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RECEIVED 17 December 2024
ACCEPTED 24 December 2024
PUBLISHED 06 January 2025

CITATION

Yang Z and Li C (2025) Editorial: Dynamics of land use and carbon emissions in the context of carbon neutrality and carbon peaking. *Front. Environ. Sci.* 12:1546729. doi: 10.3389/fenvs.2024.1546729

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Editorial: Dynamics of land use and carbon emissions in the context of carbon neutrality and carbon peaking

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KEYWORDS

dynamics, carbon neutrality, carbon peaking, land use, carbon emissions

Editorial on the Research Topic

[Dynamics of land use and carbon emissions in the context of carbon neutrality and carbon peaking](#)

In pursuing carbon neutrality and carbon peak targets, understanding the complex relationship between land use and carbon emissions has become crucial. Changes in land use have significant impacts on carbon emissions/absorption in terrestrial ecosystems, with complex mechanisms, diverse spatial characteristics, and numerous uncertainties, necessitating profound transformations in our approaches to land use and carbon emission management. The research topics covered in this Research Topic encompass the influence of various land use practices associated with different production activities on the carbon cycle from ten national research centers, providing abundant empirical cases and theoretical support for exploring strategies for the sustainable use of land resources and the synergistic optimization of carbon emissions.

Multiple analyses of land use: exploring the cornerstone of sustainable development

Land use trade-offs under the 1.5°C temperature control target

[van der Ploeg and Haigh](#) explored the land use competition situation under the 1.5°C climate stabilization scenario, proposed to jointly formulate strong policies and regulations to comprehensively promote the efficient use of land in fields such as food, energy, and nature conservation.

Precise deconstruction of natural land carbon sinks

[Qu et al.](#) took the dominant position of forests in the absorption of carbon dioxide on land as the core basis, skillfully integrated the MIT carbon cycle model simulation with the

Shell Energy Security Scenarios emission pathways, and constructed a precise analysis framework for national net-zero emission targets under different scenarios.

Deep exploration of the carbon sink potential in ecologically fragile areas

Wang et al. focused on the Luan River Basin, a typical ecologically fragile area, and used the PLUS-INVEST model to simulate the corresponding carbon sink potential of the land use/land cover change patterns under three different scenarios in 2030, providing scientific guidance for land use planning in ecologically fragile areas.

Industrial transformation: insights into opportunities and challenges of green transformation

The green transformation path of the pulp and paper industry

Laberge et al. took a pulp mill in southern Quebec, Canada as a vivid example and found that through the key strategy of optimizing the utilization of by-products, such as skillfully converting biosolids into fertilizers, providing a valuable reference model for the green transformation of the entire industry.

Examination of the sustainable development of the hemp industry

Meffo Kemda et al. deeply explored the performance of the hemp cultivation process and the seed-based food production process, and accurately evaluated its carbon storage capacity in strict accordance with the IPCC guidelines.

Deciphering the spatiotemporal code of carbon emissions in Jiangsu Province

Cai and Li analyzed the spatiotemporal distribution of carbon emissions based on detailed land use and energy consumption data, the main influencing factors are economic development, industrial structure, energy intensity, etc.

Urban development: exploration of space optimization and green space carbon sinks

Exploration of a new path for urban green space carbon sink accounting

Dong et al. combined meteorology with plant physiology and innovatively proposed a photosynthetic rate estimation method to estimate urban green space carbon sinks, aimed to promote energy

conservation and emission reduction through nature-based solutions.

The reorientation strategy for rural industrial parks in Nanhai District

Liu et al. took the redevelopment project of rural industrial parks in Nanhai District as an important breakthrough for phasing out high-polluting industries, proposed to resist the temptation of short-term land transfer revenues to achieve long-term development.

Regional coordinated development: the exploration journey of the integration of carbon emissions and ecology

Coordinated development of carbon emissions and ecosystem health

Qu et al. focused on the spatiotemporal distribution characteristics of carbon emissions and ecosystem health in the southern hilly and mountainous regions of China, found that the imbalance phenomenon still generally existed.

Analysis of the evolution of production-living-ecological space in the Taihang mountain poverty belt

Chen et al. analyzed the evolution process of the production-living-ecological space in the Taihang Mountain poverty belt, found the net carbon emissions due to terrestrial transfers increased over time.

Carbon dynamic tracking of land use in the Baiyangdian Basin

Gao et al. traced back the change tracks of land use and carbon emissions in the Baiyangdian Basin, deeply analyzed the carbon conduction effect with the help of the land transfer matrix, and looked forward to the future trends of land use and carbon emissions under four different scenarios in 2035.

In addition, there are also some new trends, such as digital empowerment to improve the emission reduction efficiency of resource-based cities

Qian and Luo found that digital transformation can significantly improve the land green use efficiency of resource-based cities through multiple paths such as driving technological innovation, promoting industrial structure upgrading, and alleviating the problem of land factor mismatch.

Land systems possess both carbon sequestration and emission functions, and transitioning to carbon neutrality requires maintaining a delicate balance between these two roles. By making conscious and sustainable choices in land use, we can make significant progress in addressing climate change and creating a more resilient and low-carbon future for future generations.

Protecting natural ecosystems

Improve the carbon storage capacity by protecting natural ecosystems such as forests, grasslands, farmlands and wetlands. This includes delimiting and managing ecological protection red lines and nature reserves to make effective use of the carbon sequestration capacity of natural ecosystems.

Optimizing human activities space

With the goal of low carbon emissions, the rational distribution of population and industries should be guided. By optimizing the quantitative structure and spatial pattern of land use, it will be beneficial to adjust the industrial layout, reduce the land use types mainly relying on fossil energy consumption, and improve energy utilization efficiency.

Strengthening land use regulation

Strictly control the expansion of construction land and deforestation to reduce carbon emissions from land use. It is crucial to monitor the carbon emissions and carbon emission intensity of major land use types and strengthen policy interventions in the process of carbon emissions from land use.

Innovating land management measures

Economic and policy incentives can be used to guide farmers to cultivate high-carbon sequestration crops, thereby increasing the carbon storage of farmland and grasslands.

In general, this series of colorful, diverse, and in-depth studies in this issue reveals the complex relationships among land use, carbon emissions, and sustainable development. The various research results echo and closely connect with each other, just like the pieces of a jigsaw puzzle, jointly piecing together a magnificent blueprint for sustainable development. Achieving carbon neutrality and reaching peak emissions is a complex and long-term endeavor,

with the dynamics of land use and carbon emissions being integral components of its success. Through measures such as scientific planning, rational layout, technological innovation, and policy guidance, we can promote a virtuous cycle between economic and social development and ecological environmental protection, contributing to the harmonious coexistence between humanity and nature.

Author contributions

ZY: Conceptualization, Writing–original draft, Writing–review and editing. CL: Supervision, Writing–review and 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

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