived and recommend possible interventions to restore the ecological character of the wetland.

Keywords: Wetlands, ecological-integrity, ecosystem-services, shorebirds, fisheries

4. *Abstract*

T. Thematic Working Group sessions: T2 Quantifying the relationship between biodiversity and ecosystem services across landscape / seascape management intensification gradients

Combining methods to estimate ecosystem integrity and ecosystem service potentials and flow for crop production in Schleswig-Holstein, Germany

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Human well-being is strongly dependent on the benefits supplied by nature, especially in food provision. This study has been developed in the ecosystem service framework and focuses on the evaluation of ecological integrity as a base for the capacity of the study area to provide the ecosystem service crop production using open-acess remote sensing data. The natural capacity or potential of an ecosystem to provide the service crop production is assessed based upon two different approaches; a Bayesian belief network (semi-qualitative) and the qualitative ecosystem service matrix. The service flow is estimated from official regional statistics. The spatial distribution of the different ecological integrity variables, the crop production potential and the crop production flow are compared and interpreted with respect to the characteristics of the main landscape types within the study area. The results indicate a decoupling of the actual crop production from the natural ecosystem potential and integrity and respective

service potential. Agricultural production of biomass proved strongly negatively related to ecological integrity indicators, whereas the relation had gradually diminished in pastures and forests. The results show strong trade-off in agricultural practice, where high production is achieved at the expense of the overall ecosystem integrity. We hypothetise that lacking potential as well as integrity is substituted by fertilizers, thus achieving high production despite poor conditions, but at severe costs. We argue that provisioning services should not be assessed without the underlying ecological integrity, which can otherwise lead to incomplete and misleading results. The findings of the study can be used to support the development of sustainable land management strategies, which aim to harmonize agricultural production and environmental conditions.

Keywords: Ecosystem research, quantification and mapping, BBN, remote sensing, regional statistics, expert evaluation, interrelation analysis

5. *Poster abstract*

T. Thematic Working Group sessions: T3 Science meeting reality: developing fit-for-purpose ecosystem services indicators

The Naturvation assessment framework – an operational framework for assessing benefits of nature-based solutions towards urban challenges

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Urban areas are facing a number of urban challenges such as densification, climate change as well as loss of biodiversity. Green and blue infrastructure, here defined as nature-based solutions (NBS), is now being considered or implemented in cities to meet the urban challenges. However, there is a lack of understanding in how to assess the magnitudes and multifunctionalities of NBS benefits. Here we create an easy, ready to-use operational assessment framework that can evaluate how NBS contribute to solve urban sustainability challenges through the usage of indicators that is credible, salient, legitimate and feasible.

The development of our operational framework was guided by two questions;) How can we link and compare multiple NBS benefits to relevant urban challenges? and 2) How can we make certain that the framework is both scientifically credible as well as salient and legitimate to stakeholders and different user groups? Our results illustrates the need for scoring and normalization of NBS indicators in order to compare multiple NBS benefits towards challenges since each indicator is unique in terms of units and ranges. Further, we enhanced the credibility, salience and legitimacy of our framework through an iterative process where we develop and inform the framework with empirical and modeling indicator data combined with stakeholder interactions.

Keywords: Nature-based solution, indicators, multifunctionality, urban, operational framework

6. Poster abstract

T. Thematic Working Group sessions: T3 Science meeting reality: developing fit-for-purpose ecosystem services indicators

Index-based, multipurpose, top-down ecosystem hierarchy of indicators and nomenclatures: Whole system approach to eliminating policy fragmentation

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Ecosystem indicators and nomenclatures vary from simple parametric or statistical measurements such as the area of NATURA 2000 or water abstraction, to complex indices, e.g. status and trends for species of European interest, phenology or nutrient deposition (involving modelling over multiple data series). Indicator and parameter sets typically do not distinguish between fine and coarse spatial and temporal scales and often mix structural and functional categories.

Moreover, the parallel development of governance structures in policies impacting ecosystems but targeting different anthropogenic pressures have led to methodological inconsistencies between said policies. Reconciling them requires the creation of complicated cross-walks. For example, the 84 pressures in the MAES assessment framework form a part of its 238 condition indictors, whereas Art. 7 reporting under the Habitats Directive has a nomenclature of 220 pressures outside the indicator framework; both extensive sets still have gaps, e.g. lack of pressures on genetic diversity. Exploring such large ensembles of indictors and nomenclature items (e.g. for linking ecosystem structure and functions described by 238 condition indicators with the 90 CICES ecosystem services categories) would require the study of an unfeasibly large number of permutations, by necessity neglect many synergies and require extensive modelling at the expense of precision. Such indicator fragmentation contradicts the parsimony principle defined in the indicator ensemble criteria requirements of the SEEA-EEA revision process.

We present the development of a single-index indicator hierarchy originally created for the ecosystem mapping and assessment in Bulgaria, being adapted for future habitat and species monitoring and reporting. Based on the "Whole system" approach and extensible by design, it will allow for wide data reuse across policies, with inputs from several monitoring and inventory schemes (water, marine, forestry, air, soils, etc.) and coherent analytical outputs towards ecosystem service accounts and multiple policies, such as climate change adaptation, or NEC Directive.

Keywords: Long-term ecosystem research, holistic approach, indicator hierarchy, extent condition and capacity ecosystem accounts

7. Poster abstract

T. Thematic Working Group sessions: T3 Science meeting reality: developing fit-for-purpose ecosystem services indicators

Using evidence-based logic chains to develop indicators for impacts of heavy metals on ecosystem services

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Heavy metals can have far-reaching ecosystem impacts, resulting from direct initial toxicity, through to non-lethal bioaccumulation effects. These impacts cascade through a series of ecosystem processes and trophic levels, making this an ideal system to demonstrate multiple cascading effects on ecosystem services, and to develop primary and secondary indicators of damage. In this study, we develop consistent and evidence-based logic chains to demonstrate the wider effects of heavy metal contamination on a suite of ecosystem services.

We developed logic chains to highlight two aspects of metal toxicity: for impacts of copper pollution in soil ecosystems, and for impacts of mercury in freshwaters. Each link of the chains is supported by published evidence, with an indication of the strength of the supporting science. Copper pollution to soils (34 unique chains) showed a complex network of pathways originating from direct effects on a range of invertebrate and microbial taxa and plants. In contrast, mercury pollution on freshwaters (63 unique chains) shows pathways that broadly follow the food web of this habitat, reflecting the potential for mercury bioaccumulation.

Despite different pathways, there is considerable overlap in the final ecosystem services impacted by both of these metals and in both ecosystems. These included reduced human-use impacts (food, fishing), reduced human non-use impacts (amenity value) and positive or negative alterations to climate regulation (impacts on carbon sequestration). Other final ecosystem goods impacted include reduced crop production, animal production, flood regulation, drinking water quality and soil purification.

Using this ecosystem services approach allows selection of indicators which consider the direct effects of metal contamination of soils and water, but also the potential total impacts of these pollutants on multiple services. Construction of logic chains, evidenced by published literature, allows a robust assessment of these impacts indicating primary, secondary and tertiary effects.

Keywords: Impact chains, Ecosystem process, Copper, Mercury, Biodiversity

8. Poster abstract

T. Thematic Working Group sessions: T3 Science meeting reality: developing fit-for-purpose ecosystem services indicators

The pollination potential of wild bees in Germany – suggestion of a new monitoring indicator

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The ecosystem service of pollination is especially provided by wild insect population which decline due to increasing loss of nesting and foraging habitats. For monitoring those habitats in Germany, we created an indicator of the pollination potential for wild bees. The indicator is based on the framework of Zulian et al. (203) who assessed the pollination potential on the basis of Corine land cover data with a minimum mapping unit (MMU) of 25 ha at the European scale. For our indicator, we used the German land cover model (LBM-DE) which has a MMU of ha and includes Corine land cover types. Since 2009, the LBM-DE is issued and updated by the German Federal Agency for Cartography and Geodesy every three years. We applied the LBM-DE data of the last two time steps (205 and 208) as they are most comparable regarding their classifications of land cover types. LBM-DE is lacking small scale structures and infrastructure elements to some extent, but the fringes of these elements provide important nesting and foraging habitats. Therefore, hedges, tree rows, rocks, streams, roads, railway lines and lanes from the German topographic-cartographic information system (ATKIS) were added to the LBM-DE. Within GIS, the pollination potential was derived from the potential nesting and foraging sites and displayed in a nation-wide map of 5x5m resolution for 205

and 208. Furthermore, the national mean pollination potential was assessed. When combining the LBM-DE with small structures, trends of losses of hedges and other valuable habitats for wild bees could be monitored. Concerning the development of a future national monitoring, however, it is important that the LBM-DE is surveyed in a standardized manner.

Reference: Zulian, G., Maes, J., Paracchini, M.L. 203. Linking land cover data and crop yields for mapping and assessment of pollination services in Europe. Land 2, 472-492.

Keywords: ecosystem service, nesting habitat, foraging site, small structures, land cover model

9. Poster abstract

T. Thematic Working Group sessions: T3 Science meeting reality: developing fit-for-purpose ecosystem services indicators

Comparison of two methods to calculate flood regulating ecosystem services: indicator "flood retention capacity" and hydraulic modelling with HEC-RAS

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Regional climate projections show that regionally river flooding is becoming more severe in the future. To develop adaptation options, there is the need to quantify flood regulating ecosystem services. A frequently used indicator for "flood retention capacity" is based on the calculation of the respective floodplain area. However, previous studies have mentioned that the capacity of flood protection not only depends on the area.

To show the relevance of other landscape elements, this paper focuses on a comparison of two methods. In addition to the flood retention capacity indicator, hydraulic modelling with HEC-RAS was applied. Two events were simulated: a real flood of 203 and a hypothetic 0 % higher water level, exemplary for increased flooding in the future. Both methods were conducted for three landscape scenarios: the current situation, a forest in the floodplain and a dike relocation.

While the forest does not affect the results of the indicator, the dike relocation leads to a larger retention area. In comparison to several studies that suggest important water retention functions of the forest, this fact was not taken into account by the indicator. Additionally, using the complete retention capacity of the floodplain, the model showed an increase of the water depth. In contrast to this, the resulting water volume and depth were lower in a larger floodplain area.

The comparison of the results shows that the indicator approach disregard some crucial flood regulation factors, for example the climate impact and the slope of the water retention area. Furthermore, it has to be mentioned that interflow is also an important component for the flood retention capacity, so information about soil and geology are helpful. It can be concluded that an appropriate calculation of an area's flood regulating ecosystem services is necessary to develop properly dimensioned flood protection for now an in the future. Therefore, the indicator should be further developed and considering the mentioned factors and elements.

Keywords: Ecosystem services, Indicator, Flood regulation, Hydraulic modelling, HEC-RAS

13. Poster abstract

T. Thematic Working Group sessions: T4a Times are changing: temporal mapping of dynamic ecosystem services

Earth Observations for Improved Ecosystem Service Estimates: Vegetation Development and Trends for Grasslands of the U.S. Great Plains, 200-207

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A time-series analysis of Moderate Resolution Imaging Spectrometer (MODIS) 6-day maximum value composite normalized difference vegetation index (NDVI) and enhanced vegetation index (EVI) data (MOD3Q Collection 5) was performed to explore differences in vegetation phenology and to assess long-term trends in grassland vegetation greenness across the Great Plains ecoregion of the United States. Extending from southern Canada to norther Mexico and spanning the area between the Mississippi River (east) to the Rocky Mountains (west), it

represents one of the largest tracts of prairie grasslands in the world and includes significant agricultural activity. The Breaks for Additive Season and Trend (BFAST) decomposition method was applied to images from 200-207 to derive spatially-explicit estimates of change. The program TIMESAT was also used to extract key measures of vegetation phenological development across the same study period. Phenometrics of interest included () season length, (2) start of growing season, (3) end of growing season, (4) middle of growing season, (5) maximum NDVI value, (6) small integral, (7) left derivative, and (8) right derivative. Analyses were performed to determine the significance of spatiotemporal differences in grassland phenology across the Great Plains and interannual changes in vegetation conditions. Accounting for grassland condition through vegetation index proxies offer the potential for better linking Earth observations with ecosystem service models. Modelled results for services such as carbon storage and sequestration could be vastly improved, and be reflected of annual change, by moving beyond simple landuse/landcover classifications as primary inputs and including remotely-sensed estimates of biomass or relative condition via vegetation indices. Such work is a prerequisite step for future analyses seeking to quantify the influence of climate and soils, along with key regional anthropogenic factors such as fire, on shaping long-term vegetation dynamics and the role of dynamic grassland conditions on the provision of essential ecosystem services.

Keywords: Grasslands, remote sensing, vegetation trends, MODIS, Great Plains

14. Poster abstract

T. Thematic Working Group sessions: T4a Times are changing: temporal mapping of dynamic ecosystem services

Mapping and assessment of seasonal and annual solar energy potential in Lithuania

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Abiotic ecosystem services are a key natural capital to life. They are the base to the survival of individual species, community and all the ecosystem. Solar energy is one of the most important abiotic ecosystem services and is the basis for life on earth. The objective of this work is to map and assess the annual and seasonal solar energy potential in Lithuania. For this purpose, annual, autumn/winter, and spring/summer average of solar radiation (average 970-2000) potential were assessed. Slope aspect and inclination were ranked according the most favourable conditions to receive solar energy. The maps produced were overlaid using weighted sum. We attributed to radiation a weight of 0.50 and to the slope and aspect a weight of 0.25, respectively. The model was validated using insolation data from fourteen stations distributed across Lithuania. The results showed that in autumn/winter solar energy potential does not have a clear spatial pattern, while in spring/summer, the northeast areas had a lower solar energy potential than the rest of the territory. A similar pattern was observed annually. The spring/summer model was the most precise ($r^2=0.57$), followed by annual ($r^2=0.38$). In Autumn/winter a very poor correlation was observed ($r^2=0.8$) and this might be attributed to the reduced number of insolation during theses seasons that may not affect the radiation energy.

Keywords: Abiotic, Solar energy, mapping, assessment

15. Poster abstract

T. Thematic Working Group sessions: T4a Times are changing: temporal mapping of dynamic ecosystem services

Mapping the potential of ecosystem service of aquifer recharge in the Brazilian Savannah

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The Savannah biome, located in the central portion of Brazil, is responsible for the springs of watercourses of three major Brazilian hydrographic regions, playing a crucial role in the water cycle. However, few studies have focused on the mapping of ecosystem services – ES, in this biome. Given that mapping is becoming a key tool to guide decision making, the quality of such maps is important in order to be able to provide the most accurate information. The objective of this work is to map the potential of ecosystem service of aquifer recharge – PSERA in a region of the Brazilian Savannah, the Federal District – DF, using geoprocessing techniques. This indicator was selected considering the relevance and the possibility of application, reproduction, updating and integration of the indicators of this service in the study area. In order to generate PSERA, the methodology used was described by Gonçalves et al. (2009). Some intermediate results were obtained, the map of maximum water retention capacity in the soils, the rainfall distribution map, the water availability map and the infiltration rate map. From the integration of these maps the PSERA map was generated. It is possible to verify the interference of the land use the infiltration process. Despite the predominance, in DF, soil sealing caused by urban expansion restricts areas with greater potential to infiltrate. Thus, the greatest potential of this service is concentrated in the areas of vegetation preserved on permeable soils (hydrological groups A and B). The agricultural and urban areas, mainly those of high density of occupation, cause the reduction of the level of recharge, even in favorable soils. It was verified that it was possible to map the potential of providing ecosystem service of aquifer recharge and the techniques of geoprocessing can allow its constant updating.

Keywords: Savannah biome, water resources, soil

16. Poster abstract

T. Thematic Working Group sessions: T4b Mapping cultural ecosystem services: use of social media to assess cultural ES

Comparative assessment of recreational opportunities across a latitudinal gradient in Chile

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As part of cultural ecosystem services (CES), recreation and tourism play a major role in the maintenance of human well-being and act as important sources of countries' economic income. Fair access and distribution to the supply of these CES are important and may depend on the size of properties where they are supplied.

In this project, we are interested in understanding the spatial pattern of recreational opportunities across a latitudinal gradient in Chile, assessing the influence of different predictors of recreation and tourism, and studying the connection of property sizes with recreational opportunities. The regions of study are Maule Region in the Central, Los Lagos Region in the South and Magallanes and Chilean Antarctica Region in the Austral. We hypothesize that the patterns of recreational opportunities vary across regions and are highly influenced by the presence of different predictors such as topography, land use characteristics, and access including farm property size.

We used geo-tagged photographs from InVEST software's Recreation and Tourism model to map visitation rates and create a recreation opportunities indicator in the areas of study. Predictors such as road networks, land cover, presence of water bodies, protected areas, and archaeological sites were selected from literature sources. Linking this information to the property sizes, we developed an ecosystem services supply area relationship (ESSAR) to analyze its relationship to recreational opportunities and assess the implications of property size patterns on CES distribution in a highly unequal country.

Keywords: recreation and tourism, inVEST modeling, ecosystem services supply inequality, spatial mapping, social media

17. Poster abstract

T. Thematic Working Group sessions: T5 Integrated ecosystem services models – advancing modeling science and application

A multi-model and cross-scale approach for land use change impacts: a conceptual framework with a case study of Dong Nai River Basin in Vietnam

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The concept of 'a system of systems (SoS) which emphasizes on the interactions between components of a system is a useful to understand land use system in a holistic way. SoS can be considered from three perspectives: how different socio-ecological systems perform as drivers within a land system, and their consequent impacts on the provision of ecosystem services; how a land use system interacts with its spatial sub-system and super-system; and how a land use system interacts with its neighboring system within a higher system. This study aims to suggest a conceptual framework for assessing land use change impacts and supporting future land use decisions using multi-model and cross-scale approach as a way to address the concept of SoS. The case study area is the Dong Nai River Basin (DNRB), which is a key economic development region in Vietnam including the Central Highlands as a major coffee and agricultural production area and the Southeast region as a leading industrial area. This study specifically focuses on the dynamics of different socio-ecological factors which lead to land use decisions and their impacts on ecosystem services across spatial scales through integrating multiple modules and models, individually for the Central Highlands and the Southeast region. Then, we identify the linkage between the Central Highlands as upstream and the Southeast region as downstream within the DNRB taking into account potential trade-offs between the systems such as a decrease in water provision in one system caused by a certain land use decision in another system. This framework can provide an insight into comprehensive future planning based on the connectivity and interactions between different

systems, which have not been so far considered in land use management and planning especially in the Vietnamese context.

Keywords: A system of systems, Socio-ecological system, Integrated modelling, Land use planning

18. Abstract

T. Thematic Working Group sessions: T5 Integrated ecosystem services models – advancing modeling science and application

Integration of landscape biodiversity into models of ecosystem functions (on the example of combined habitat layer)

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Biodiversity is directly reflected in the ability and quality of performance of individual ecosystem functions, as well as in the internal mechanisms of ecological stability and self-regulation. Therefore we place great emphasis on biodiversity integration into individual models of ecosystem functions (EF) and services (ES). The contribution describes the formation mechanism of combined layer, as our most commonly used habitat map for republic scale, and then examples of its use in modeling selected ecosystem functions and services.

The combined layer is a habitat map, created from several data sources (eg topographical background, conservation mapping), distinguishing 56 natural and 38 non-natural types of habitats. The map is created in the format Esri file geodatabase, in scale : 0 000 and for the whole Czech Republic and it contains 3,397,852 segments. Selected features of habitats are revised by current satellite images from Sentinel2 and airborne orthophotos. For each type of habitat a large knowledge base is built, quantifying more than 5 parameters, both by the nature of the habitat itself (eg maturity, naturalness, diversity of habitat, rarity of habitat, vulnerability), as well as the degree of fulfillment of selected EF and ES (eg carbon sequestration, air conditioning).

This layer then enters into all individual models of EF and ES as a basic geospatial matrix and allows multi-criteria assessment of the ES provision. Above it all calculations (presence of specific habitats, their spatial pattern and abundance) are performed. At present, this layer is already integrated into the model for assessing the economic value of biodiversity in the landscape, the degree of biodiversity sensitivity to driving forces and multiple pressures, carbon sequestration, evapotranspiration and air conditioning and erosion EF. Case studies for the valuation of selected EF and ES will be presented in two scale levels and compared.

Keywords: biodiversity, combined layer, ecosystem function, habitat

19. Poster abstract

T. Thematic Working Group sessions: T5 Integrated ecosystem services models – advancing modeling science and application

Are you sure this is the best option? – Quantifying uncertainty in ecosystem service modelling

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Using integrated ecosystem service (ES) models to project ES provision under different future scenarios can support long-term planning. Decision-makers require information on the predicted effects of potential management options to optimize ES provision. To make robust management decisions, additional information on the uncertainty of these predictions is equally important. Disregarding uncertainty information biases ES valuation if stakeholders are not risk neutral. Depending on their risk preferences, stakeholders may prefer a smaller but more certain ES payoff to a potentially higher but more uncertain ES payoff. Looking for optimal solutions, the uncertainty of each option's outcome is crucial for decision-making.

Along the North Sea coast, stakeholders are faced with ongoing environmental changes which affect their livelihoods and safety. Rising sea levels and increasing winter rainfalls put a considerable strain on the existing drainage system. Simultaneously, summer droughts intensify the salinization of low-lying areas and reduce the productivity of farmland and

pastures. Tourism is an important source of income in the region that can counterbalance agricultural losses, but also poses challenges: Increased drinking water demand can lead to shortages during droughts. The development and sealing of low-lying flood-prone areas amplify the effects of and exposure to rainwater flooding.

The inter- and transdisciplinary project RUINS (Risk, Uncertainty and Insurance under Climate Change. Coastal Land Management on the German North Sea) assesses available management options discussed in the region today. We especially focus on the sources of uncertainty in external drivers (i.e. climate change and sea-level rise), assumptions (e.g. feasibility of technical solutions), model structure and data. As a result, we provide stakeholders with information on the projected effect of potential options as well as the uncertainty involved, to enable them to make management decisions robust against various uncertainty sources.

Keywords: uncertainty, coastal services, decision support, stakeholder communication

20. Poster abstract

T. Thematic Working Group sessions: T6a Valuing marine ecosystems services in the anthropocene

Using ecosystem services approach to assess multiple impacts of human activities on coastal and estuarine habitats.

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Coastal and estuarine ecosystems provide a wide variety of ecosystem services as food, climate regulation, tourism, among others. Yet, they are of the most threatened ecosystems, suffering from several human pressures derived from the multiple human activities that are established in these areas. There is an urgent need to balance human activities and conservation of healthy and productive ecosystems but assessing the impacts of such pressures is usually addressed by using sectoral approaches. Over the last decades, the ecosystem services approach has been used to guide and implement sustainable management of natural resources. Our study area is the NW of Portugal that is part of the Iberian Peninsula ecoregion, receiving the influence of three oceanic water masses. Its coast features rocky and sandy beaches and

several estuaries, some of them under environmental protection. This area is highly urbanized, hosting the second major city of Portugal (Porto) and supporting several human activities, with tourism exponentially growing over the last decade. The coastal zones are prime real estate areas and new tourism economic opportunities are growing fast, stressing the need to manage human activities without compromising ecosystem health and the maintenance of ecosystem services and goods provisioning. In this study, we used the Habitat Risk Assessment model from InVEST (open-source ecosystem services modelling tools) to assess the cumulative impacts of the several anthropogenic activities of the area. Results showed that fisheries were the main activity in the marine and coastal areas, while tourism, agriculture and urban areas were mainly affecting coastlines and estuaries. Overall, the results identified several areas were the impact of human activities pose risks to ecosystems functionality that can comprise the delivery of services and goods, highlighting the need to consider ecosystem functioning and services in decision-making and environmental management of coastal areas.

Keywords: Coastal ecosystems, Estuarine Ecosystems, Ecosystem services, Risk Assessment

21. Poster abstract

T. Thematic Working Group sessions: T6a Valuing marine ecosystems services in the anthropocene

A Study on the Evaluation of the Aquaculture Potential in Coastal Waters of Busan and Gyeongnam using Marine Environmental Data

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Aquaculture industry is an important part of the local economy in Busan and Gyeongnam provinces in RO Korea. Therefore, spatial evaluation of aquaculture potential can be effectively applied for marine spatial planning and management including zoning scheme implementation as well as aquaculture industry development.

In this study, aquaculture potential refers to expected biological production when marine life is raised in a particular area. As a result of a quantitative evaluation model can function as a useful raw data, we utilized the GPI(Growth Performance Index)-based evaluation model. For

regional relevancy, the Korean domestic fish and shellfish habitat was selected for an object of this study. With the calculated GPI values, depth of water, amounts of dissolved oxygen and a chlorophyll-α concentration were considered for an assumption of the best location for aquaculture. Furthermore, spatial data for navigation and military activity areas were used to exclude unsuitable spaces from the best places above. In conclusion, by putting a price on the computed aquaculture potential, the amount of production was estimated along with the total production.

This study aims to assess the local scale aquaculture potential and its production based on local data related to the environmental, social and economic characteristics of the waters. It is expected that the evaluation of aquaculture potential can provide effectiveness and rationality in decision-making by converting the aquaculture potential into economic value. Based on the results of this study, estimating the change in the potential according to new environmental factors such as climate change in the future could also contribute to alleviating the socioeconomic impact of changes in aquaculture output.

Keywords: Aquaculture Potential, Growth Performance Index, Economic Evaluation, Marine Spatial Planning

22. Poster abstract

T. Thematic Working Group sessions: T6a Valuing marine ecosystems services in the anthropocene

A strategic approach to assess marine and coastal ecosystem services in French Natura 2000 sites

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The Life Integrated Project Marha (208-2025) aims to restore and sustain a favourable conservation status of marine natural habitats in French Natura 2000 sites. In this context, ecosystem service assessments (ESA) are carried out in various sites. The incompleteness of current knowledge and the priorities expressed by the stakeholders and / or reflected in the

existing management plans are expected to be taken into account from the beginning of the ESA process. To identify these priorities and clarify the scope of these assessments, the TRIAGE method is used. The TRIAGE guides the ESA by seeking to specify the purpose, the scale, the methods and the tools needed to implement it. It thus constitutes a preliminary step in the ESA as such and makes it possible to conduct the latter in a strategic way (its scope is clarified since it is not realistic to assess everything) and in an operational way (according to the available knowledge and means, and in coherence with the management plan).

The poster presents the implementation of the TRIAGE method in Chausey archipelago and in the Bay of Marseille (France). This work is based on the holding of working groups bringing together experts and managers of the sites. The results of this work show the management of visitor attendance, the massification of recreational uses and their compatibility with the favourable conservation status of marine habitats as a starting point for the ESA. These results reflect a more national issue which is the development and intensification of recreational and tourist uses within coastal and marine socio-ecosystems that lead to reconsider the nature-society relationships. The poster also presents, in a comparative approach, the analysis of the benefits of this method before listing the obstacles to its optimal implementation.

Keywords: Triage, Ecosystem Service Assessment, Natura 2000 sites, Chausey Archipelago, Bay of Marseille

23. Poster Abstract

T. Thematic Working Group sessions: T8 Linkages between ecosystem services and multi-dimensional well-being: how have we progressed since the Millennium Ecosystem Assessment?

Understanding ecosystem services and human well-being through perception of rural residents in the Grain for Green Project region, China

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Ecosystem services (ES) and human well-being (HW) are greatly influenced by environmental change and social development. Since the implementation of China's Grain for Green Project (GFGP), researches have long been focused on biophysical and economic evaluation, while neglected sociocultural perspectives on the importance of ES and achievement of HW in rural areas. In this study we investigated 379 rural residents to explore their perceptions of ES, HW and awareness of environment conservation and policy implementation. We used a structural equation model to identify dominant indicators of ES categories and HW dimension as well as to construct causal relationships between ES perception and awareness of environment and policy. Overall, rural residents put emphasis on food, fresh water, air purification, water purification and aesthetic values of ES, and achieved more on traffic condition, air quality and family ties of HW. Results of structural equation model showed that both provisioning, regulating and cultural ES also basic materials, health and security of HW were potentially linked at different degrees. Among these, provisioning and regulating ES as well as health and security of HW were strongly linked and the dominant indicators were fresh water and air purification of ES as well as physical condition and living area of HW respectively. In addition, we found that perceptions of regulating ES more influenced awareness of environment conservation which was dominantly judged by supporting rather than propagandizing environmental protection and perceptions of cultural ES more influenced awareness of policy implementation which was dominantly judged by monetary benefit from GFGP policy. We conclude that sociocultural evaluation and structural model construction can serve as useful tools to identify dominant indicators for further improvement and to inform policy decision focusing on the balance of ecological recovery and economic development.

Keywords: Ecosystem services; human well-being; perception; rural residents; structural equation model

24. Poster Abstract

T. Thematic Working Group sessions: T9 Cultural ecosystem services and public health in urban areas

Nature benefits from mountain National Parks – how do local environmental characteristics relate to perceived restorativeness?

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Nature experience deeply and positively impacts human health and well-being through psychological restoration (Hartig et al 204). Assessments of cultural ecosystem services (CES) seek to unfold the immaterial benefits people can obtain from their experiences of nature. As such, CES assessments can be used to better understand the experience of psychological restoration in natural environments. However, few studies have explored the influence of specific natural landscape characteristics on stated psychological benefits. We propose a novel approach to the links between landscape characteristics, CES and psychological restoration. Our works makes use both of biophysical modelled data describing six landscapes indicators related to CES supply and in-situ survey data, gathered in the context of the ECOPOTENTIAL H2020 project. In summer 208, we carried out a survey with over 400 visitors of three mountain national parks in Europe (the Swiss National Park, the Austrian Kalkalpen National Park and the Portuguese Peneda-Geres National Park), aiming at understanding which CES they enjoyed, and where, as whether they experienced the environment as restorative. We combine data on i) locations enjoyed by national park visitors collected through participatory mapping with ii) landscape indicators related to CES supply, and iii) the stated importance of landscape characteristics assessed through the same individual surveys. Using regression analyses, we assess the extent to which specific landscape characteristics at places enjoyed by national park visitors, as well as the CES experienced, contribute to the perceived restorativeness of the natural park. We show contrasted results from the three national parks, highlighting the variable influence of landscape characteristics on psychological restoration. Our results provide novel insights on the links between CES, characteristics of the local

environment and public health. Further, we believe our methodology can be of interest to a large audience as it can easily be transferred to alternative contexts.

Keywords: Psychological restoration, Perceived restorativeness, Cultural ecosystem services, Mountain national park, Landscape indicators

25. Abstract

T. Thematic Working Group sessions: T9 Cultural ecosystem services and public health in urban areas

Influence of natural environments on urban dwellers' health in the Basque Country

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The contribution of natural environments and ecosystem services to human well-being and quality of life is being increasingly recognized specially with reference to public health and the major role they may play in prevention efforts. In a present context of global change and a growing population worldwide, the subsequent expected negatives outcomes would jeopardize billion people lives due to a variety of impacts encompassing environmental, social and economic issues. In terms of human health, the effects on morbidity and mortality rates have been highlighted so there is an urgent need to gain insights against declines in quality of life and the promotion of resilience with regards to public health. Natural environments provide a range of cultural ecosystem services that may help ameliorate contextual vulnerabilities and enhance population's quality of life at the physiological, psychological and social levels.

In this study we explored the relationship between urban natural environments and human health in several socioeconomic contexts in the Basque Country (Northern Spain). We quantified the exposure to natural environments by means of NDVI, and analyzed its influence on mortality risks as a health outcome. To account for the contribution of natural environments within different socioeconomic circumstances, we took into consideration an

index of deprivation. Data were retrieved from official public sources and examined using GIS tools. Models were fitted for women and men separately. Results showed differences in mortality risks with reference to green space and the socioeconomic context for both sexes which suggested the potential contribution of natural environments to ameliorate disadvantaged areas. Our results contribute to set a baseline for further research aimed at understanding urban natural environments' benefits to human health. We encourage urban planners to prioritize sustainable planning of natural environments in order to guarantee their protection, enhancement and equitable distribution and access for the population.

Keywords: Natural environments, NDVI, Health, Mortality, Deprivation Index

26. Poster abstract

T. Thematic Working Group sessions: T10 Does modelling trade-offs gives the full picture, or can stakeholders tell it all? The complementarity of models and participative methods

Cultural ecosystem services in an urban park: understanding bundles, trade-offs and synergies

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Cultural ecosystem services (CES) are nonmaterial benefits people obtain from ecosystems and directly influence the quality of human life. However, complex relationships existing among CES makes it complicated to apply in practice, such as landscape design and planning. Interactions of different CES can result in positive (synergies) or negative (trade-offs) for the provision of CES. This study presents an integrating approach based on stated-preference to analyze interactions among multiple cultural services, including bundles, trade-offs, and synergies.

We performed questionnaires, participatory mapping, and interviews of CES perceived by park users in Huanhuaxi Park, China. The results show that) bundle analysis can identify areas with different landscape features in provisioning CES, which is crucial for park management; 2) trade-offs and synergies among CES occurred frequently in the park. For instance, aesthetic

values have very strong positive correlation with recreation and sense of place. To conclude, we recommend stated-preference and mapping techniques to assess bundles, trade-offs and synergies of cultural services. Besides, we encourage more studies to identify drivers and build monitoring mechanism to better understanding the interaction among CES.

Keywords: cultural ecosystem services; bundles; trade-offs; synergies

27. Poster abstract

T. Thematic Working Group sessions: T11 Tele-coupling through flows of ecosystem services from regional to global scales

Beyond national ecosystem services assessments – analyzing selected interregional ecosystem services for Germany

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Ecosystem services assessments receive increasing attention to account for ecosystems and their services on a national level. However, especially in the context of globalization, people also benefit from ecosystem services provided by ecosystems abroad. In addition, countries of the Global North frequently obtain tangible and intangible benefits from ecosystems in the Global South. The consequences of these international dependencies, for example, the destruction of rainforest in the Global South to cover the dietary preferences in Europe (e.g. meat consumption), are rarely considered in national ecosystem services assessments. We present an assessment of four ecosystem services flow types to show Germany´s dependency from distant places, representing the interconnection of a high-income country of the Global North to the Global South:) cocoa import providing a luxury traded provisioning service, 2) migratory birds providing pest control, 3) floodplain ecosystems providing flood control, and 4) the loan of pandas to the Berlin Zoo providing information related to bequest values. We argue that ecosystem services assessments should also include interregional ecosystem service flows since they contribute substantially to national prosperity and human well-being.

Keywords: ecosystem services, assessment, interregional flows, dependencies

28. Poster abstract

T. Thematic Working Group sessions: T14b Assessing effects of landscape structure on ecosystem services for landscape planning and management: striking a balance between level of detail and feasibility

Ecosystem service potential, flow, demand and their spatial associations: A case study of nutrient retention service in a human dominated watershed in Southwestern China

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The spatial associations between the potential, flow, and demand of nutrient retention service have scarcely been investigated. Our study aims to reveal the spatial patterns of the retention potential, load (representing demand), actual retention (indicating flow) and export (reflecting demand-flow budget) of non-point source total phosphorus (TP) and their spatial associations in the Dianchi Lake (DL) watershed in Southwestern China.

We investigated numerous literature to derive the values of TP retention potential and load and modeled TP retention and export using InVEST. Then we mapped the four indicators on the catchment scale, analyzed the trends of these indicators along elevation and slope gradients, calculated the correlations between these indicators, and calculated TP retention and export by different landscape types. The results show spatial mismatches between TP retention potential and TP retention, load, and export, and spatial congruence between the latter three on the catchment scale and along elevation and slope gradients. In addition, although forest and shrubs had high TP retention potential, their TP retention and export intensity were relatively low due to their low TP load intensity. In contrast, dryland crops and residential areas, which although had low TP retention potential, exhibited high TP retention and export intensity because of their considerably high TP load intensity. Landscape structure and the values of the four indicators related to TP retention service determined the spatial pattern of and the associations between the four indicators on the catchment scale and along

the elevation and slope gradients. Possible strategies to reduce the spatial mismatches between TP retention potential and the load and actual retention of TP, and reduce TP export in the DL watershed are: building buffer strips, developing new residential areas on hills, implementing low impact development in newly built urban areas, and converting sloping dryland to terraced dryland.

Keywords: nutrient retention, flow, demand, spatial mismatch, modeling

29. Poster abstract

T. Thematic Working Group sessions: T14b Assessing effects of landscape structure on ecosystem services for landscape planning and management: striking a balance between level of detail and feasibility

Land cover scores-based ecosystem services supply assessment for green infrastructure planning: case of Harku rural municipality, Estonia

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To assess the supply of ecosystem services (ES) a capacity matrix method was applied in the context of the Biodiversa IMAGINE project. This allowed to evaluate all of the ES and disservices available to be evaluated in the same unit. In addition the method enabled the engagement of local experts, and will facilitate, presumably, subsequent appropriation of the results by them (Roche & Campagne 208).

Land cover units were based on Corine land cover classes. Expert-based stakeholder interviews were conducted to evaluate the ES supply capacity potentials for each land cover unit separately and based on the assessment scores. Respective maps of services' groups were then composed displaying the spatial distribution of ES.

Results from the ES capacity matrix showed that natural areas with the most diverse vegetation provide the highest ecosystem services capacity potential and that artificial units have no or very low service supply capacities. Forests were evaluated with the highest scores under all ES

groups, including disservices. Industrial or commercial sites and mineral extraction units scored less than low or non-existent.

As regulation services, forest and peat bogs provide the highest capacities especially for local climate and air regulation. Provisioning services had the highest capacity in forest, agricultural lands and peat bog, by providing biomass for human consumption. For cultural services, the Sea is seen as the highest aesthetic value provider, and forest as major provider of physical and experiential interactions. The highest capacity to provide disservices was assessed for forest and sea units.

The maps of potential supply capacity of ES groups and the green infrastructure (GI) plans of Harku municipality were compared. The core areas of GI plan consisted of very high and high ecosystem services supply capacity units and none of the low capacity units were considered under green infrastructure. However, from the map synthesis three areas with high ES potential outside the existing GI plan were proposed to improve the connectivity elements of GI.

Keywords: land cover scores, ecosystem capacity matrix, ecosystem services mapping, spatial planning

30. Abstract

T. Thematic Working Group sessions: T14b Assessing effects of landscape structure on ecosystem services for landscape planning and management: striking a balance between level of detail and feasibility

Testing landscape units for combined landscape value assessment and ecosystem service assessment

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Undermined by the increasing urban sprawl as well as intensification of agricultural production, the urban-rural fringe agricultural landscapes face challenges of ensuring viable food production, reducing environmental degradation and biodiversity loss, as well as sustaining rural development. Policies and strategies such as the Common Agricultural Policy,

the European Landscape Convention and Biodiversity Strategy address these problems in their objectives, but they are based on different concepts regarding landscape functions and ecosystem services. To provide planners with a comprehensive landscape valuation framework, we refer to the policy objectives by assessing three rural landscape functions: environmental balance, food production and providing vital space to live, and tourist businesses with the use of landscape indicators and ecosystem services. We introduce the criteria of vulnerability to landscape changes, legal environmental protection, cultural heritage, scenic variety, and clarity to assess landscape values and water purification and retention, food production and recreational potential to assess ecosystem services. The results encourage the combination of the two approaches, since in a well-structured framework they complement each other in terms of covering different aspects of landscape value. An integrated approach to landscape assessment enables the picturing of more diverse values, and can better inform landscape and spatial planners. The novelty of this research is the use of landscape units as the basis for the application of ecosystem service and landscape valuation integrated assessment at the level that matches the scale of land use policy on the municipality level

Keywords: Landscape value assessment; integrated framework; landscape units; ecosystem service; landscape management

31. Poster abstract

T. Thematic Working Group sessions: T14b Assessing effects of landscape structure on ecosystem services for landscape planning and management: striking a balance between level of detail and feasibility

Mapping cultural ecosystem services as a background for better informed landscape management in protected areas (Case study of Terchovská dolina valley and Horný Liptov region, Slovakia)

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There are numerous studies that highlight the importance of intangible benefits provided by cultural landscapes which are shaped by intimate human-nature interactions. Due to methodological challenges they are rarely fully considered in ecosystem services assessments. Cultural services follow specific patterns in terms of intensity, richness and diversity of their provision, obviously they are related to specific landscape features and land cover forms.

In this study we focused on linking land cover information from field surveys and GIS to ecosystem service supply in two selected areas of Slovakia (Terchovská dolina valley micro-region, that consists of 7 municipalities; and selected 5 municipalities of Horný Liptov region). We also used spatial distribution of recreation & leisure hotspots and tried to find out if ecologically more valuable areas are places of cumulating socio-cultural values to visitors rather than those with lower value. Finally, we compared our results with national assessment of ecosystem services, looking for both verification of general results and specific features of our mountainous case study areas.

Main aim of our research was to reveal patterns of human activities as well as the capacities of different ecosystems to provide cultural ecosystem services. Our approach was based on an ES matrix, linking spatially explicit biophysical landscape units to cultural ecosystem service supply and using spatial distribution of recreational and cultural-historical attractions. In the discussion, we also have considered the advantages and disadvantages of this approach and have concluded that it could be an effective means for supporting the participatory planning

and management process; as well as for the sustainable tourist development in protected areas and mountainous regions.

Keywords: recreation, cultural ecosystem services, nature conservation value, landscape planning & management, Slovakia

32. Poster abstract

T. Thematic Working Group sessions: T14b Assessing effects of landscape structure on ecosystem services for landscape planning and management: striking a balance between level of detail and feasibility

Urban regulation ecosystem services assessment based on green infrastructure structure indicators with patch-level case study in Shanghai

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Urban green infrastructure (UGI) attracts much interest because they provide urban ecosystem services (UES), especially in regulation UES for current deterioration in urban environment. However, among all methodologies that evaluate regulation UES, none of them directly has physiology connections with UGI. As a result, a new UGI structure-based modeling methodology was constructed in this study, and analysis was carried out through case studies in urban parks of Shanghai. In our methodology, nine model UGI structures were constructed and each of them was given unique quantitative value based on physiological mechanisms. Moreover, the whole assessment system was expanded with “air purification,” “microclimate regulation,” “noise reduction,” “carbon sequestration and storage,” and “rainwater retention” valued as most concerned regulation UES. We also got feedback to methodology adjustment through implementation in two urban parks in Shanghai, and consider this methodology would most suitable in patch-level cases or regions without sufficient data. In all, this methodology can make certain efforts to regulation UES assessment, and besides quantitative results and certain evaluation, it would also be an assist to policy suggestions of urban green planning.

Keywords: Urban regulation ecosystem services, Urban green infrastructure, Structure indicator, Modeling methodology assessment, Patch-level, Shanghai

33. Poster abstract

T. Thematic Working Group sessions: T14b Assessing effects of landscape structure on ecosystem services for landscape planning and management: striking a balance between level of detail and feasibility

Mapping ecosystem services in a Brazilian subtropical landscape

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There are many urban Ecosystem Services (ES) that bring well-being for people. Climate regulation, air pollution retention and recreation are some of the important ES for urban areas, which can be provided by a well-planned multifunctional landscape. This study was conducted in the Monjolinho basin (Figure), which is composed meanly by agricultural areas and where live about 200,000 urban habitants, located in Atlantic Forest – Cerrado (Brazilian savanna) ecotone. We chose 43 different points with 500m buffer, along waterbodies. We modelled and mapped the microclimate regulation (cooling effect based on the canopy cover), the air pollution removal (based on the Leaf Area Index and the particulate matter (PM0) local concentration, and the nature-based recreation (outdoor recreation opportunities). To assess their spatial distribution, the ES intensity data were normalized and categorized into three classes (Low: 0-0.33; Medium:0.33-0.66; High: 0.66-.00). The bivariate OLS correlation model was run to assess the relationship (synergies and trade-offs) among them. The results indicated a better scenario for Cooling and Air pollution retention outside the urban areas, where most of the fragments and the largest vegetation remnants are located, which are probably driving the synergy (positive correlation) found between both; and the best scenario for Nb-recreation inside the urban area, which explains a trade-off (negative correlation) between Cooling and Recreation. Considering that recreation areas are the places with a higher demand for ES, the lack of better levels of regulation ES indicated the need for an improvement of the green-infrastructure and nature in these areas, aiming to change this negative trade-

off trend. São Carlos municipality has low nature-based recreation opportunities outside of the urban area, but at the same time, holds a significative amount of natural areas that could be better planned to offer more recreation opportunities.

Keywords: Modelling, Air pollution, Climate regulation, Nature-based recreation, trade-offs

34. *Poster abstract*

T. Thematic Working Group sessions: T14c Ecosystem services and drivers of change

Interrelations of six soil-related ecosystem services within an agricultural headwater catchment

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Agricultural soils incur increasing degradations, although they provide essential ecosystem services (ES) underlying human well-being. Thus, applying locally the ES approach is showing useful insight to support agricultural land-use decision-making. Only, scarce literature studies have quantified ES biophysically, whilst taking into account their temporal evolution on the mid-term and their local spatial variations linked to agro-pedo-climatic factors. Thus, within the SOILSERV project 206-2020, this study aims to assess the sensitivity and interrelations of six soil-related ES in regards to local soil variability.

The studied site is the small (5km2) agricultural headwater catchment Kervidy-Naizin, Brittany, which is part of the Environment Research Observatory (ORE) AgrHys. Added to past representative conventional cattle and cropping practices' descriptions, 00 detailed quantitative and qualitative soil samplings were obtained in 208. The applied ES approach targets to indicate i) ES and ii) ES in regards to the ecosystem input levels. It includes i) three ES benefiting farmers: food provision, N plant provision, water plant provision and ii) three ES benefiting the local and global population: water table recharge, water quality regulation (N) and climate regulation (C). Modeling with the STICS agronomic model enables to assess

simultaneously the ES over a 20 year-period (998-208). The tested situations differ based on 00 soil profiles under a conventional crop maize-wheat-mustard rotation.

Within this small basin, variations and interrelations of ES in the form of synergies and antagonisms have been assessed. For each ES, the ranking of ES results for the tested situations and associated soil types has been analyzed. The main soil properties explaining ES variabilities and interrelations have been determined. These aim to provide local insight to discriminate soils based on their ES provision level. A further analysis will deepen the influence of local soil variability compared to regional soil variability on ES results.

Keywords: Ecosystem Service, Soils, Model, Interrelations, Agricultural catchment

35. Poster abstract

T. Thematic Working Group sessions: T14c Ecosystem services and drivers of change

Visual perception of landscape – what and how do we see through the car window?

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Observational interactions with natural environment are related to several ecosystem services. These interactions may be both intentional and unintended and occur in a number of ways. Mobility of people in Latvia has increased considerably due to improvement of overall economic situation over last 0 years. In 205, the country was leader in terms of purchase of new cars per capita reaching more than 200% increase comparing to previous year. Thus, landscape has been more and more often perceived through the windows of a motorized vehicle. While the importance of spectacular and picturesque views or areas of particular interest are often highlighted, the importance of everyday landscapes is usually underestimated. This is also true when road landscape is under discussion. Considering the fact that more than half of country area is covered with forests, perception of the road landscape within the forest is of particular interest.

In our study, we focused on road landscape of commercial forests where road network is strongly linked to extensive long-term management. Several road segments were selected to represent the diversity of natural and man-made landscape elements along roads. The focus group consisted of 30 participants of both genders, varying ages and a range of different professional backgrounds and occupations. In each section of the road route, the participants were asked to observe roadsides while driving and comment on their observations, recording them on smartphone. Comments and qualitative evaluation of road landscape were optional. The records were afterwards deciphered, identifying most common phrases and most often detected landscape elements. Drone Mavic Pro images at 00 m altitude were recorded covering all sections of the route, and ortophoto was generated from these images enabling the comparison of visible landscape elements with those perceived by participants of the study.

Keywords: Forest roads, driving, everyday landscape, landscape elements, visual perception

36. Poster abstract

T. Thematic Working Group sessions: T14c Ecosystem services and drivers of change

Ecosystem services provision in year 2020 and in 220: a case study analysis in the Kvarken Archipelago

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Maritime spatial planning advances sustainable development and growth. Plans are made for decades further but what will the future look like in 00 years? The Gulf of Bothnia (GoB) in the Baltic Sea is an area of special interest because its underwater nature will be the most affected by climate change. Many species are already on the verge of their existence due to low salinities which will further decline due to climate change. Bladder wrack (Fucus vesiculosus) and blue mussel (Mytilus edulis) are vanishing keystone species providing regulating and maintenance ecosystem services (ES). Cultural services will also change e.g. due to loss of sea ice caused by warmer winters. To ensure sustainable maritime development a clearer vision of future ES needs to be assessed.

The case study area is situated in the Kvarken Archipelago, GoB. The area is defined by the WFD Water Body Typology, an accepted division of water bodies. We apply a recently developed methodological approach and tool called the Marine Ecosystem Services Assessment Tool (MESAT) to address changes in ES provision over time. MESAT includes 3 CICES ES and 54 indicators assess the services. We address changes in ES provision over time by defining two statuses (year 2020 vs. 220), applying future climate scenarios for our case study area. By comparing the changes between the indicators, we get the changes in services provision.

The results of the upcoming assessment suggest which services will strengthen and which weaken in year 220, but also if new services occur. The results indicate changes in the water body of the case study area and support decision makers in their work. If the tool is proven reliable the assessment will be applied for an area of 60 water bodies in the region. Results are made available for the public on a GIS-platform.

Keywords: Maritime Spatial Planning, Climate Change, Baltic Sea, Ecosystem Service, Future Scenario

37. Poster abstract

T. Thematic Working Group sessions: T14d Biodiversity and ecosystem services offsets using spatial nature compensation measures

Constructed floating wetlands as a mean to enhance ecosystem services in coastal lagoons

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Constructed floating wetlands (syn. floating island, floating treatment wetlands) is a Nature-based Solution (NBS) increasingly applied for water restoration and creation of natural floating riverbanks in the cities. The LiveLagoons project (funded by Interreg South Baltic Programme 204-2020) aims at improving the water quality and other ecosystem services in eutrophic lagoons in the South Baltic. We test nutrient removal technology along with the socio-

economic benefits in different environments at three pilot installation sites: Curonian Lagoon (Lithuania), Szczecin Lagoon (Poland) and Darss-Zingst Bodden Chain (Germany). We present variable experience of macrophyte growth on floating installations, both custom made and constructed by commercial producer.

In addition to the main expected effect - removal of nutrients, we have identified site-specific contributions to a wide range of ecosystem services starting from the coastal protection against coastal to habitat provision and cultural services. To assess the possible synergetic effects an additional island was installed in a coastal resort area to examine attitudes of local community and National park visitors towards the island as an esthetically attractive object. We discuss the possible guidelines for the maximization of potential effects of constructed floating wetland in different locations.

Keywords: nature based solution, habitat restoration, nutrient removal, coastal protection

38. Poster abstract

T. Thematic Working Group sessions: T14d Biodiversity and ecosystem services offsets using spatial nature compensation measures

Are protected areas covering important biodiversity sites? An assessment of the nature protection network in Sicily (Italy)

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GIS spatial analysis of three indicators (vegetation value, faunal richness and landscape eterogeneity) was used to detect and map High-Value biodiversity Areas (HVBAs), estimate the coverage of biodiversity in the Sicilian protected areas network, and identify new priority areas that could improve long-term biodiversity conservation outcomes. Findings indicated that only 32% of HVBAs are currently covered by the protected areas network. Hotspot analysis revealed that a modest expansion (less than %) in the current extent of protected areas would include a disproportionate amount (56%) of biodiversity hotspots, and identified prioritized candidates HVBAs for designation of new protected areas.

Keywords: Protected areas, Biodiversity value, Conservation planning, GIS, Spatial analysis, Hot spots

39. Poster abstract

T. Thematic Working Group sessions: T18a Towards governance innovation for ecosystem services provision: legal & economic instruments, and policy mixes

Collaborative governance of agri-environmental measures for the provision of ES at landscape scale

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Agri-environmental schemes (AES) can be conceptualized as governmental payments for ecosystem services (PES) to incentivize sustainable ES provision in agricultural landscapes. In the European Union, they are typically based on individual contracts with farmers. However, the success of schemes in delivering positive ecological effects across European landscapes is debatable. One reason is a lack of spatial coordination and targeting of measures applied at landscape scale. This neglect of considering the landscape scale for ES provision is conceptualized as institutional misfit, when social systems fail to appropriately align to the ecosystems they govern. One approach to improve AES is collaborative governance which aims to include stakeholders from all spheres of society who have the mutual goal to coordinate their individual activities at landscape scale. Such kind of approaches gave rise to the introduction of the group option for AES within the Common agricultural policy (CAP).

So far, the Netherlands are the only member state which implemented the group option as a mandatory scheme to systematically enhance collaboration at the landscape scale. Since 206, farmers have to join an environmental cooperative to receive agri-environmental subsidies. There is one contract between a cooperative and the public authorities whereas individual contracting of farmers is done within the cooperative. The cooperatives have some flexibility in choosing the measures according to pre-defined ecological priorities for their region and in organizing themselves which led to a great divert of existing initiatives: some are more involved in collaboration with a variety of civil, public and private stakeholders than others. In

the presented study, two initiatives have been reviewed to investigate their institutional design characteristics and how this helps in mitigating aspects of institutional misfit. The investigation was based on empirical research with in-depth interviews conducted with involved stakeholders in combination with institutional and transaction costs analysis.

Keywords: collaborative governance, agri-environmental measures, coordination at landscape scale, institutional analysis, transaction cost analysis

40. Abstract

T. Thematic Working Group sessions: T18b Policy impact of TEEB inspired studies – lessons for natural capital valuation

Assessing ecosystem services with local stakeholders along a planned motorway section in Hungary

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An ecosystem services assessment research was compiled in 207-208 in the Northern Alföld region in East Hungary at the Ukrainian border with the aim to demonstrate the key ecosystem services of the subregion and to show their values and relevance as a reference for the planned M3 motorway construction.

Built on the key concepts of the cascade model and participatory approach data, were collected through numerous methods ranging from deep interviews through desktop studies, surveys, preference assessments, statistical analysis to focus groups. Based on the data, we established an overview of the subregion along with the key socio-economic drivers and the most important ecosystem services.

According to the interviews, poverty, segregation, unemployment, ageing settlements and migration come hand in hand with hopelessness and lack of future perspectives, which are not addressed with strategies. On sharp contrast, we discovered relatively thriving nature – we found that stakeholders consider more than 20 relevant ecosystem services.

With the help of local stakeholders, we further narrowed down those services that were deemed the most significant. Tisza as a place for recreation and as a unique landscape, local identity and spirit of nature, tourism, water, game and mosaic landscape were selected. We also assessed their monetary values – we found that game has an estimated 05.4 million HUF annual value, whereas tourism related ecosystem services provide around 40 million HUF annual income, while the other services deliver the basis for many other sectors or simply unquantifiable mental and spiritual benefits.

Our main conclusion is on one hand, the planned motorway will likely impact these ecosystem services and entail limited socio-economic benefits. On the other hand, the region although being currently deprived, can be developed to a more thriving area building on its rich ecosystem services with complex and sustainable socio-economic strategies and investments.

Keywords: ecosystem services, valuation, participatory approach

41. Poster abstract

T. Thematic Working Group sessions: T18b Policy impact of TEEB inspired studies – lessons for natural capital valuation

Costa Rica´s readiness in the implementation of Nature-Based-Solutions: A methodology of policy assessment

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Nature-Based-Solutions (NBS) are a combination of economic, social, and environmental goals and benefits that requires an adaptable policy framework for its implementation. They have emerged as a major approach when discussing about the sustainable future of urban areas suffering from rapid urbanization and stormwater problems. However, NBS have fallen behind in reaching to the political and legal framework, and with this, to a policy mix for urban sustainability. When looking closer at NBS, it becomes more than obvious that they are loaded with many challenges, including institutional, political ones, and what is more, to the urban areas social context. These challenges are also deepened by the lack of policy guidelines for

its implementation. In addition, the European Commission stated that the NBS definition is still at the concept phase and in need to increase awareness through case studies and living labs for its proper implementation, while the Economic and Social Research Council (ESRC) consider living labs as urban experiments for policy making. For this reason, this paper proposes a Policy Feedback Cycle (PFC) of an urban experiment for successive policies suggestions that promote NBS. The PFC assesses the policies in a cyclical manner, from policy creation to its maintenance, to enhance the design of subsequent policy outcomes. Combined with the criteria of urban experiments to promote sustainable innovations and new policies initiatives, this paper elaborates a PFC from the New York City (NYC) Green Infrastructure (GI) Plan as it can work as an evidence-based policy making for future projects. Finally, this PFC will be compared against the current policy framework of the province of Heredia in Costa Rica. Results indicate that sustainability policies for NBS at the municipal level should incorporate not only economic and public policies, but also; (i) community involvement and communication; (ii) transdisciplinary knowledge transfer between specialists and relevant stakeholders and (iii) constant communication and community´s feedback.

Keywords: Nature-Based Solutions, sustainability policies, rapid urbanization, Policy Feedback Cycle, urban experiments

42. Poster abstract

T. Thematic Working Group sessions: T18c Governance of ecosystem services for rural-urban synergies: bridging science and decision-making

Contributions of ecosystem services in space transport planning: review of the state of art

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The approach of the Ecosystem Services (Es) vision is increasingly present in the political decision making related to environmental sustainability. Especially, to land use and to the promotion of spatial planning, however, it is verified that this view is not restricted to urban areas, but also in some applications related to the transport infrastructure planning (TP). This work intends to present a review on ES, TP and the contribution of ES in TP, also, it is demonstrated, in this research, the evolution of research related to the theme in the last ten years, that is, in the period of 2009 to 208. To present the importance attributed to the theme ES, several research on the scientific production are related to ES in the period from 2009 to 208. Therefore, to evaluate the evolution of research related to ES, both in Brazil and around the world, consultations were conducted on the Google Scholar and Science Direct search tools. It was verified that the ES theme has been receiving exponential repercussion in academic research, however, transportation planning has identified little evolution in the amount of studies carried out in the last decade. In addition, when considering the themes ES and TP simultaneously, only 0 published scientific work was identified. However, the great potential of use of the ES variable in the TP decision-making process is perceptible, but it is still necessary to have a better understanding of the subject to evaluate the impact of ES on TP. It can also be deduced that the question of mapping and valuation of ES still lacks evolution to have a better condition of inserting the ES variable within the TP decision process.

Keywords: Spatial Planning, Transportation Planning, Ecosystem Services, Valuing Ecosystem Services