frontiers | Frontiers in Environmental Science

TYPE Editorial
PUBLISHED 31 January 2024
DOI 10.3389/fenvs.2024.1373672

OPEN ACCESS

EDITED AND REVIEWED BY
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RECEIVED 20 January 2024
ACCEPTED 22 January 2024
PUBLISHED 31 January 2024

CITATION
García-Ayllón S and Pilz J (2024), Editorial: Territorial spatial evolution process and its ecological resilience.
Front. Environ. Sci. 12:1373672.
doi: 10.3389/fenvs.2024.1373672

Editorial: Territorial spatial evolution process and its ecological resilience

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KEYWORDS

territorial spatial evolution, ecological resilience, land use analysis, territorial diffuse anthropization, resilience-related indicators, ecological restoration policy, environmental management, remote sensing analysis

Editorial on the Research Topic
Territorial spatial evolution process and its ecological resilience

The large-scale territorial transformation of our planet is possibly the anthropogenic footprint that most clearly defines the behavioral patterns of human beings today (Bronts et al., 2023). This footprint, which was difficult to analyze a few decades ago due to the absence of real social awareness and evaluation tools, can now be measured precisely. The effects associated with climate change often occur dramatically in scenarios that we can clearly visualize with catastrophic events such as floods, droughts, tornadoes, *etc.* (Lang et al., 2016; Virah-Sawmy et al., 2016; Romera et al., 2017; Mansoor et al., 2022). However, the impact associated with what some authors call diffuse territorial anthropization is much more complex to diagnose because it has more sophisticated cause-effect patterns of functioning.

Thanks to the important methodological advances that exist at a technological level, we are now aware of the true magnitude of the problem we face. This silent enemy that we have called diffuse territorial anthropization can thus be unmasked through a large-scale spatial analysis (Magalhães et al., 2015; Mohamed et al., 2017). The evolution of land space demonstrates the shift of land use types from natural and semi-natural land (e.g., forest land and cropland) to built-up land, altering ecosystem cycling patterns and leading to degradation of ecosystem services in terms of regulation, provisioning and support (Du et al., 2023).

At the same time, production and living space crowding out ecological space brings high potential threats, such as soil erosion (Cao et al., 2024), water imbalances in wetlands and spaces of high ecological value (Garcia-Ayllon and Radke, 2021), alteration of coastal areas (Bianco et al., 2020), forest productivity decline (Yang et al., 2023b)and habitat fragmentation (Li et al., 2022). Accordingly, in response to the problems of imbalanced territorial space development, inefficient resource utilization and ecological environment degradation, how to improve the diversity, stability and sustainability of ecosystems is an urgent issue to promote modernization and green development in the new era of territorial space evolution.

In this field of research, high-resolution remote sensing images have become a very common visual instrument to monitor the characteristics of national land space and ecological environment. However, this is not the only tool in which improvements have

been developed in the field of spatial analysis associated with this subject. There have been numerous technological or methodological advances in recent years in fields such as statistics (García-Santos et al., 2020), economic quantification of impacts (Bianco and García-Ayllón, 2021) or sociological analysis (Ibarra et al., 2023), among others, for the analysis of these phenomena linked to territorial spatial evolution processes and its ecological resilience.

For this reason, this Research Topic wanted to make a review of the state of the art of research that addresses spatial studies by using field survey, remote sensing monitoring, model simulation and other similar technologies. These contributions systematically investigate the evolutionary process of territorial space and ecological resilience to clarify the dynamic trend of ecological resilience under the action of nature and human. The Research Topic also focuses on the establishment of a territorial space simulation model for enhancing ecological resilience the stability and sustainability of the ecosystem and promote the modernization of the harmonious coexistence of human beings and nature.

On this issue, China is probably one of the areas in the world with the greatest intensity and variety of repercussions related to anthropogenic phenomena associated with land transformation. For that reason, this Research Topic has addressed it in a comprehensive way with several studies that focus the hottest topics from the subject. Among them, for example, the effects derived from the significant urbanization growth of large cities stand out. Peng et al. analyze, from a spatiotemporal perspective, the impact of land urbanization on the gross primary productivity of vegetation in the middle reaches of the Yangtze River urban agglomeration, pointing out new evidence from the township scale (Peng et al., 2023).

Wang et al. investigate the mechanism of urbanization on the net primary productivity of vegetation in the Yangtze River Economic Belt, making a comprehensive analysis from global to local effects Wang et al. Shu et al. and Li et al. make similar approaches to analysis from the perspective of the spatiotemporal trends and factors influencing online attention for China's tea industry Shu et al. and the construction of carbon budget balance index and its application in the urban agglomeration around Poyang Lake area Li et al. By last, Meng et al. show an interesting case study on the growing problem of surface urban heat island effect and its spatiotemporal dynamics in cities with case study of the Zhengzhou metropolitan area (Meng et al.).

Other interesting phenomena are addressed from the ecological perspective with the parameterization of the environmental resilience of the territory through the behavior of its high-value natural areas. In this field, Zeng et al. show an interesting example with monitoring and control of water-ecological space in the Dongting Lake region (Zeng et al.). Yang et al. show a different approach for monitoring in their study for digital research on the resilience control of water ecological space under the concept of urban-water coupling (Yang et al.) and Huang et al. design and optimize an ecological security pattern based on landscape ecological risk assessment in the affected area of the Lower Yellow River Huang et al.

Finally, a third pillar of this Research Topic, no less interesting than the previous ones, is the establishment of territorial planning criteria through zoning and the use of ecosystem services. In this field, several authors have carried out enlightening studies: Yin et al. evaluate the factors influencing ecological environment and zoning control for the study case of the Dongting Lake area (Yin et al., 2024) and Ma et al. analyze the spatiotemporal variation and driving factors of habitat quality in the northern foothills of the Qinling Mountains in Xi'an (Ma et al.). On the other hand, other authors address this issue with a different approach: Li et al. adopt a "structure–function" perspective in the analysis of the evolution and zoning of spatial ecosystem functional stability in the southern hilly province of Hunan (Li et al.), Meng et al. research on multilevel evaluations and zones of territorial spatial functions in Yibin Meng et al., Tan et al. study the trade-off/synergy spatiotemporal benefits of ecosystem services and its influencing factors in hilly areas of the southern area of the country (Tan et al., 2024) and Huang et al. analyze the spatiotemporal evolution and influencing factors of ecosystem service in the Changsha-Zhuzhou-Xiangtan urban agglomeration (X. Huang et al., 2024).

In conclusion, it is a quite heterogenous field of research in which there have been great technical advances and important methodological improvements in recent years, but which continues to progress. Even so, further research is needed in this area, as the relationship between the effects of territorial anthropization and their effects is becoming more and more complex, and therefore difficult to analyze. There is and will be no planet B for us or for our generations to come. Therefore, a good spatial analysis of the evolution of the territory will undoubtedly be a determining factor in the future, if we want to make the planet we inhabit ecologically resilient to the footprint we are going to leave on it.

Author contributions

SG-A: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing–original draft, Writing–review and editing. JP: Conceptualization, Data curation, Formal Analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing–original draft, 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

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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