frontiers | Frontiers in Forests and Global Change

TYPE Editorial
PUBLISHED 08 October 2024
DOI 10.3389/ffgc.2024.1474882

OPEN ACCESS

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RECEIVED 02 August 2024
ACCEPTED 17 September 2024
PUBLISHED 08 October 2024

CITATION
Sasaki N, Zhang L, Meadows J, Seo J-W and Boehmer HJ (2024) Editorial: Dynamics of Asia's and Australasia's forests in a changing world. *Front. For. Glob. Change* 7:1474882. doi: 10.3389/ffgc.2024.1474882

Editorial: Dynamics of Asia's and Australasia's forests in a changing world

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KEYWORDS

air pollution, biodiversity conservation, climate change, carbon sequestration, forest fragmentation, forest soils, plantation forests, tree phenology

Editorial on the Research Topic
Dynamics of Asia's and Australasia's forests in a changing world

The world's forests are under extraordinary pressure. Increasingly frequent droughts (Alizadeh et al., 2020), more extreme heat (Hammond et al., 2022), more frequent and severe storms (Senf and Seidl, 2021; Seidl and Turner, 2022), tree decline and dieback from increased insect pressures (Sallé and Bouget, 2020), and other effects of global warming are taking their toll, as well as anthropogenic disturbance which is affecting pristine forests at an unprecedented speed (Stibig et al., 2014; Ferrante and Fearnside, 2020). Biological invasions contribute to the complexity of interacting challenges (Seebens et al., 2023). At the same time, foresters and the forest economy in total struggle to adapt to rapidly changing conditions to achieve sustainability (Raj et al., 2024).

When precipitation patterns, temperatures and light availability suddenly deviate significantly from the usual values, this can, for instance, result in increased tree mortality (Hartmann et al., 2018), reduced reproductive success and a shift in species and ecosystem ranges (Pouteau et al., 2018; O'Sullivan et al., 2021). Consequently, some forest ecosystems have become particularly vulnerable through synergetic effects of climate change (Boehmer, 2011), and provision of their ecosystem services such as freshwater retention and disaster risk reduction is likely to become more and more limited (Sudmeyer-Rieux et al., 2021). Additionally, long-term analysis by Schmidt et al. underscores the significant impact of fire frequency, intensity, and burn severity on Kalimantan's peatland areas, highlighting the need for comprehensive fire management strategies. Forest structure and dynamics under these conditions have now become one of *the* research fronts of ecology (Ehbrecht et al., 2021; Hammond et al., 2022; Boehmer and Galvin, 2024), and what is being worked out is as interesting as it is concerning (Engert et al., 2024).

Meanwhile, the Global Agreement reached at the 26th Conference of the Parties (COP26) to the UNFCCC, signed by over 100 world leaders, represents a significant commitment to restore forests by 2030. This landmark pledge, endorsed by countries representing 85% of the world's forests, aims to halt and reverse forest loss and land degradation. Such initiatives are crucial for addressing deforestation and promoting sustainable land use practices. They leverage the latest research in forest ecology,

conservation biology, and environmental science to ensure that forest management strategies are both sustainable and effective (UNFCCC, 2021). Thus, scientific research underpins these global agreements and initiatives, providing essential data and methodologies to guide effective policy and practice.

The Research Topic entitled "The Forest Science Regional Spotlight: Asia and Australasia" provides a snapshot of current research on forest ecosystems in this region where major issues have been highlighted since the 1970s (Collins et al., 1991; Huettl and Mueller-Dombois, 1993). The Research Topic of 21 articles explores various dimensions of forest science, offering critical insights that align with international efforts to combat deforestation, enhance biodiversity, and promote sustainable land use practices.

The Research Topic begins with a focus on carbon sequestration and the impact of climate change on forests. For instance, Mu et al. explore the role of soil in absorbing isoprenoids in a *Eucalyptus urophylla* plantation in subtropical China. This study highlights the importance of soil chemistry in carbon storage processes. Similarly, Lee and Kim examine the potential for reforestation to sequester CO_2 on the Korean Peninsula, offering a spatiotemporal approach that underscores reforestation's role in mitigating climate change.

Ecosystem management and restoration practices are prominently featured in the Research Topic. Lin and Fu provide a comprehensive study on optimizing tropical rainforest ecosystem management in Hainan Tropical Rainforest National Park, China. Their research tracks changes in ecosystem service values over the past 40 years, providing valuable insights for future management practices. In a related study, Zhu et al. investigate the challenges posed by monoculture plantations in the regeneration of lowland subtropical forests in Hong Kong, advocating for more diverse planting strategies to enhance the recovery of this biologically important forest community. Guan et al. model the branch attributes and biomass for *Catalpa bungei* plantations under various fertilization regimes, offering insights into the impacts of fertilization on forest growth.

The intricate relationships between environmental factors and biological processes are examined in several studies. Takeda et al. reveal how global warming increases soil respiration across a 1200-meter elevational gradient, highlighting broader climate change impacts on soil processes. In addition, Lai et al. explore the complex interplay between microbial activity and the growth of the invasive plant *Triadica sebifera*, illustrating the multifaceted nature of ecosystem interactions. A study by Wang C. et al. examines the dynamics of opposite wood and compression wood formation in *Pinus massoniana*, revealing how mechanical stress influences xylem cell division and wood formation under varying climatic conditions. Moreover, the study by Choi et al. utilizes tree-ring oxygen isotope chronologies to reveal significant regional climate differences and their correlations with temperature and precipitation across the Korean Peninsula, providing a valuable reference for understanding rainfall variations in East Asia. Chen et al. show how radiation and temperature dominate the spatiotemporal variability in resilience of subtropical evergreen forests in China, emphasizing the influence of climatic factors on forest health.

Socioeconomic perspectives and policy implications are addressed through research on economic incentives and market dynamics. Han et al. analyze the willingness of farmers to enter the forestry property market in southern China, shedding light on the economic motivations behind forest conservation. Complementing this, Ding et al. present a dynamic game model to determine effective subsidy standards for public welfare forests in Jiangxi, China, providing a useful framework for designing sustainable forestry policies.

Biodiversity and ecosystem health are critical themes throughout the collection of this Research Topic. Cheng et al. study the effects of elevation, aspect, and slope on woody vegetation structure in northwestern Yunnan, China, providing insights into biodiversity conservation in human-altered landscapes. Meanwhile, Wang K. et al. examine the dynamic variation of non-structural carbohydrates in temperate broad-leaved trees, offering a deeper understanding of tree physiology and its response to environmental changes. Research by Jin et al. analyzes further into the responses of economic and anatomical leaf traits to soil fertility factors in eight coexisting broadleaf species in temperate forests, further contributing to our understanding of forest ecology.

The Research Topic also explores the effects of mixed planting and species interactions on forest health. He et al. demonstrate that mixed planting improves soil aggregate stability and aggregate-associated C-N-P accumulation in subtropical China, suggesting benefits for soil health and nutrient cycling. Cui et al. report that mixed Eucalyptus plantations enhance phosphorus accumulation and transformation in soil aggregates, underscoring the potential of mixed-species plantations for sustainable forest management.

Additional research highlights the influence of atmospheric conditions on forest ecosystems. For example, Kim and Lee investigate the potential effects of surface ozone on forests in Gangwon Province, South Korea, based on critical thresholds, revealing the impact of air pollution on forest health. Zhao et al. explore the influence of hydrothermal factors on a coniferous forest canopy in the semiarid alpine region of Northwest China, providing insights into the adaptive strategies of forests under varying climatic conditions. Finally, Shin et al. emphasize the importance of improving the accuracy of plant phenology observations and land-cover and land-use detection by optical satellite remote-sensing in the Asian tropics, showcasing the role of advanced technologies in forest monitoring and management.

This Research Topic underscores the importance of interdisciplinary approaches to understanding and managing forests in Asia and Australasia. From carbon sequestration to biodiversity conservation, these studies provide valuable knowledge that can help inform policy, guide sustainable management practices, and address the pressing challenges of climate change and ecological degradation.

We hope this Research Topic inspires further research and action toward preserving the vital forests of this region for future generations. The diversity and depth of these studies demonstrate the dynamic interplay between natural processes and human activities, highlighting the critical role forests play in maintaining ecological balance and supporting human well-being. Further, by aligning with global agreements such as the Paris Agreement and

the Sustainable Development Goals, this Research Topic aims to contribute to international efforts in environmental conservation and sustainable development.

Explore these insightful articles and join the ongoing conversation about forest science in Asia and Australasia here.

Author contributions

NS: Writing – original draft, Writing – review & editing. LZ: Writing – review & editing. JM: Writing – review & editing. J-WS: Writing – review & editing. HJB: Writing – original draft, Writing – review & editing.

Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The author(s) declared that they were an editorial board member of Frontiers, at the time of submission. This had no impact on the peer review process and the final decision.

Publisher's note

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