Ecosystem Services Towards Ecological Civilization: Postprint Review of the 9th International Ecosystem Services Conference 2017

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Abstract

The 9th International Ecosystem Services Partnership World Conference (ESP9) was convened in Shenzhen, China, from December 11 to 15, 2017. The conference, themed "Enhancing Ecosystem Services, Promoting Ecological Civilization Construction," aimed to explore critical issues in ecosystem services science, exchange cutting-edge research findings, and pursue nature-based green solutions. It further sought to advance the integration of ecological restoration and environmental protection policies with practice, while providing a robust platform for strengthening international cooperation in ecological restoration and governance. This paper presents a comprehensive review of the seven keynote presentations and thirty thematic sessions, covering frontier and emerging topics in the ecosystem services domain, including ecosystem conservation management and sustainability, biodiversity, ecosystem vulnerability, ecosystem services assessment and modeling, climate change, land use and landscape dynamics, policy and decision analysis, among other areas.

Full Text

Preamble

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Ecosystem Services for Ecological Civilization: A Review of the 9th International Ecosystem Services Partnership World Conference, 2017

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Abstract

The 9th International Ecosystem Services Partnership World Conference (ESP9) was held in Shenzhen, China, on December 11–15, 2017. The conference theme was "Enhancing Ecosystem Services for Ecological Civilization," aiming to explore cutting-edge scientific issues in ecosystem services, seek nature-based green solutions, and further promote the integration of ecological restoration and environmental protection policies with practice. The conference provided an excellent platform for international cooperation on ecological restoration and governance. This paper reviews the content of 7 keynote presentations and 56 thematic sessions, covering ecosystem conservation management and sustainability, land use and landscape, policy and decision analysis, and other directions.

Keywords: ecosystem services, sustainable development, biodiversity, ecosystem vulnerability, ecosystem service assessment

1. Conference Background

Ecosystem services represent the various benefits that humans obtain from ecosystems [1]. Since the advent of industrial civilization, rapid economic development and unrestrained exploitation of natural resources have triggered a series of ecological and environmental problems, including ecosystem degradation, biodiversity loss, and diminished ecosystem service functions, which seriously threaten human survival and development [2]. As contradictions between socioeconomic development and ecological environment intensify, the concept of ecosystem services and management has attracted worldwide attention. Whether limited natural resources and fragile ecosystems can support the long-term sustainable development of Earth' s economy and society has become a key scientific question that ecology and related fields urgently need to address.

Ecological civilization represents a new stage of human civilization development and the sum total of material, spiritual, and institutional achievements obtained by humans to protect and build a beautiful ecological environment. It is a systematic project that runs through the entire process and all aspects of economic and social construction, advocating respect for nature and rational utilization of natural resources in socioeconomic development to achieve harmony between humans and nature by enhancing ecosystem services.

The International Ecosystem Services Partnership (ESP), established to promote the development of ecosystem service science, decision-making management, and practice, has held annual global conferences in Germany, Costa Rica, South Africa, and other countries. These conferences represent the highest-level

academic meetings in the global ecosystem services field and enjoy an excellent reputation in the international ecological community. To promote ecological civilization construction and enhance ecosystem service functions for green development and sustainable development goals, the 9th International Ecosystem Services Conference was convened in Shenzhen, China. As the first ESP conference held in China, this event held significant academic importance and far-reaching influence for both China and the international ecological community, and was of great significance for promoting academic development and industrial progress in China' s ecological restoration field.

2. Conference Overview and Themes

This conference marked the first time the International Ecosystem Services Conference was held in China. The theme was "Enhancing Ecosystem Services for Ecological Civilization." The conference was organized by the International Ecosystem Services Partnership and co-hosted by Southern University of Science and Technology and the Chinese Society of Environmental Sciences, with support from the Beijing Ecological Restoration and Environmental Protection Consortium, the Institute of Ecology of the Chinese Academy of Sciences, Tsinghua University, and other institutions. Professor Junguo Liu from Southern University of Science and Technology served as the conference chair.

The opening ceremony was attended by Ms. Guo Yurong (Party Secretary of Southern University of Science and Technology), Rudolf de Groot and Robert Costanza (ESP Co-Chairs), Li Feng (Co-Chair of the ESP China National Network), and other distinguished guests. Nearly 500 experts and representatives from around the world participated, presenting 56 oral reports and 42 academic posters covering various ecosystem service fields. The conference also arranged field trips to Shenzhen Bay Park, Xianhu Botanical Garden, and OCT Ecological Park to showcase Shenzhen' s remarkable achievements in coastal ecological construction and socioeconomic development. Participants examined and exchanged ideas on watershed ecosystem management and harmonious coexistence between humans and nature.

The conference featured 7 Biome Working Group sessions, 8 Thematic Working Group sessions, 3 Sectoral Working Group sessions, 2 Regional Chapter sessions, and 3 General sessions, organized around ecosystem service planning and practice, decision-making and management, and nature-based solutions.

Table 1 Summary of the 9th International Ecosystem Services Partnership World Conference

Session Topics	Organizations	Session Chairs
Biome Working Groups		

Session Topics	Organizations	Session Chairs
Marine Ecosystem Climate Change Adaptation	BioMe Working Group	L. Brander, E. Drakou
Wetland Ecosystem Function and Service Assessment	Wetland Research Institute, Chinese Academy of Forestry	D. Lerner, S. Meulen
Urban Surface Water and Urban Reconstruction	University of Sheffield, University of Wageningen, Southern University of Science and Technology	L. Willemen, L. Inostroza
Rural Ecosystem Services in Development	University of Twente	H. Zepp, S. Salaa
Thematic Working Groups		
Ecosystem Services Assessment and Trade-offs	Ruhr-University Bochum, Italy Milan Polytechnic	M. Schaafsma, F. Bernaerd
Green and Blue Infrastructure	National Institute for Environmental and Agricultural Science (IRSTEA)	P. Roche
Spatial Evaluation and Ecological Value for Ecological Civilization	Leibniz University Hannover, Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences	B. Burkhard
Future Scenarios and Natural Assets	UNU Institute for Sustainability and Peace	O. Saito, K. Takeuchi
Conflicts and Hazards in Ecosystem Services Research and Practice	UNU Institute for Environment and Human Security	Z. Sebesvari
Integration of Social Sciences in Ecosystem Services Assessment	Institute of Ecology, Chinese Academy of Sciences	J. Langemeyer, J. Spangenberg
Innovation and Multidisciplinary Approaches to Cultural Ecosystem Services and Decision-making	Autonomous University of Barcelona	S. Villasante, S. Chen, H. Zhen

Session Topics	Organizations	Session Chairs
Determinants and Boundary Conditions for Ecosystem Disaster Risk Prevention and Climate Change Adaptation	German Helmholtz Centre for Environmental Research	P. Clemente, R. Lopes
Sectoral Working Groups		
Payment for Ecosystem Services and Co-investment Mechanisms	World Agroforestry Centre	S. Daniels
From Biophysical Assessment to Decision Application	EU Joint Research Centre	F. Bernard, A. La Notte
Community Adaptive Management and Ecological Governance	Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences	D. Vollmer, N. Nagabhatla
Water Security and Ecosystem Services	Beirut American University, UNU	S. Talhouk, S. Kulczyk
Tourism and Ecosystem Services for Sustainable Development	Conservation International	E. Osipova, R. de Groot
Nature-based Conservation Based on Ecosystem Services	IUCN, Wageningen University	R. de Groot
Regional Chapters		
Regional Chapters and National Network Workshops	Wageningen University	Various
Science and Decision-making for Nature-based Approaches	ESP Asia Regional Working Group	Various
Ecosystem Services Research in Middle East and North Africa	German Agency for International Cooperation	Various
General Sessions		
Ecological Civilization Awakening: Are You Being Heard?	FAO	N. Lee, Y. Sin

Session Topics	Organizations	Session Chairs
Ecosystem Services Assessment Guidelines and Toolkits	Wageningen University	O. Schlein
Youth Ecosystem Services Scholars Forum	Various	M. De Cristofaro, I. Gschwandtl
From Research to Publication	Elsevier	R. De Groot
Improving Ecosystem Service Outcomes Through International Ecological Restoration Practice	Society for Ecological Restoration	Ina M. Sieber

The conference attracted scientists, NGO representatives, and other stakeholders from the global ecosystem services community. Participants engaged in extensive discussions on ecosystem services, ecological restoration, and ecological civilization, exploring scientific hotspots, exchanging latest research findings, and seeking nature-based green solutions, thereby promoting the integration of ecological restoration and environmental protection policies with practice and providing a platform for international cooperation.

[Figure 1: see original paper] **Figure 1 Geographic distribution of participants at the 9th International Ecosystem Services Partnership World Conference**

3. Conference Content

The main content comprised academic exchanges organized around 7 keynote presentations, 7 Biome Working Group sessions, 8 Thematic Working Group sessions, 3 Sectoral Working Group sessions, 2 Regional Chapter sessions, and 3 General sessions, focusing on ecosystem service planning and practice, decision-making and management, and nature-based approaches.

[Figure 2: see original paper] **Figure 2 Keyword cloud of the 9th International Ecosystem Services Partnership World Conference**

Keynote Presentations

The conference featured 7 keynote presentations addressing the theme "Enhancing Ecosystem Services for Ecological Civilization," introducing international research progress, opportunities, challenges, and applications in decision-making and management.

Professor Robert Costanza presented on "Ecosystem Services: Achievements and Future Challenges," detailing global progress in ecosystem services research

since 1997. He emphasized the importance of ecological valuation, noting that ecological value differs from market value derived from ecosystem services, and proposed that human society is part of ecosystems.

Professor Junguo Liu from Southern University of Science and Technology presented on "Ecological Restoration and Ecological Civilization Construction in China," introducing global ecosystem degradation over the past 20 years and highlighting China's efforts, contributions, and achievements in ecological restoration and civilization construction. The report noted that China transitioned from an "economic development priority" stage (2000–2012) to an "ecological construction priority" stage (post-2012), emphasizing the importance of international cooperation.

Dr. Sonya Dewi, Indonesia National Coordinator for the World Agroforestry Centre, presented on "Green Growth Planning for Multiple Ecosystem Services: The Sumatra Green Growth Plan," comprehensively analyzing potential ecological service improvements from the plan, including biodiversity increase and greenhouse gas emission reduction.

Environmental economist Helen Ding from the World Resources Institute presented on "The Economic Value of Landscape Restoration," detailing opportunities, challenges, and future directions. She proposed that landscape restoration represents an investment yielding long-term ecological and economic benefits, calling for enhanced communication between economists and decision-makers.

Professor Ouyang Zhiyun (Deputy Director of the Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences, and Vice President of the Ecological Society of China) presented on "Integrating Ecosystem Services into Chinese Policy-making," introducing the Gross Ecosystem Product (GEP) concept to evaluate natural ecosystems alongside GDP and HDI. Using InVEST models, his team assessed ecosystem services across 31 Chinese provinces for 2000, 2010, and 2015, mapping ecosystem type changes and analyzing how assessments support China's environmental policies.

Professor Bai-Lian Li from the University of California, Riverside, presented on "Biophysical Pathways in Ecosystem Services Quantification," introducing multiple quantification methods and emphasizing the importance of applying scientific knowledge and technical methods to ecosystem services research.

Princess Basma Ali, Founder of the Royal Botanic Garden of Jordan, presented on "Ecological Restoration for Enhanced Ecosystem Services," introducing Jordan's ecological development status and challenges, showcasing achievements including the Royal Botanic Garden, community-based rangeland rehabilitation programs, and the "Sitir" women's cooperative for ecological restoration.

Biome Working Group Sessions

Seven Biome Working Groups facilitated information exchange on specific ecosystem services and values, providing assessment guidelines for governments

and decision-makers.

Marine Ecosystem Climate Change Adaptation: Global warming severely threatens marine ecosystem stability and biodiversity [4-5]. Luke M. Brander from Vrije Universiteit Amsterdam reported on Pacific island community-based ecosystem adaptation to climate change. Thammasak Yeemin from Ramkhamhaeng University, Thailand, evaluated coral reef ecosystem services in the Bay of Bangkok, emphasizing the need for baseline data collection, impact factor research, and functional assessment.

Wetland Ecosystem Function and Service Assessment: Coupling effects between biodiversity and wetland ecosystem service patterns have become a hotspot [6-8]. Zheng Haifeng from the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, presented on "Adaptation of Endangered Oriental Storks to Climate Change in Northeast China," identifying precipitation as the main climatic factor affecting stork habitats and recommending wetland restoration through returning farmland to wetlands. Liu Gang from the Chinese Academy of Forestry reported on "Why Asian Great Bustards Choose Yellow River Wetlands for Wintering" through dietary analysis, showing that wild plants and soil animals provide food sources, making wetland vegetation restoration crucial for bird habitats.

Urban-Rural Ecosystem Services: With rapid population growth and urbanization, rural ecosystem services research has gained attention. Professor David Lerner from Southern University of Science and Technology introduced urban river ecosystem services for biodiversity and waterfront recreation. Solen Le Clec' h from ETH Zurich presented on "Portfolio Management of Swiss Grassland Ecosystem Products and Services," mapping spatial distributions under different management types and analyzing supply from forage production, recreation, and biodiversity. Philip Roche from IRSTEA discussed "Suburban Gradients and Ecosystem Service Capacity" using French case studies, showing that service supply increases with distance from cities while capacity relates closely to land use patterns.

Thematic Working Group Sessions

Eight Thematic Working Groups promoted disciplinary development and researcher collaboration under global climate change.

Land Use and Landscape: Land use strategies significantly impact ecosystems and landscape ecology. Wu Xutong from Peking University presented "Land Use Optimization Based on Ecosystem Services: A Case Study of the Yanhe River Basin," quantitatively evaluating 5 ecosystem services (soil retention, water yield, water purification, carbon sequestration, and agricultural production) under 4 land use scenarios from 2000–2015. Results showed that the "Green Grain for Green" program could effectively resolve trade-offs between multiple services for regional sustainable development.

Climate Change Adaptation: Understanding ecosystem service responses to climate change has become urgent. Gaius Elenga from the University of Kinshasa, Democratic Republic of Congo, presented "Climate Resilience of Agricultural Production Systems Through Rural Populations: Lessons from DRC' s National Adaptation Program," showing how the program provided rural communities with resilient crop varieties, early warning systems, and ecological techniques for agricultural production, water management, and soil fertility maintenance, helping restore ecosystem services and rural-agricultural connections.

Ecosystem Service Valuation: Dr. Blal Adem Esmail from the University of Trento, Italy, presented "Assessing Trade-offs in Mountain Agricultural Landscape Ecosystem Services," calculating evaluation indicators for 5 study areas to assess trade-offs and identify spatial hotspots, providing reliable references for local landscape management.

Policy and Decision Analysis: Policies affect ecosystem services through land use changes and resource utilization [10]. Zhang Fan from Beijing Normal University presented "Spatiotemporal Changes in Terrestrial Carbon Storage Due to Land Use/Cover Change During Shanghai's Rapid Urbanization,"proposing potential policy measures to mitigate negative impacts on urban carbon storage.

Sectoral Working Group Sessions

Three Sectoral Working Groups examined relationships between ecosystem services and sectors like tourism, local communities, and conservation.

Water Security and Ecosystem Services: One-fifth of the global population faces severe water pollution. According to UN definitions, water security refers to sustainable water resources needed for human survival and development, and the capacity to protect lives and property from water-related disasters and pollution [11]. Nidhi Nagabhatla from UNU-INWEH reported on integrating ecosystem services into water security agendas, noting that water security degree programs based on Kenya, Panama, and Thailand have been developed.

Tourism and Ecosystem Services for Sustainable Development: Integrating ecosystem services concepts into protected area management highlights direct links between biodiversity and ecosystem services. Zhang Jingjing from the Chinese Academy of Sciences evaluated correlations between ecosystem services and giant panda habitats in the Qinling Mountains to support China' s Giant Panda National Park design.

Nature-based Conservation Based on Ecosystem Services: Emmanuelle Cohen-Shacham from IUCN emphasized that nature-based solutions must be adopted to manage and restore ecosystems facing challenges like climate change, water security, and human health. These solutions, applied in Germany' s Rhine River Basin, generate social benefits equitably and fairly.

Regional Chapters

Regional Chapters discussed assessment methods at regional and national levels.

ESP Asia Regional Working Group: Established in Korea in 2015, this working group promotes policy research and collaborative projects among Asian scholars. The conference session preheated for the upcoming Asia Regional Conference.

Middle East and North Africa (MENA): As one of the world' s most water-scarce regions severely affected by land degradation and climate change [12], MENA lacks regional cooperation [13]. Li Xuemei from Chongqing Normal University presented on "Ecosystem Service Functions in Chongqing," analyzing severe soil erosion and proposing multifunctional agricultural land conflict optimization. Zhang Yushuo from Beijing Normal University evaluated trade-offs and synergies between rapid urbanization and ecosystem services in the Beijing-Tianjin-Hebei region. Hamed Daly-Hassen from Tunisia' s National Institute of Agricultural Research presented on economic evaluation of forest management options for multiple ecosystem services, emphasizing stakeholder interests for win-win outcomes.

General Sessions

General sessions focused on ecosystem service assessment guidelines, tools, and publishing.

Ina M. Sieber from Leibniz University Hannover and Sylvie Campagne from IRSTEA discussed sharing global expert opinions to bridge theoretical research and practical ecosystem services. Leon Braat from Elsevier presented on transforming research into publishable papers, emphasizing abstract and language quality. Kremena Gocheva from the Bulgarian Academy of Sciences introduced advanced literature management techniques using BibTeX and MS Word plug-ins to enhance efficiency in ecosystem services research. The Youth Ecosystem Services Scholars (YESS) program promoted collaboration and critical thinking among young scholars.

4. Conclusions and Outlook

The conference represented another high-level international academic event in ecosystem services and the first ESP conference held in China. It gathered global experts focusing on challenges under global change and sustainable development, discussing strategies for enhancing ecosystem services and promoting ecological civilization.

Current research frontiers include ecosystem conservation management and sustainability, biodiversity, ecosystem vulnerability, ecosystem service assessment and modeling, and policy and decision analysis. International institutions emphasize research on the dependency between ecosystem services and human

well-being, while Chinese scholars focus more on assessment studies. Ecosystem services research involves multiple disciplines, requiring a global cooperation network to unite multidisciplinary experts.

The conference' s success provided a platform for showcasing global achievements and facilitated international exchange and cooperation for Chinese experts, demonstrating China' s research capacity in ecosystem services. The conference highlighted the need to strengthen support for young scientists—a key theme of the event. Ecological civilization construction benefits contemporary society while laying foundations for the future. The 9th International Ecosystem Services Conference successfully built a platform for global achievements and promoted international collaboration.

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Note: Figure translations are in progress. See original paper for figures.