Post-print Review of the 2017 Academic Symposium for Young Scientists of the Hainan Ecological Society

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Abstract

To promote mutual understanding among ecological researchers and strengthen academic exchange and cooperation, the 2017 Hainan Ecological Society Young Scientific and Technological Workers Academic Symposium was held in Haikou on November 27, 2017, under the theme "Innovating Scientific Research, Serving Ecological Civilization Construction." Fifteen researchers in the field of ecology delivered academic presentations covering topics including the driving forces of species coexistence in tropical and subtropical forests, plant distribution patterns and underground ecological processes in tropical forest ecosystems, genetic analysis of forest harmful plants, distribution of wetland animals and analysis of causes and countermeasures for wetland degradation, urban vegetation variation and diversity, integrated land-sea ecological environment management, landscape ecological monitoring, resource utilization of waste based on ecological principles, and research on plantation growth and development as well as proteomics studies.

Full Text

2017 Hainan Provincial Ecological Society Young Scientists Academic Symposium

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Abstract

To promote mutual understanding and strengthen academic exchange and cooperation among ecological researchers, the 2017 Hainan Provincial Ecological Society Young Scientists Academic Symposium was held in Haikou under the theme "Innovative Scientific Research Serving Ecological Civilization Construction." The symposium featured academic presentations by numerous researchers in ecology, covering topics including drivers of species coexistence in tropical and subtropical forests, plant distribution patterns and belowground ecological processes in tropical forest ecosystems, genetic analysis of harmful forest plants, distribution of wetland fauna and analysis of wetland degradation causes and countermeasures, urban vegetation variation and diversity, integrated land-sea environmental management, landscape ecological monitoring, waste resource utilization based on ecological principles, and research on plantation growth development and proteomics.

Keywords: Ecology

1. Background and Overview

A beautiful ecological environment is the most important prerequisite for human development and happiness. As public understanding of ecological and environmental issues continues to improve, an increasing number of stakeholders are participating in ecological civilization construction [1-2]. The primary mission of ecological researchers is to serve regional economic and social development through scientific research. To exchange the latest advances in ecology, enhance mutual understanding among young ecological researchers, and promote collaborative studies, the 2017 Hainan Provincial Ecological Society Young Scientists Academic Symposium was held at Hainan University. The symposium theme was "Innovative Scientific Research Serving Ecological Civilization Construction."

Participants came from various research and teaching institutions including Hainan University, Hainan Normal University, Hainan Provincial Environmental Science Research Institute, Chinese Academy of Tropical Agricultural Sciences, Hainan Tropical Ocean University, and Hainan Provincial Forestry Science Research Institute. The symposium featured both invited and contributed presentations covering a wide range of topics, from drivers of species coexistence in tropical and subtropical forests to plant distribution patterns in tropical cloud forest ecosystems, from belowground ecological processes in tropical forests to genetic analysis of harmful forest plants, from distribution studies of wetland fauna to analysis of wetland degradation causes and countermeasures, from urban vegetation variation to integrated land-sea environmental management, from landscape ecological monitoring to waste resource utilization based on ecological principles, and from macro-scale plantation growth studies to micro-scale plantation proteomics research.

2. Invited Expert Reports

2.1 Yu Shixiao' s Report

Yu Shixiao addressed fundamental scientific questions in ecology: why tropical regions harbor more species than temperate zones, what mechanisms underlie this pattern, and what determines species diversity. He focused on species coexistence and biodiversity, the Janzen-Connell hypothesis, and density dependence—questions that remain unresolved in ecological research. He systematically investigated the drivers of species coexistence in tropical and subtropical forests, particularly examining whether microbial processes in soil feedback mechanisms serve as driving forces for species coexistence, including the roles of soil pathogens and arbuscular mycorrhizal fungi.

Tropical forests, covering a significant portion of Earth' s land surface, exhibit a latitudinal gradient in species diversity from the tropics to the poles in the western hemisphere. Tropical regions contain more species than temperate regions at both regional climate scales and local plant community levels. Species coexistence mechanisms may be key to explaining what determines species diversity. His research analyzed species density across different latitudinal forest communities, from Bawangling in Hainan and Heishiding in Guangdong to Changbai Mountain in Jilin.

The study revealed that conspecific density dependence is significantly stronger at low latitudes than at high latitudes. At high latitudes, closely related tree species tend to cluster spatially, whereas the opposite pattern occurs at low latitudes. Tropical and subtropical forest species exhibit high density dependence, results associated with negative density effects caused by soil pathogens. For example, in areas with multiple large Ormosia glaberrima trees, seedlings of the same species struggled to survive, while areas with only one large tree supported conspecific seedlings. By isolating the host-specific soil pathogen Fusarium oxysporum and conducting pot experiments, the research verified that host-specific pathogens near mother trees cause negative soil feedback, demonstrating that plants regulate conspecific seedling survival and growth by modulating pathogen concentrations.

Kinship relationships among plant species play a constraining role in species coexistence, with pathogens as the driving factor. For some plants, soil pathogens inhibit seedling germination and growth, while arbuscular mycorrhizal fungi promote it. These two microbial groups create antagonistic effects that influence plant density and distance effects, with the antagonism weakening as distance from the mother tree increases. Based on these findings, Yu proposed that microbial processes in soil feedback are drivers of species coexistence. Participants engaged in extensive discussions on the applicability of species density dependence across different species and environmental conditions, the relationship between density dependence and neutral theory, and factors determining species diversity at different scales.

2.2 Yang Xiaobo' s Report

Yang Xiaobo began with the history of environmental science and ecology. While ecological research has a long history spanning over a century, environmental science truly emerged with *Silent Spring*, and wetland research is among the most recent and slowest-developing fields. In the context of Haikou' s international wetland city construction, comprehensive baseline wetland surveys and analyses are needed to improve wetland planning, enhance Haikou' s international image, and create a new tourism 名片.

Using Haikou' s Meilan District as a case study and employing field surveys and remote sensing technology, Yang analyzed wetland degradation causes and restoration strategies. The investigation traced the historical evolution of Meilan wetlands: local residents cut mangroves for salt production and reclamation in the 1960s-70s, later converted areas to aquaculture when agriculture proved unviable, and eventually restored aquaculture ponds to mangrove wetlands. The survey revealed that previous planning considered only construction land and agriculture, with no wetland planning content, indicating that insufficient understanding of wetlands is the root cause of degradation.

The study found that Dongzhai Harbor wetland development suffered from fragmented planning that considered only mangrove protection within the harbor while neglecting surrounding rivers. When river problems occurred, the entire Dongzhai Harbor wetland water system was affected. The research identified abundant species and produced vegetation distribution maps. Restoration measures were proposed covering wetland classification, ecological red line designation, invasive species control, and resource utilization. Participants held extensive discussions on these topics.

3. Report Content

3.1 Forest Ecology Research

Xiao Chuchu analyzed tropical cloud forest epiphytic vascular plant distribution patterns, covering definitions of tropical cloud forests, epiphyte concepts, host tree functions, and host-epiphyte relationships. She conducted remote sensing monitoring and landscape impact analysis of typical Hainan Island distributions. Cheng Yikang investigated plant functional traits and diversity through community species surveys, exploring relationships between environmental factors and aboveground biomass. Participants discussed host-island theory, epiphyte observation methods on hosts, relationships between tree age and trunk surface area, and epiphyte research scope.

Xin Kun examined the distribution patterns of wood borers (*Sphaeroma* sp.) in Hainan' s mangroves, analyzing characteristics of borer distribution, population outbreak causes, infestation features, relationships between inundation time and outbreak severity, and human activity impacts. The study revealed distribution

patterns in Dongzhai Harbor mangrove wetlands. Participants discussed mangrove community classification standards, whether polluted water substances trigger outbreaks, and the generality of outbreak cases.

Liu Wenjie addressed the unclear key processes and mechanisms of soil organic carbon stability in forest ecosystems, conducting research on stability and influencing factors in tropical montane rainforests using Jianfengling in Hainan as a study site. Participants discussed plot selection, soil element analysis methods, and litter species sources and subdivision.

Jiang Huan presented research progress on genetic diversity of the harmful forest plant *Mikania micrantha* (金钟藤) in Hainan Island. Wen Xing analyzed functional relationship characteristics at intra-specific, inter-specific, and community levels in tropical cloud forests.

3.2 Urban Ecology Research

Zhang Cuiping, working within the Mekong River project cooperation framework with ASEAN countries, international foundations, and other research institutes, conducted systematic studies on Hainan Island from the perspective of integrated land-sea management and blue carbon sinks. Her research addressed conflicts between ecological protection and urbanization space demands, weak technical capacity for marine ecological protection, and encompassed spatial management design from land to sea, natural capital accounting, and terrestrial forest resources. Participants discussed blue carbon concepts, ecosystem service functions, ecosystem health evaluation systems, study unit expansion, and research framework improvement.

Wang Huafeng identified limitations in current urban green space research, including limited ecosystem perspective, lack of long-term studies for single city types, insufficient consideration of socioeconomic factors, and absence of systematic frameworks. Focusing on interactions among ecological, socioeconomic, and biophysical factors in cities and their temporal changes, his research aimed to enhance ecological service functions of limited urban green spaces and urban sustainability. He conducted studies on tropical urban vegetation and plant diversity variation and their drivers based on functional units at landscape, community, and molecular levels. Participants exchanged ideas on functional versus structural units, quantification, correlation versus causation, urban socioeconomic data acquisition, urban plant species changes and drivers, and natural resource accounting.

3.3 Agricultural Ecology Research

Wang Xuchu used rubber latex as a research object, combining plant proteomics techniques to study natural rubber synthesis based on small rubber particle proteins, artificial mutations, and in vitro synthesis. He introduced plans for *Taraxacum kok-saghyz* (rubber dandelion) genome and proteome research.

Tang Liang investigated evolutionary dynamics of self-incompatibility loci in Xinjiang wild apple, addressing scientific questions about gene numbers, typical characteristics of self-incompatibility loci, relationships with close relatives, and whether genes can infer population dynamics. He also discussed application of ecological principles including systems theory and engineering in waste disposal and resource utilization from plantation, industrial, and household waste. Participants exchanged views on coupling market demand with species diversity.

Qi Dongling reported on monthly diameter growth dynamics of young rubber trees (*Hevea brasiliensis*), focusing on stem thickening characteristics of low-tapping-age trees. Participants discussed rubber tree growth-yield relationships, integration of positioning observation data, and international standardization of rubber tree variety names.

4. Symposium Significance

4.1 Serving Innovative Development of Ecological Science

The symposium covered an extensive range of content, from basic research on drivers of species coexistence in tropical and subtropical forests to applied studies on waste resource utilization based on ecological principles, from tropical forest underground carbon cycle processes to genetic analysis of harmful forest plants, from baseline research on wetland animal distribution to applied research on wetland degradation causes and countermeasures for regional sustainable development, from urban vegetation variation to integrated land-sea environmental management, and from macro-scale plantation growth studies to meso- and micro-scale plantation proteomics research. This comprehensive scope holds positive significance for the development of ecology and environmental science.

4.2 Strengthening Research Cooperation Through Exchange

The symposium discussions were demand- and problem-oriented. Research content on urban and agricultural ecosystems is extensive and wide-ranging. Through this symposium, participants shared research ideas, methodologies, and achievements, gaining understanding of each other' s progress while improving their own research through exchange. This interaction helped clarify scientific questions and research frameworks, creating opportunities for complementary collaboration in research methods and personnel strength across institutions, providing conditions for interdisciplinary cooperation.

4.3 Pooling Scientific Strength to Aid Regional Ecological Civilization

Whether concerning healthy forest ecosystems, urban ecosystems, or agricultural ecosystems, all constitute important components of ecological civilization construction in tropical regions and the material foundation for achieving a beautiful tropical zone. Pooling scientific strength to create favorable production and

living environments for tropical region residents, and leveraging the comprehensive services of forest, urban, and agricultural ecosystems, will contribute to both regional ecological civilization construction and national ecological security.

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