BOOK OF ABSTRACTS

I. SESSION DESCRIPTION

ID: **T13**

Stepwise ecological restoration for planetary health

Hosts:

	Title	Name	Organisation	E-mail
Host:(1	Prof.	Junguo Liu	Southern University of Science and Technology; Society for Ecological Rehabilitation of Beijing (SERB)	liujg@sustech.edu.cn
Co-host(s):	Dr.	Florian Kraxner	International Institute for Applied Systems Analysis (IIASA)	kraxner@iiasa.ac.at

Abstract:

The United Nations General Assembly declared 2021–2030 as the "Decade of Ecosystem Restoration", which positions "the restoration of ecosystems as a major nature-based solution towards meeting a wide range of global development goals and national priorities". Ecological restoration, when it was implemented effectively, contributes to increasing ecosystem services, protecting biodiversity, and enhancing human and ecosystem health. Given ecosystems are degraded, damaged, or destroyed at different severity levels, stepwise ecological restoration (STERE) is required to repair them through different approaches e.g., environmental remediation, ecological rehabilitation, and natural restoration. This session aims to discuss the scientific advances in STERE, the linkages of STERE to ecosystem services, and the practical applications of STERE theory for eco-health and a more ambitious planetary health. Different experiences will be shared among countries in Asia and other continents.

Recommended Reading:
Liu J., Cui W., Tian Z., Jia J., 2021. Theory of stepwise ecological restoration. Chinese Science Bulletin 66 (9): 1014-1025

Goals and objectives of the session:

1. Communicate the research progress of stepwise ecological restoration
2. Discuss application of stepwise ecological restoration

Planned output/ Deliverables:

Journal special issue

Related to ESP Working Group/National Network:

TWG 13 – Role of ES in Ecosystem restoration

II. SESSION PROGRAM

Date of session: Thursday, 16 December 2021

Time of session: 14:00 – 15:30

List of abstracts and speakers

Time	Presenter Name	Title of presentation
14:00-14:03	Prof. Liu (Host)	Opening
14:03-14:15	Kraxner	The RESTORE+ approach for Indonesia
14:15-14:27	Han	An integrated evaluation framework for Land-Space Ecological Restoration planning strategy making in rapidly developing area
14:27-14:39	Ryota	Benthos communities of flood mitigation dam –A case study in Nishinotani Dam -
14:39-14:51	Yang	Assessing the temporal-spatial dynamic reduction in ecosystem services caused by air pollution: a near real-time data perspective
14:51-15:03	Hiroshi	Long-term ecological evaluation of the nature-oriented river work in a mountain stream, the Yamatsuki River.
15:03-15:15	Qi	Impacts of urban expansion on vegetation in arid regions： A comprehensive analysis based on vegetation disturbance index
15:15-15:30	Host/Co-host	Discussion & Closing

III. ABSTRACTS

The RESTORE+ approach for Indonesia

Presenting author: Florian Kraxner
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Restoration of degraded land, as promoted by the declaration of the UN Decade on Ecosystem Restoration, is a significant contributor to the global effort of enhancing land use sustainability and addressing multiple related challenges including UN-SDG 3 "Good Health and Well-Being", and SDG13 "Climate Action". However, interventions and approaches differ widely due to the diverging perceptions of degradation as motivation for restoration. Additional complexity arises through the need of landscape restoration to address contextual specifics and a range of interlinked practical challenges.

This leads to the question as to how diverse and site-specific restoration activities contribute to the aspirational targets of national/global restoration efforts. The RESTORE+ project addresses restoration potential with a comprehensive assessment of degradation and restoration, combining the identification of degraded areas, multi-objective modelling and trade-off analysis. Striving to reconcile regional (landscape) heterogeneity with efforts to inform large scale restoration policies, the project aims at enhancing land use planning capacity related to restoration or utilization of degraded areas in Indonesia and Brazil.

The project integrates biophysical aspects of degradation with social, policy and conservation dimensions by including enhanced datasets gained from novel mapping approaches into biophysical modelling, economic land use modelling, and biodiversity impact assessment. Further, potentials of scalable financing mechanisms for restoration are examined. With this approach, the project generated innovative mapping products for Indonesia. Instead of degradation, the maps focus on restoration potential, including improvements of vegetation and biodiversity and associated ecosystem services. The maps thus identify suitable areas for restoration interventions considering both, the biophysical condition as well as the socio-economic context. The presentation will elaborate this approach and present first mapping examples.

An integrated evaluation framework for Land-Space Ecological Restoration planning strategy making in rapidly developing area

Presenting author: Bo Han
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Ecological restoration is important to mitigate global ecological degradation. However, previous restoration, mainly targeting a single ecosystem or ecological problem and based on ecological engineering, could not effectively solve systemic ecological problems, especially in rapidly developing areas. In China, Land-Space Ecological Restoration (LSER) policy was proposed to change the situation that traditional ecological restoration lacked overall planning and united goals. In this study, a systematic approach for LSER planning strategy making based on landscape, ecological, GIS methods

was proposed to integrate ecological restoration measures in different departments and scales in LSER practice and management. Then we used the Yangtze River Economic Belt in Jiangsu Province, China as a case to verify the effectiveness of the evaluation framework. We took the fishnet scale as data calculation unit and town, county, regional scales as decision units to formulate a hierarchical decision-making system. In the study area, ecological engineering type (including seven kinds of protection or restoration and artificial or natural measures) at town level was identified, guided by county-level LSER zoning (including five zones with different locations, resource characteristics, and ecological issues) and grading (which requires diversified investment intensity and scheduling) obtained by normal cloud model. At the regional scale, an ecological network including 53 ecological sources, 95 corridors, 674 restoration points, and 80 footstones was constructed to optimise the regional ecological security pattern. The proposed systematic approach could integrate the data and decision-making process of different ecological restoration measures. Therefore, it will assist regional ecological goal setting and space strategy-making of LSER planning to achieve sustainable development goals.

Benthos communities of flood mitigation dam –A case study in Nishinotani Dam

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A flood mitigation dam (FMD) is a gate-less dam that is designed only for flood control. The normal flood discharge of a flow-through dam is located at about the same elevation as the riverbed elevation. Therefore, FMD is a dam that is friendly to the river environment because the river continuity is maintained except during floods. However, there are few examples of assessments of river ecosystems around FMDs. In this study, we conducted a biological survey using benthos communities as environmental indicators, a habitat survey, and a reservoir topographic survey using a UAV at Nishinotani Dam, an FMD constructed in Kagoshima Prefecture, Japan. In the lower reaches of the Nishinotani Dam, there was no coarsening of the riverbed material, which is often observed in the lower reaches of reservoirs. On the other hand, the average grain size at 100 m upstream from the dam was about one-fiftieth of that at 750 m upstream. The average grain size at 100 m upstream from the dam was about one-fiftieth of that at 750 m upstream. At 300 m upstream from the dam, bedrock was exposed for about 50 m due to riverbed lowering. This is caused by sediment deposition in the upper reaches of the Nishinotani Dam reservoir, which prevents the supply of sediment to the lower reaches of the reservoir. The individual density of benthos in the downstream part of the reservoir was about one-tenth of that in the upstream part of the reservoir. The habitat of benthos in the downstream area of the river in the reservoir was affected by the discontinuity of sediment transport.

Assessing the temporal-spatial dynamic reduction in ecosystem services caused by air pollution: a near real-time data perspective

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Air pollution is impacting ecosystem services (ES). Yet, few studies have directly and quantitively assessed the dynamic impacts of near real-time air pollution on ecosystem services, often resulting in an underestimate of the impacts and inefficient management and conservation of ecosystems. To overcome the challenges above, this study proposes a method framework to assess the dynamic impacts of near real-time air pollution on ES at multiple temporal-spatial scales. This framework includes the logic of reduction in ecosystem services caused by air pollution, the accounting techniques of the impacts of air pollution on ES by assessing the human health and ecosystem quality losses caused by air pollution. This paper presents Shenzhen, China, as a case study, and further investigates the impacts of air pollution on its ES in 2020, compares the differences of reduction in ES based on average (R1) and real-time (R2) air pollution data. The results indicate that, in aggregate, the total R1 and R2 for all air pollutants are 1.45E+12 sej/ha and 2.09E+12 sej/ha, with a difference of 44.83%, implying an underestimate of the impacts of air pollution on ES based on average data. O3 (68.31%) is the key air pollutant in Shenzhen, followed by PM10 (19.56%), PM2.5 (12.06%) and N2O (0.07%). The reduction in ES accounts for 0.20% of the total ES per unit area, suggesting the relatively good air quality in Shenzhen. At temporal scale, the reduction in ES caused by O3 mainly focus on Autumn (54.55%), while the reduction resulted from PM10 and PM2.5 mainly occurred in Winter (46.51%, 57.24%). The reduction in ES distributes spatially evenly. The detail and timeliness of reduction in ES estimates will facilitate more high time-efficient and fine ES management and conservation.

Long-term ecological evaluation of the nature-oriented river work in a mountain stream, the Yamatsuki River

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River restoration are being carried out by restoring natural river structures such as step-pool structures to improve the degraded river environment in mountain streams. The Step-Pool is determined by many river parameters, and the appropriate Step-Pool geometry for the local area has not yet been determined. Technical guidelines for construction methods that balance the environment and flood control have not yet been developed for mountain streams. There are many cases which concreate check dam generally used through river construction in the mountain river and deteriorate of the river environment. Environmentally friendly methods of river restoration in mountain streams are a major issue in river management. River improvement methods that balance flood control and the environment are being explored around the world, but there is insufficient knowledge on the subject. In particular, there is need to accumulate knowledge on the evaluation of construction practices.

River improvement work was carried out by keeping natural giant boulders in the river channel in Yamatsuki river in Japan in 2009. This river was used as a study site to conduct geomorphological and biological monitoring surveys after 3 and 10 years. In this study, the effects of the retained giant boulders on the riverbed topography and the fish habitat distribution were analyzed.

As a result, when boulders were in close proximity, the process of capturing gravels supplied from upstream by further narrowing the distance between the boulders and developing a Step-Pool was

confirmed. The boulders with the largest diameter moved in a way that the surrounding gravel was sucked out.Fish populations were affected by the increase in water depth, suggesting the influence of the development of the Step-Pool.

Impacts of urban expansion on vegetation in arid regions： A comprehensive analysis based on vegetation disturbance index

Presenting author: Tao Qi
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Arid regions have experienced rapid urban expansion in recent years, and it will continue in the future. This process has caused a serious threat to the originally fragile vegetation in arid regions. Therefore, effective assessment of impacts of urban expansion on vegetation in arid regions is of great significance to promote regional sustainable development. Therefore, based on the Vegetation Disturbance Index (VDI), this study takes the Hohhot-Baotou-Ordos-Yulin (HBOY) urban agglomeration of China as an example to reveal impacts of urban expansion on vegetation in arid regions. The study found that from 2000 to 2020, the urban expansion of HBOY mainly have negative impacts on vegetation, and the proportion of negative impacts is much higher than that of positive impacts. The area of negative impacts on vegetation is 2.09 times than the area of positive impacts. The negative impacts is mainly distributed in large cities. The area of negative impacts in large cities is 5.29 times than the area of positive impacts. Among the large cities, the urban expansion of Hohhot has the most serious negative impacts on vegetation. The area of negative impacts in large cities is 13.56 times than the area of positive impacts. The negative impacts of urban expansion in arid regions is mainly due to the encroachment of grassland and cropland during the urban expansion process. Therefore, it is recommended that arid regions should strengthen the optimization of urban land pattern and improve the level of urban land intensive use, and control the occupation of cropland and grassland by urban disorderly expansion. Meanwhile, actively construct green spaces and vegetation parks within the city, rationally build green ecological corridors in urbanized areas, expand the urban ecological space, effectively improve the ecological environment inside and around the city, and create a green and healthy urban living space.