

Understanding land for high-quality development

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Land is the basis for human survival and production, providing food, fuel, fiber, and other ecosystem services (Verburg *et al.*, 2013; Jin *et al.*, 2021). Land-use change is both a cause and consequence of many biophysical and socioeconomic changes (Van and Verburg, 2013). Human land-use activities have a great impact on biodiversity and the ecological environment by changing the ecosystem (Newbold *et al.*, 2015; Asamoah *et al.*, 2017; Tilman, 2017; Zheng *et al.*, 2020). Research by Song *et al.* (2018) showed that 60% of all land change is related to direct human activities and 40% to indirect drivers such as climate change. More research is needed to deepen the understanding of the land system mechanism and the ecological impact of land use. Issues such as land-use dynamic changes, interactions between humans and the natural environment in the land-use process, and the sustainability of land use have aroused widespread concern in the international academic community (Verburg *et al.*, 2015; Liu, 2018; Jin *et al.*, 2019; Peng *et al.*, 2020).

Land is the most important resource in China (Fan *et al.*, 2022). Chinese economy has entered a new normal period of transition, in which the construction of ecological civilization has brought a series land-use challenges, and new ideas and countermeasures are needed to formulate land-use models and policies to adapt to China's strategic transformation (Liu *et al.*, 2018). As an important measure to promote regional high-quality development, the key to the optimization of territorial space development and protection patterns is to form three spatial patterns including urbanized areas, major agricultural production areas, and ecological function areas based on the carrying capacity of resources and environment. On this basis, we should optimize the layout of major infrastructure, production forces, and public resources and build an orderly division of labor model of spatial organization and a reasonable policy support system. Optimization of territorial space layout for high-quality development includes but is not limited to the following goals: promoting efficient agglomeration of economy and population in urbanized areas; protecting basic farmland and eco-

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logical space; improving the agricultural production capacity of the main agricultural production areas; guiding the ecological function zone to focus on the development of the ecological environment and provision of ecological products; and promoting the gradual and orderly transfer of population in ecological functional areas. Constructing a high-quality land development, protection, and support system has become a hot topic of concern throughout society (Jin *et al.*, 2020; Li *et al.*, 2021; Liu and Zhou, 2021; Lin *et al.*, 2022), but a theoretical framework that focuses on production space to promote the economy, living space to promote coordination, and ecological space to promote harmony still needs to be deepened. The typical local showcases that can reflect regional differences are still to be summarized. Comprehensive technical solutions based on production space and its economic benefits, living space and its social fairness, and ecological space and its guaranteed preservation need to be improved.

This special issue of the *Journal of Geographical Sciences*, Land for High-quality Development, aims to show the latest progress in the study of land for high-quality development at different time and spatial scales by bringing together cutting-edge research in theory, methods, and empirical research. It includes 10 articles across a variety of topics, ranging from efficiency assessment to spatial collaboration and the promotion of human well-being. Among them, there are two articles about the perspective of land supply and demand and land-use efficiency. By utilizing an SBM-Undesirable model and an improved coupling coordination model, Yang *et al.* (2023) analyzed the land space utilization efficiency of the urban agglomeration in the middle reaches of the Yangtze River and the coupling and coordination relationship among its subsystems. They suggest that it is necessary to implement a differentiated land spatial development strategy in this area. This study promotes the efficient utilization and coordinated development of land space utilization systems. Ke *et al.* (2023) studied the typical patterns and spatiotemporal characteristics of the eco-efficiency of cultivated land use (ECLU) in the Yangtze River Economic Belt through the super-efficiency slack-based measure (SBM) and a spatial autocorrelation model. They classified the typical patterns of ECLU based on the decision tree algorithm, which provides a reference for decision makers to improve ECLU in different regions.

Three articles carry out research from the land development and protection perspective. Hu *et al.* (2023) constructed a sensing-based ecological index evaluation model including humidity, greenness, dryness, and heat; discussed land-use changes and the eco-environmental quality response in Wuhan from 2000 to 2018; and provided suggestions for the coordinated development of land use and eco-environment in rapidly urbanized areas. Zhu *et al.* (2023) proposed a comprehensive framework of the resource environment carrying capacity (RECC) and land-use change (LUC) and took Zhengzhou as an example to carry out empirical research to provide strategies for optimizing land-use spatial patterns to achieve high-quality development. Yin *et al.* (2023) discussed the land pollution caused by human economic activities. Based on the soil cadmium (Cd) content in 2014 (Cd_{soil14}) and soil Cd content in 2019 (Cd_{soil19}), this study predicted the Cd content in rice grains ($CD_{P-rice19}$) in the Northern Zhejiang Plain in 2019, compared the temporal and spatial changes of rice production from 2014 to 2019, and analyzed the rice production safety risk areas by using a geographical information system (GIS). The authors found that economic activities and agricul-

tural irrigation may increase the risk of soil Cd pollution, thus threatening the safety of rice production.

Two articles conducted research from the perspective of public service and human well-being. Wang *et al.* (2023) measured human well-being (HW) and ecosystem services (ES) of 17 prefecture-level cities in Shandong province from 2000 to 2018 and used the coupling coordination degree model to analyze the coupling relationship between HW and ES. This work provides a scientific basis and reference for urban management and policy-making in Shandong. By constructing 18 combined scenarios of population growth and land-use policy effects on food production, Gao *et al.* (2023) made a comprehensive model of urban and rural development in Henan province. This study reveals the influence mechanism of population growth, land-use policies, and their combinations, highlighting the benefits of securing food production by agricultural intensification. The results of the study provide a reference for urban and rural development decision making in Henan Province.

Three articles discuss the coordinated development of production-living-ecological space. Qu *et al.* (2023) constructed a multifunctional framework to guide coordinated spatial development, matching the use of land space with the supply of resources and environment (SRE). The authors put forward the land multifunctional space (LMFS) coordinated development system of functional orientation-comprehensive zoning-regulation strategy, carried out empirical research on Shandong province, and advanced a differentiated spatial land-use development strategy to provide reference for the relevant decision-making of spatial land-use optimization in the province. Liu *et al.* (2023) simulated and predicted the ecological space of the Yangtze River Economic Zone in 2035 using the future land use simulation (FLUS) model. Their work reveals the spatiotemporal evolution and promotion mechanism of the ecological space of the Yangtze River Economic Belt and provides an effective reference for territory spatial planning, ecological civilization construction, and even the sustainable development of the regional economy. Zhang *et al.* (2023) evaluated the spatial distribution of urbanization in the Beijing-Tianjin-Hebei region and quantified the ecosystem service budget based on the supply-and-demand matrix of ecosystem services. Their research results can provide a reference for ecological protection and sustainable development decision making in similar areas.

The articles in this special issue introduce different viewpoints and methods with respect to land for high-quality development. Using multidisciplinary research methods, these articles focus on land supply and demand, land-use efficiency, high-quality land development, land development and protection, the promotion of human well-being, and the coordination of production–living–ecological space. These studies provide a more comprehensive knowledge basis for understanding high-quality land development and show typical cases of regional high-quality land development. Land for high-quality development is an interdisciplinary research field, which requires the joint efforts of management scientists, economists, ecologists, practitioners, and community members. There is still a long way to go to realizing high-quality land development. We advocate strengthening cooperation between various fields to further improve the theory and method system for this theme. Based on more case studies and practical experience, we can enrich the connotation of land for high-quality development and further explore the realization path and optimization scheme of high-quality

land development.

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