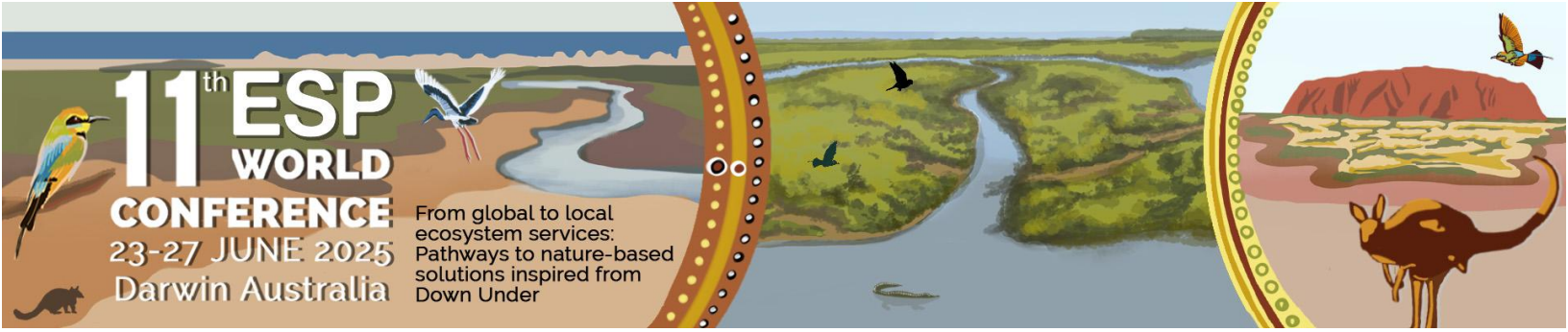


BOOK OF ABSTRACTS

I. SESSION DESCRIPTION

ID: R1

Implementing ecosystem services into multi-scale practices: from assessment to the realization of ecological product value

	Name	Organisation	E-mail
Host:	Xiao Sun	School of Ecology and Environment, Renmin University of China, Beijing, China	sunxiao03@ruc.edu.cn
Co-host(s):	Qingxu Huang	Beijing Normal University, China	qxhuang@bnu.edu.cn
	Hongxiao Liu	South China Botanical Garden, Chinese Academy of Sciences, China	liuhx@scbg.ac.cn
	Yuehan Dou	Xi'an Jiaotong-Liverpool University	Yuehan.Dou@xjtlu.edu.cn
	Baolong Han	Chinese Academy of Sciences, Beijing, China	blhan@rcees.ac.cn

Abstract:

Ecosystem services are critical to human well-being; however, how their value can be fully recognized and effectively utilized and conserved is of even greater practical significance. Assessing ecosystem services ensures that the benefits people derived from nature are recognized and valued, while the realization of ecological product value makes nature conservation profitable thus providing a viable pathway to bridge science and policy-making, especially for those policy-driven countries and regions. Although notable progress has been made, implementing ecosystem services into practices still facing various significant challenges including lacking standardized data and scientific assessment methodology, difficulties in collateralizing or realizing the value of ecological products, etc. Therefore, this session focuses on the topic "from theory to practice", especially for connecting the information conveyed by ecosystem services modeling with decision-making to accelerate Nature-based Solutions implementation across different countries and regions. During the process of value transformation and decision-

making, scientifically grounded information on the values of ecosystem services is essential. Moreover, to transform ecological value into economic value and achieve a win-win outcome for both ecology and the economy, innovative approaches are urgently needed. These include institutional and policy advancements, such as ecological compensation systems and ecological credits, as well as new industrial development models like ecotourism. Simultaneously, we hope to integrate a multi-scale approach, as it can effectively promote the consideration of ecosystem services across different levels of governance—from local, regions to national and global policy-making.

Goals and objectives of the session:

1. This session aims to gather and exchange the frontiers in ecosystem services modelling from different countries and regions. We also hope to further explore and share diverse approaches to model construction and adaptation, ensuring their local applicability across various contexts.

2. This session focuses on in-depth sharing the typical cases, context-specific practices of ecological product value realization across different countries and regions. It aims at sharing experiences and the exchanging of solutions for ecological product value realization across different scales.

3. This session helps researchers and government agencies from various countries gain a comprehensive understanding of how policy-driven nations like China integrate ecosystem services with ecological product value realization. Furthermore, it enhances understanding of how the process of ecological product value realization adapts to local conditions to support informed decision-making at all levels.

Planned output / Deliverables:

1. Advancing ecosystem service assessment models and datasets across countries and regions at different scales.

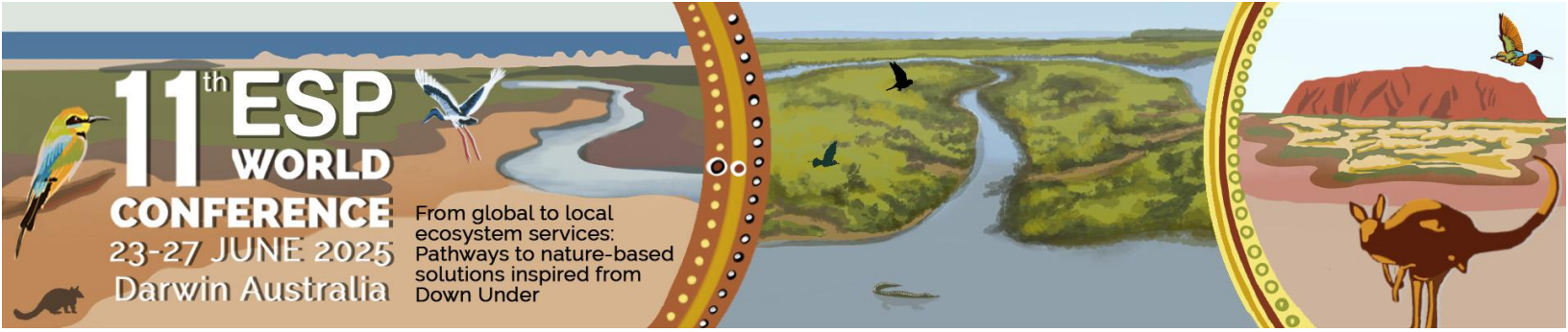
2. Expanding the approaches and pathways for realizing the value of ecological products in different countries and regions at different scales.

3. Sharing and popularizing extensive experience in ecosystem service assessment and value realization in countries with top-down policy management systems, such as China.

4. Establishing a structured and collaborative platform for the ESP China Network, and drafting a two-year action plan focused on network development, capacity-building initiatives, and regional collaborations.

II. SESSION PROGRAM

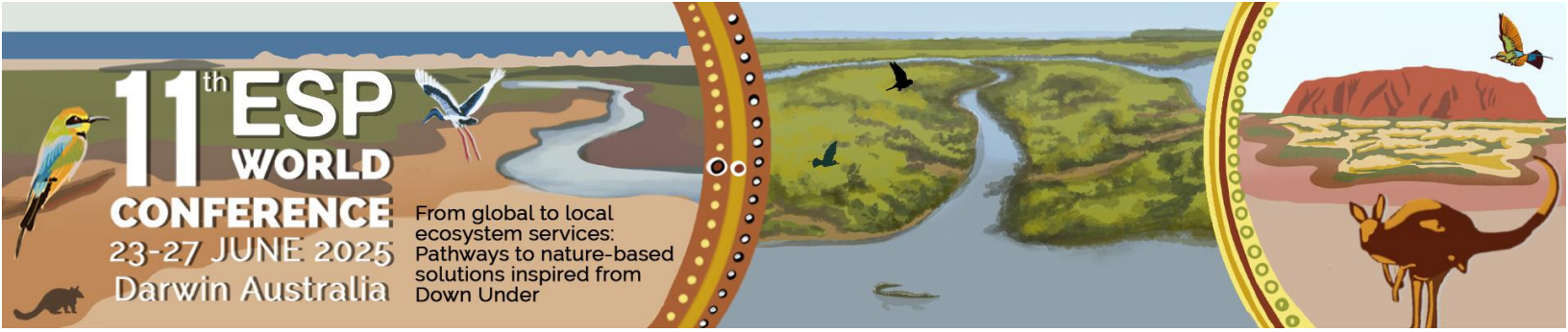
Room: Waterfront 1
Date of session: Monday 23 June 2025



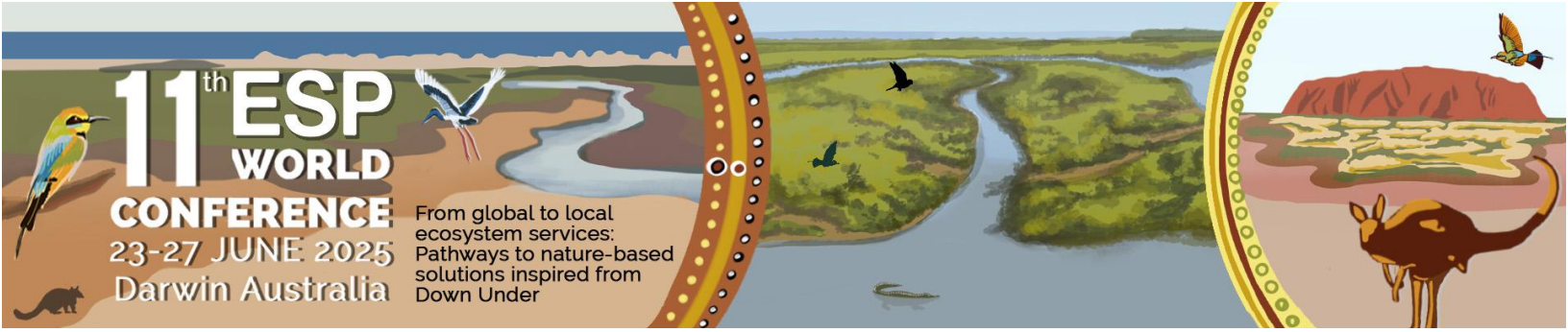
Time of session: 14:00-17:30

Timetable speakers:

Time	First name	Surname	Organization	Title of presentation
14:00-14:15	Si	Wu	China University of Geosciences (Wuhan), China	Future Food-Biodiversity Trade-offs in China under Localized SSP-RCP Scenarios
14:15-14:30	Chong-En	Li	National Science and Technology Center for Disaster Reduction	Trade-offs in Ecosystem Services from Bamboo Forest Expansion: A Dual-Scale Analysis of Global Carbon Storage and Local Environmental/Disaster Risks
14:30-14:45	Agnieszka	Sosnowska	Department of Landscape Architecture, Institute of Environmental Engineering, Warsaw University of Life Sciences, Poland	Climate Change Challenges and Nature-Based Solutions in Medium-Sized Cities: A Case Study of Mińsk Mazowiecki, Poland
14:45-15:00	Crystal	Bradley	Australian National University	Operationalising the concept of critical natural capital to understand and manage nature dependency risk
15:00-15:15	Yihan	Zhou	Beijing Normal University	Assessing the impact of drought on ecosystem services and human well-being: Evidences from Beijing-Tianjin-Hebei urban agglomeration, China
15:15-15:30	Yasuo	Takahashi	Institute for Global Environmental Strategies	Corporate nature-positive action typologies and their potential contribution to ecosystem services: Empirical results from a regular corporate survey in Japan
15:30-15:45	Guojie	Zhang	Guangzhou Urban Planning Survey & Design Institute	Planning and strategy of key areas for land space ecological restoration in the Nanling Mountain ecological



Time	First name	Surname	Organization	Title of presentation
				barrier area: a case study in Yingde City
Coffee break			15:45–16:00	
16:00–16:15	Umi	Purnamasari	World Resources Institute Indonesia	Water for Energy, Local Knowledge for Forests: Jurisdictional Watershed-Based Payment Mechanisms in Jambi, Indonesia
16:15–16:30	Huang	Zhou	Soochow University, China	Comprehensive Preference Assessment of Green-Blue Infrastructure (GBI) in Suzhou: Integrating Visual Aesthetics, Spatial Perception, and Ecological Function for Synergistic Optimization
16:30–16:45	Handan	Zhang	Zhejiang Institute of Water Resources and Electric Power	Risk Assessment and Prevention and Control Pattern Construction of Non-point Source Pollution in Qiantang River Basin
16:45–17:00	Hongxiao	Liu	South China Botanical Garden, Chinese Academy of Sciences	Greenspace exposure and its dual role as mediator and moderator in the relationship between urban density and mental health
17:00–17:15	Yuehan	Dou	Xi'an Jiaotong-Liverpool University	Integrating Cultural Ecosystem Services into Ecological Restoration: Enhancing Mental Health through Landscape Transformation in Shenzhen
17:15–17:30	Xiao	Sun	Renmin University of China	Advancing the spatial optimization of ecosystem service supply-demand and flow to promote regional landscape sustainability
Session Hosts			Discussion	



III. LIST OF ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Optimizing ecological compensation mechanisms through metacoupling of ecosystem Services

First authors(s): Si Wu

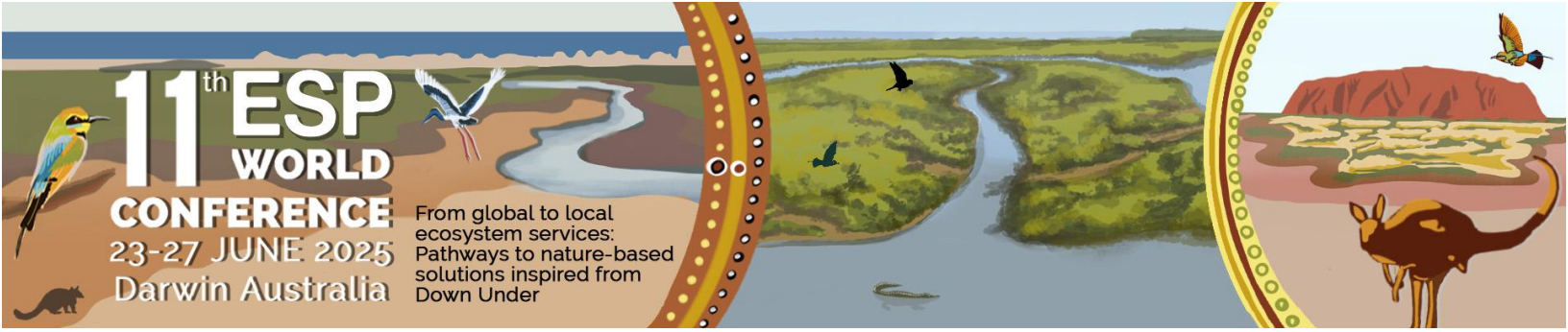
Other author(s): Shougeng Hu, Wenyan Xie

First author affiliation: China University of Geosciences (Wuhan)

Contact: 13545861936@163.com

Keywords: ecological compensation, metacoupling, ecosystem service flow

Constructing an effective ecological compensation mechanism requires a systematic understanding of ecosystem service flows and their interactions across spatial and temporal scales. This study develops a metacoupling framework for ecosystem service flows, focusing on carbon sequestration and food production, to optimize ecological compensation design. Using China, particularly Hubei, Hunan, and Jiangxi provinces, as the study area, we integrate supply-demand dynamics, spatial transfer processes, and stakeholder participation to propose a mechanism that enhances the precision and efficiency of compensation policies. Moreover, we incorporate a cost-benefit analysis in determining compensation standards to ensure economic feasibility and fairness. Quantitative models are employed to assess the spatial relationships and benefit distribution of carbon sequestration and food production services, aligning compensation with ecological contributions and socio-economic needs. The findings provide theoretical and methodological support for refining ecological compensation strategies, promoting sustainable regional development and ecological conservation.



2. Trade-offs in Ecosystem Services from Bamboo Forest Expansion: A Dual-Scale Analysis of Global Carbon Storage and Local Environmental/Disaster Risks

First authors(s): Chong-En Li

Other author(s): Wang Sheng-Hong, Wu Shu-Ping, Yuan Mei-Hua

First author affiliation: National Science and Technology Center for Disaster Reduction

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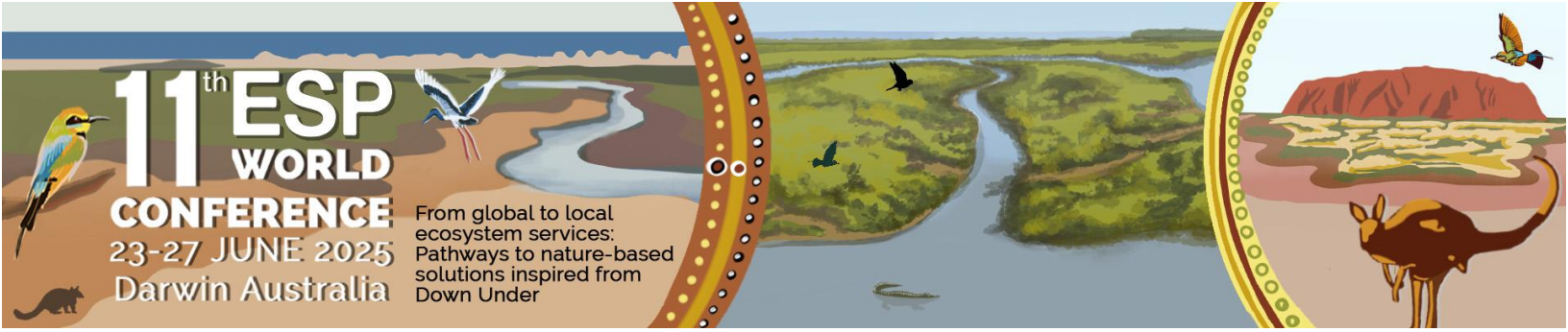
Keywords: Ecosystem Services, Bamboo, Carbon Storage, Trade-offs

The impact of bamboo forest expansion on ecosystem services may involve trade-offs at both global and local scales. Therefore, it is crucial to assess ways to enhance global carbon storage benefits while avoiding increased local environmental and disaster risks. This study employs the InVEST model to simulate changes in carbon storage, water yield, soil erosion, nutrient export, and habitat quality dynamics under different bamboo forest expansion scenarios in Nantou County, Taiwan. The results suggest that bamboo forest expansion is associated with increased carbon storage and reduced soil erosion and nutrient loss; however, it is also linked to a decline in water yield and degradation of habitat quality. Interestingly, certain regions exhibit a synergistic effect, where increases in carbon storage coincide with improvements in habitat quality. This finding suggests that evaluating bamboo forest expansion based solely on aggregate indicators may obscure localized environmental and disaster risks. Thus, incorporating localized indicators is essential for capturing spatial heterogeneity more accurately. Ultimately, we propose a replicable quantitative framework to provide scientific support for decision-makers, enabling them to balance global climate change mitigation with local community well-being and, in turn, promote environmental justice.



3. Climate Change Challenges and Nature-Based Solutions in Medium-Sized Cities: A Case Study of Mińsk Mazowiecki, Poland

First authors(s): Agnieszka Sosnowska

Other author(s): Joanna Adamczyk, Agata Cieszewska, Martyna Kaniewska-Gołek, Magdalena Kuchcik, Dorota Pusłowska-Tyszewska, Renata Giedych, Joanna Dudek-Klimiuk, Gabriela Maksymiuk

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Keywords: climate change adaptation, urban heat island, flash floods

Regardless of the size of the city or its population, the challenges posed by climate change remain unchanged. These include rising air temperatures, increased rainfall intensity, more frequent windstorms, and the urban heat island (UHI) effect. According to the OECD, 24.2% of people in Europe live in small and medium-sized cities (5,000 to 50,000 inhabitants), and when including larger cities (up to 500,000), the proportion rises to nearly half (44%).

Environmental issues in small and medium-sized cities are as significant as in larger ones, though on a different scale. Climate problems, like the UHI effect, depend on the size of the built-up area, may occur in cities with populations above 3,000, but its intensity is lower. Hydrological problems, such as flooding and flash floods, are more localized and depend on impermeable surfaces and relief, with impacts comparable to those in larger cities.

The research conducted is part of the IntegrateNbS project within the Driving Urban Transition program, which explores the potential for implementing nature-based solutions (NbS) in medium-sized cities. Our case study is Mińsk Mazowiecki, a medium-sized city, where potential exposure to climate change has been identified in terms of UHI occurrence and flooding. The spatial structure of the city was then analyzed to explore possibilities for implementing NbS.

The spatial structure of Mińsk Mazowiecki indicates potential significant problems with the city's adaptation to climate change. Currently, 67% of the city's area is built-up land, while agricultural areas and forests occupy only 26%. The problem intensifies with the increasing construction of multi-family housing in the densely built-up zone, which exacerbates issues related to rainwater management and the UHI. The implementation of NbS in the limited spaces available for adaptation reduces the catalog of possible solutions. Will the implementation of small-scale solutions be sufficient to improve quality of life for residents?

4. Operationalising the concept of critical natural capital to understand and manage nature dependency risk

First authors(s): Crystal Bradley

Other author(s): Sarah Clement, Michael Vardon, Ben Milligan, Kazuki Kagohashi,

First author affiliation: Australian National University, Australia

Contact: crystal.bradley@anu.edu.au

Keywords: Nature dependency risk, Ecosystem services, Wellbeing, Natural capital accounting, Research operationalisation

Human dependency and use of ecosystem services have led to the depletion and degradation of natural capital, putting human wellbeing and economic prosperity at risk. The concept of critical natural capital offers a pathway to better understand and manage nature dependencies and support integration of ecosystem services concepts into government policy.

Following a review of existing definitions and frameworks for determining critical natural capital, we propose a new approach, informed by global ecosystem service accounting standards, that can be operationalised in Australia and other country contexts. We propose that the primary concern for identifying critical natural capital is determining what is most important, for whom and for what purpose. A hierarchical importance framework is suggested to identify critical

natural capital and ecosystem services that are essential to human wellbeing. Historically, key vulnerability factors such as substitutability, scarcity and threats were also proposed to identify critical natural capital. We argue that these factors should be omitted from the identification process and instead be included in subsequent risk assessments and associated policy processes.

The approach is applied to identify Australia's critical natural capital. Nature dependency analysis is conducted at a macroeconomic level and highlights specific interfaces with nature that are of national interest. Nature dependencies supporting the essential wellbeing of Australians', including direct and indirect nature-economy dependencies, are presented. The new approach enables explicit and proactive management of nature-related dependency risks and nature-based solutions of interest to governments, complementing risk disclosure efforts in the private sector.

5. Assessing the impact of drought on ecosystem services and human well-being: Evidences from Beijing-Tianjin-Hebei urban agglomeration, China

First authors(s): Yihan Zhou

First author affiliation: Beijing Normal University

Other author(s): Qingxu Huang

First author contact: zyhstory@163.com

Keywords: ecosystem services, human well-being, drought, Beijing-Tianjin-Hebei urban agglomeration

Recently, researchers have explored the impacts of drought on ecosystem services and human well-being, respectively. However, few studies have assessed the impacts of drought on the dynamic relationship between ecosystem services and human well-being. Therefore, taking the Beijing-Tianjin-Hebei urban agglomeration (BTH), a region facing the challenge of increasing water deficiency, as the study area, we quantified annual drought index (SPEI), multiple ecosystem

services (i.e., food supply, water yield, soil conservation, habitat quality and carbon sequestration) and multiple human well-being indicators from 2001 to 2022, and then analyzed their associations using the structural equation modeling. The results showed that from 2001 to 2022, the drought in the BTH showed a fluctuating trend, with the average SPEI ranging from -1.62 to 0.83. The relationship between ecosystem services and human well-being is spatially heterogeneous under different drought levels. We also identified some changes in relationship between ecosystem services and human-being during the recovery after drought. The findings can shed lights on understanding ecological and societal recovery and resilience after extreme climatic disturbance.

6. Corporate nature-positive action typologies and their potential contribution to ecosystem services: Empirical results from a regular corporate survey in Japan

First authors(s): Yasuo Takahashi

Other author(s): Chihomi Shigematsu, Osamu Saito

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Keywords: business and biodiversity, nature-positive, Nature-based Solutions, TNFD, GBF

Increasing number of companies are stepping up their nature-positive actions, responding to accumulating scientific evidence on unprecedented and exacerbating biodiversity loss and their economic consequences, as well as to global policy and business frameworks such as the Kunming-Montreal Global Biodiversity Framework (KMGBF) and the Taskforce on Nature-related Financial Disclosures (TNFD) recommendations. With this backdrop, the Japan business federation (Keidanren) Nature Conservation Council has started an annual questionnaire survey of Japanese companies focusing on the progress of biodiversity mainstreaming into business administration, corporate nature-positive actions aligned with KMGBF, information disclosure along the TNFD

recommendations, as well as integrated carbon neutral and nature-positive actions. Using the 2024 survey data to which 281 companies responded across sectors including businesses and financial institutions, we developed corporate nature-positive action typologies including Nature-based Solutions, and evaluated their potential contribution to safeguarding/enhancing ecosystem services and abating negative biodiversity impacts. Furthermore, we identified the drivers of and barriers for these corporate actions from financial, technical and socio-political perspectives. The results are inherently descriptive due to the contents of the questionnaire, but would provide critical foundation for future quantitative assessment of the contribution of corporate nature-positive actions to biodiversity and ecosystem services. These also would make important contribution to the discussion on the session theme, particularly for scoping biodiversity-related risks and opportunities for the financial sector.

7. Planning and strategy of key areas for land space ecological restoration in the Nanling Mountain ecological barrier area: a case study in Yingde City

First authors(s): Guojie Zhang

Other author(s): Rui Yang, Yongtao Ya

First author affiliation:

Contact: 1538278095@qq.com

Keywords: National spatial ecological restoration; Ecological security pattern; Ecological 'pinch point'; Ecological obstacle points; Yingde city

Carrying out ecological restoration of national land space is an important means to optimize the national land spatial pattern, promote the health and stability of ecosystems, and enhance ecological functions. Scientific identification and accurate positioning of key areas for ecological restoration of national land space are the prerequisites for this work. As the largest county-level city in Guangdong Province, Yingde City is located in the transitional zone between northern

Guangdong and the Pearl River Delta. It plays an important role in building the ecological security barrier of the Pearl River Delta, but also bears enormous ecological pressure. This article takes Yingde City as a case study area and proposes an ecological restoration plan based on the idea of "source identification resistance surface establishment corridor construction", which includes "ecological key problem diagnosis ecological security pattern construction ecological restoration key area identification", in order to provide reference for regional ecological protection and restoration. The research results indicate that: (1) there are 37 ecological source areas in the city with an area of 1237.21km2, mainly distributed in two national nature reserves, Shimentai and Shuishan; The total length of the ecological corridor is 369km, mainly distributed in the northwest and southeast regions, with a key ecological corridor of 115km. (2) The urban ecological "pinch point" covers an area of 63.7km2, including 7 towns and 20 villages such as Lianjiangkou Town and Shihuipu Town; Ecological obstacle point of 61.1km2, involving 17 towns and streets such as Dawan Town and Shakou Town.

8. Water for Energy, Local Knowledge for Forests: Jurisdictional Watershed-Based Payment Mechanisms in Jambi, Indonesia

First authors(s): Umi Purnamasari

Other author(s): Gemasakti Adzan, Rahmat Gunawan, Deki Yasnova, Muhammad Falensky, Dewi Sari, Muhammad Afwani

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Contact: umi.purnamasari@wri.org

Keywords: Watershed-based Payment Ecosystem Services, hydropower, Indigenous Knowledge, Social Forestry, RIMBA Corridor

Jambi Province, located within the RIMBA Corridor—a nationally prioritized biodiversity-rich landscape spanning Jambi, Riau, and West Sumatra—offers a strategic context for piloting

jurisdictional watershed-based Payment for Ecosystem Services (PES). This study focuses on the Batang Merao sub-watershed in the districts of Kerinci, Sungai Penuh, and Merangin, which plays a pivotal role in the Batang Hari River system and supports a national renewable energy project relying on hydropower. The area not only harbors rich biodiversity but is also home to diverse Indigenous communities (Kerinci, Malay, and others) whose forest stewardship practices are deeply rooted in local wisdom.

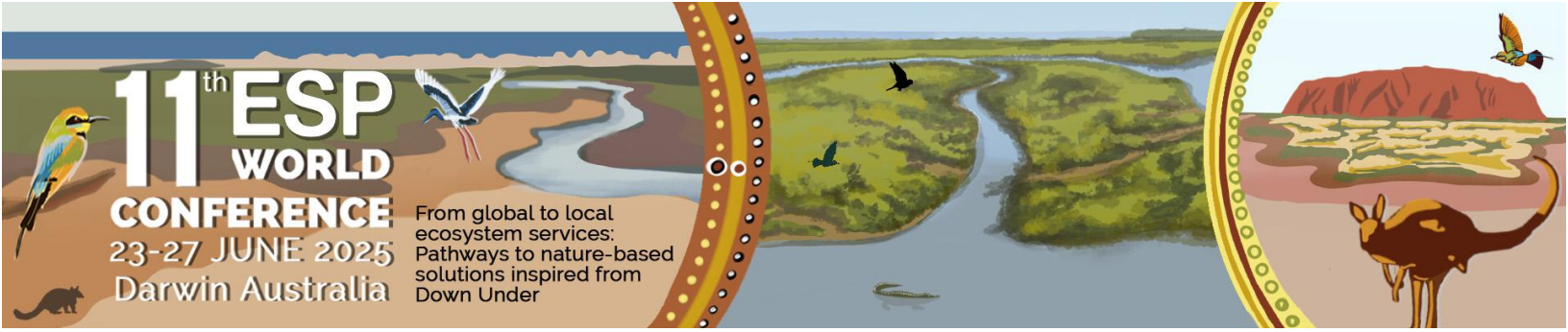
Despite its ecological and cultural significance, the watershed faces growing threats, including forest encroachment, mining, agricultural expansion, unmanaged tourism, and waste, resulting in floods and landslides. This research aims to develop a cross-district PES governance model integrating social forestry, local knowledge systems, and climate adaptation strategies. Through wave analysis, in-depth interviews, FGDs, and household surveys involving 195 respondents from upstream to downstream communities, we assessed the willingness to pay (WTP) and willingness to accept (WTA) compensation.

Findings indicate a strong preference among upstream communities for structured compensation—IDR 300,000/month over five years—linked to transitioning livelihoods toward agroforestry and non-timber forest products, with a desire for secure market access. Meanwhile, downstream water and energy users indicated willingness to pay IDR 10,000/month, conditional on reliable electricity and water services. Choice modeling and regulatory analysis suggest that integrating traditional forest practices into formal PES under social forestry schemes can enhance equity, sustainability, and governance alignment.

This study underscores the need for a culturally grounded, jurisdictional PES framework to protect watershed services in support of Indonesia's climate and energy transition.

9. Comprehensive Preference Assessment of Green-Blue Infrastructure (GBI) in Suzhou: Integrating Visual Aesthetics, Spatial Perception, and Ecological Function for Synergistic Optimization

First authors(s): Huang Zhou



Other author(s): No

First author affiliation: Soochow University

Contact: huangzhouzh@outlook.com

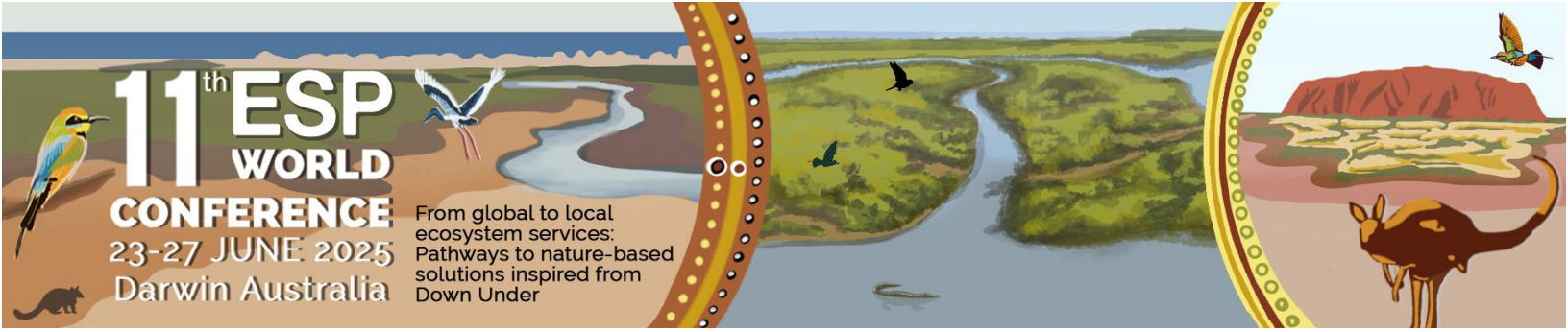
Keywords: Green-Blue Infrastructure, Ecosystem Services, Public Perception, Spatial Planning, Community Engagement

Green-Blue Infrastructure (GBI) plays a vital role in enhancing urban ecosystem services (ES), including water management, climate regulation, and biodiversity conservation. However, in Suzhou, government-led GBI development has predominantly focused on ecological functions and water governance while overlooking human-centered needs such as recreation, aesthetics, and cultural values. This imbalance may limit public engagement and hinder GBI's multifunctionality. This study integrates Visual Preference Surveys (VPS), Public Participation GIS (PPGIS), and Structural Equation Modeling (SEM) to assess how residents perceive and prioritize different aspects of GBI. Findings reveal that local cultural heritage and community engagement are key determinants of public GBI preferences, alongside ecological functions. Mismatches between planning priorities and public expectations highlight the need for inclusive and culturally integrated NbS strategies. By showcasing Suzhou's diverse GBI types—ranging from natural wetlands and urban parks to classical gardens and historic water towns—this research provides a scalable model for integrating community-driven perspectives into NbS planning. Insights contribute to nature-positive urban strategies that support SDGs and biodiversity conservation while fostering socially inclusive, culturally aware, and ecologically resilient cities.

10. Risk Assessment and Prevention and Control Pattern Construction of Non-point Source Pollution in Qiantang River Basin

First authors(s): Handan Zhang

Other author(s): No



First author affiliation: Zhejiang University of Water Resources and Electric Power

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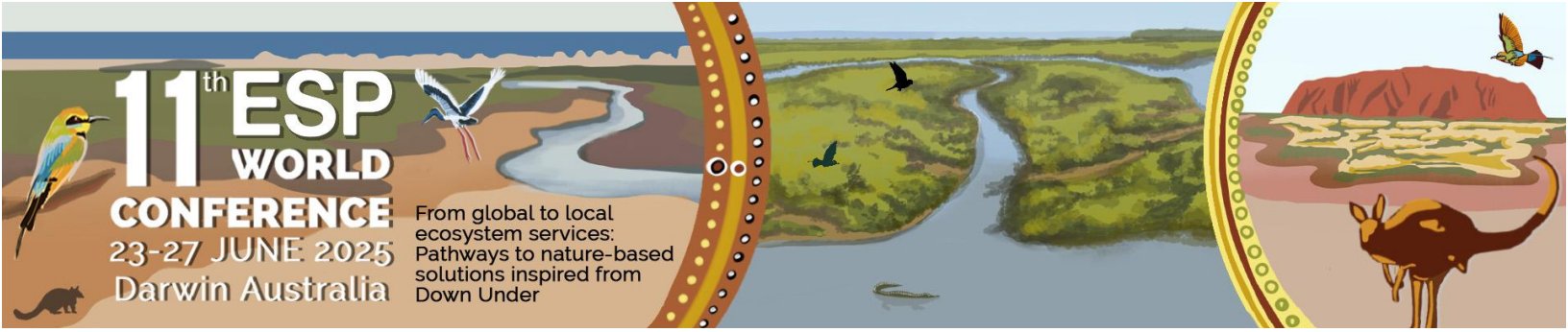
Keywords: Qiantang River basin; non-point source pollution; minimal cumulative resistance model; ecological corridor; risk prevention and control pattern

Non-point source pollution is a major ecological and environmental issue that constrains social and economic development. In this study, we took Qiantang River basin as the research area. The minimum cumulative resistance (MCR) model was used to establish the risk pattern of non-point source pollution, which combines seven main resistance factors, that is land use types, digital elevation model, normalized digital vegetation index, slope, population density, rainfall erosivity and soil erodibility. The Linkage Mapper tool was used to identify the migration paths of non-point source pollutants and pollution interception points based on the methods of ecological corridors and ecological nodes, thereby constructing a pattern for prevention and control of non-point source pollution risk. Results showed that the possibility of non-point source pollution in Qiantang River basin was relatively high, with areas of extremely high and high risk accounting for 69.16% of the total watershed area, showing a spatial distribution characterized by "high in the central urban area and low in the surrounding mountainous areas." A total of 23 source patches were extracted, covering an area of 409.26 km2, accounting for 3.25% of the total area of the study area. Additionally, 40 pollutant migration paths and 13 pollution interception points were identified, mainly distributed in Fuyang district, Jiande city, and Tonglu county. Combined with the regional development plan, an ecological network pattern of “ecological restoration-control-protection” was constructed. The research results can provide scientific guidance for the prevention and control of non-point source pollution risk in the Qiantang River basin, and its ecological protection and sustainable development.



11. Greenspace exposure and its dual role as mediator and moderator in the relationship between urban density and mental health

First authors(s): Hongxiao Liu

Other author(s): Yujin Pang; Min Jiao; Xiao Sun; Hai Ren; Taotao Han; Yua Li; Shanwen Zheng; Chunhua Sui

First author affiliation: South China Botanical Garden, Chinese Academy of Sciences

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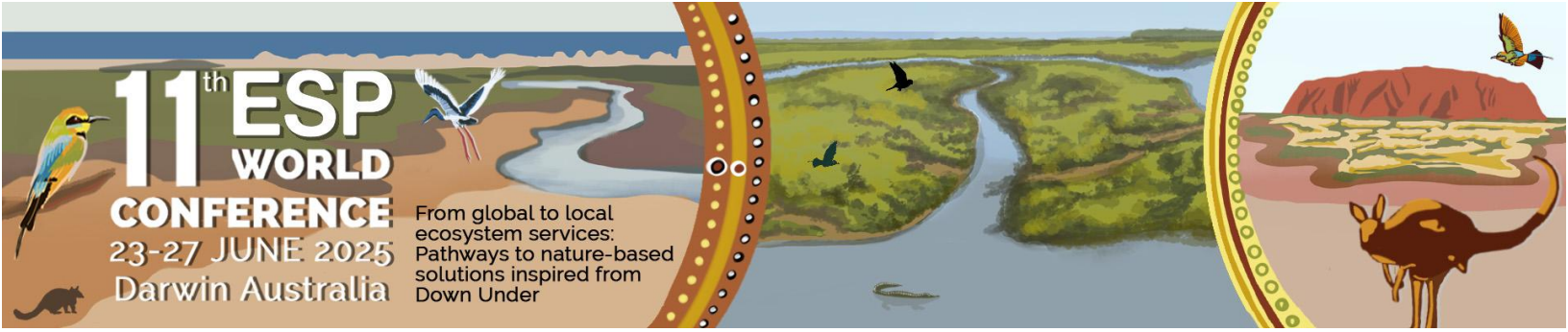
Keywords: compact city, greenspace types, built environment, Guangzhou, urban planning

The relationship between urban density, urban green space (UGS) exposure, and mental health remains complex and understudied, particularly in rapidly urbanizing cities notably characterized by high-density development. Based on a survey of 824 respondents in Guangzhou, China, this study advanced prior research by systematically unraveling the dual roles of UGS exposure: UGS visitation played as a mediator and UGS availability served as a moderator in the urban density-mental health nexus—a critical gap in existing literature. Our key findings indicated that: (1) Urban density exhibited context-dependent effects: its impacts on three mental health indicators (depression, life satisfaction and sense of worthwhilenss) hinged on UGS availability. (2) Visiting community gardens, municipal parks, and waterfront UGS was particularly effective in reducing depression risk, enhancing life satisfaction, and fostering a sense of worthwhileness, respectively. Engaging with communal gardens and municipal parks was positively associated with all three mental health outcomes. The effects of UGS visitation on mental health surpassed those of UGS availability and urban density. (3) Crucially, we revealed a dual mechanism: UGS visitation fully mediated the adverse effects of high density on mental health, while UGS availability moderated this relationship, mitigating negative impacts of high urban density. These findings provide novel empirical evidence for optimizing UGS planning: increasing UGS and its visitation can reduce the negative mental health impacts of high urban density and prioritizing communal gardens and municipal parks is advisable, given their positive effects on three mental health outcomes.



12. Integrating Cultural Ecosystem Services into Ecological Restoration: Enhancing Mental Health through Landscape Transformation in Shenzhen

First authors(s): Yuehan Dou

Other author(s): Pengfei Wang, Junguo Liu

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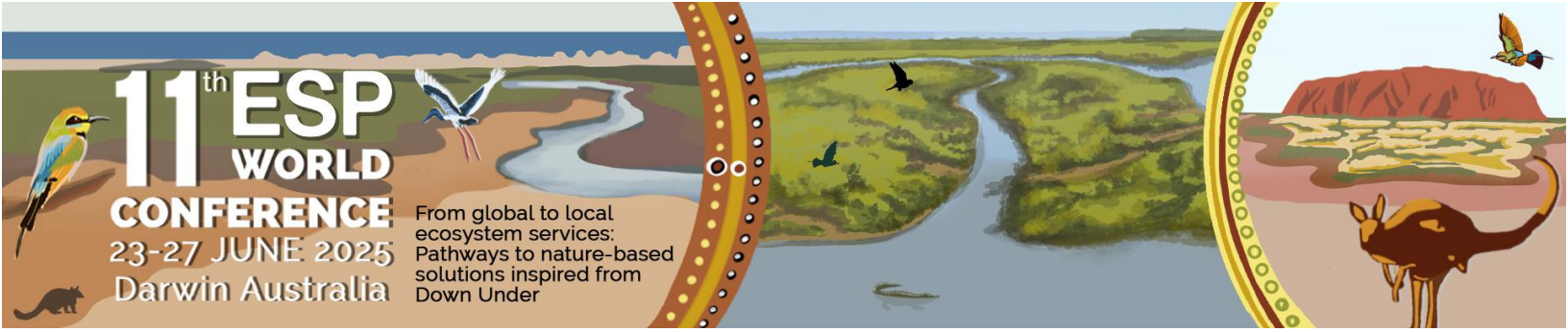
Keywords: Cultural ecosystem services, river restoration, physical and mental health, human perception, urban landscapes

Effectively integrating ecosystem services (ES) into multi-scale practices remains crucial, particularly concerning cultural ecosystem services (CES) and their impact on mental health. This study assesses how ecological restoration in the Maozhou River region of Shenzhen transforms landscapes and enhances residents' mental well-being. Employing an interdisciplinary approach—combining participatory mapping, questionnaires, interviews, and field observations—the research evaluates how restored urban green spaces, wetlands, and rivers influence local perceptions and psychological health. Results highlight that restored landscapes provide significant CES, including aesthetic appreciation, recreation, and cultural identity, positively affecting mental health. The study further emphasizes that diverse landscape combinations enhance CES benefits compared to single-type landscapes. By integrating CES assessments into ecological restoration practices, this research illustrates how scientifically informed evaluations can effectively support policy-making and value realization of ecological products, facilitating better governance and sustainable urban development across scales.



13. Advancing the spatial optimization of ecosystem service supply-demand and flow to promote regional landscape sustainability

First authors(s): Xiao Sun

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Keywords: landscape, sustainability, spatial optimization, ecosystem services

Against the backdrop of global urbanization, the socio-ecological interactions between urban and rural areas are becoming increasingly complex and intense. Issues such as the degradation of ecosystem services, supply-demand deficits, and impeded flows triggered by these interactions have severe negative impacts on ecosystems. There exists spatial inequity in the supply and demand of ecosystem services in urban-rural regions, accompanied by significant flows. Understanding the characteristics of ecosystem service supply, demand, and flows, as well as their trade-offs in urban-rural transitional landscapes, and conducting spatial optimization on this basis are crucial for promoting regional landscape sustainability. We aimed to answer the following questions: (1) How to classify or identify different types of urban-rural areas? (2) How can we not only consider the supply-demand relationships but also effectively integrate their trade-offs when optimizing ecosystem services? (3) How to optimize the ecosystem service flow and further improve the economic and ecological effectiveness? (4) How to optimize ecosystem service flow and simultaneously enhance residents' well-being, then ultimately promote urban-rural sustainability? Thus, we developed a novel transferable full- resolution convolutional neural network (FR-Net) to identify urban-fringe-rural areas. The methodological frameworks for ecosystem services supply-demand and flow optimization in urban-rural landscapes were also developed. Diferences in ecosystem services supply-demand relationships and trade-offs afected the necessity of optimizing ecological zoning in urban-rural landscapes. Assigning weights

reasonably according to trade-of curves to determine priority regions could facilitate both efcient use of ecological resources. Also, strengthening regional connections and simultaneously effectively managing core transmission nodes are of great signiffcance for improving flow efffciency and ensuring urban-rural ecosystem services sustainable management.