

Editorial

Rethinking Man–Land Relations in China: A Multidisciplinary Perspective

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Land constitutes a fundamental natural asset, vital for the sustenance, advancement, and ecological balance of human civilization [1]. Through a significant portion of human history, land has remained intricately intertwined with economic expansion, serving as a fundamental element of production. Consequently, the governance and utilization of land frequently become focal points of intense human interactions. The symbiotic connection between humanity and the land mirrors their interdependence and reciprocal influence. China has undergone a profound transformation, characterized by unparalleled urbanization, industrialization, and globalization, ushering in novel multifaceted challenges to the dynamics of man-land relationships [2]. Constructing the built environment to accommodate urban populations and their various endeavors stands as a fundamental pillar of urbanization. This dynamic places additional strain on food systems that could potentially disrupt livelihoods in vulnerable regions. However, this represents just a fraction of the evolving interactions between humans and land in China. The intricate interplay between these two entities spans a broad spectrum of dynamics, encompassing factors like intensified agricultural practices, land degradation, the abandonment of farmlands, the emergence of “hollow villages,” land fragmentation, urban renewal, traffic congestion, housing shortages, and numerous other variables [3–5]. The current body of research concerning man-land relationships in China is inadequate. It is imperative to employ diverse perspectives to scrutinize the multifaceted dimensions of human interventions on land utilization systems, as well as the reciprocal impacts of land-use transformations on human welfare. Thus, the reevaluation of man-land relationships within the context of this swiftly evolving era warrants immediate attention and inclusion on the agenda.

This Special Issue aims to reevaluate the transformations in man-land relationships within transitional China, fostering a fresh perspective on the intricacies of human-environment interactions in both urban and rural contexts. In doing so, it seeks to contribute to the advancement of theories in land-use science, a crucial component of both land management and sustainability science.

The collection of peer-reviewed articles included in this Special Issue comprises twenty research articles in total (Appendix A). The Special Issue is organized in the following format: the papers are presented under four major topics, such as (a) human activities and natural ecosystems, (b) land-use conflicts/trade-offs, (c) man–land coordination and sustainable development, and (d) man–land system coupling and optimal regulation.

Five papers focus on the human activities and natural ecosystems, from the perspectives of carbon emissions, ecological security, soil erosion, desertification, and natural resource accounting.

Yan et al. (2022) employed a carbon emissions model to estimate land-use change-related carbon emissions and utilized the logarithmic mean Divisia index (LMDI) model to



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investigate the key influencing factors. The findings indicated a significant decline in cropland area, accompanied by substantial growth in built-up areas due to rapid urbanization. Additionally, it was noted that the gross domestic product (GDP) per capita exerted the greatest influence on the rise in carbon emissions within the study area, followed by land-use structure, carbon emission intensity per unit of land, and population size. Conversely, the intensity of land use per unit of GDP exhibited a mitigating effect on carbon emissions.

Hu et al. (2022) developed an evaluation system to assess ecological security (ES) in twenty-five international border counties within Yunnan Province. The researchers utilized an entropy weight TOPSIS model to analyze changes in ES between 2004 and 2019. Furthermore, an obstacle degree model was employed to identify the factors impacting ES. The findings revealed that fixed asset investments, per-capita fiscal revenue, per-capita GDP, food production, and water regulation posed hindrances to achieving a desirable level of ES within the study area.

Zhu et al. (2022) employed the revised universal soil loss equation model to determine the soil erosion modulus and investigated the driving factors and superposition mechanism of farmland soil erosion in the hilly region of Northeast China. To achieve this, they introduced the geographically weighted regression model. The findings underscored the significance of landscape fragmentation as a key driving force behind soil erosion, sediment yield, and sediment transport.

Jia et al. (2023) employed Landsat images from 2010 and 2020 to extract desertification information, subsequently constructing the Albedo-NDVI feature space in the Gonghe Basin. The researchers then utilized Geodetector to analyze the temporal and spatial evolution of desertification and its driving factors within the basin between 2010 and 2020. The findings demonstrated effective control over desertification in the Gonghe Basin, thereby offering a valuable foundation for combatting further desertification in the region.

Tan et al. (2023) conducted a comprehensive analysis of literature pertaining to the evaluation of major functions, natural resource accounting, environmental accounting, ecosystem services, and asset accounting. Their study employed the equivalent factor method and input-output method to establish the correlation between major function accounting and natural resource accounting. The findings highlighted that accounting for major functions and resources can effectively guide regional sustainable management through function positioning, resource comparative advantages, and administrative units closely linked to functional units.

Land-use conflicts, representing the spatial embodiment of human-land contradictions, exert a significant influence on regional sustainability. Six studies focus on examining the consequences of land-use conflicts and trade-offs, highlighting economic, social, spatial, and ecological dimensions of these conflicts.

Wang et al. (2022) employed the propensity value matching technique to assess the impacts of land transfer on poverty alleviation among farm households, focusing on the vulnerability expressed as expected poverty (VEP). The findings revealed that rural land transfers have a notable effect in reducing farm households' VEP, with the magnitude of these effects influenced by factors such as location, household characteristics, and household head. This study's results offer valuable insights for policy formulation concerning land management and poverty reduction in agricultural communities.

Lv et al. (2022) employed an integrated "spatial-functional" framework to study the structure and functionality of cultivated land-use transition (CLUT) in a prominent grain-producing region of southern China. The researchers quantitatively assessed and visually represented the CLUT, revealing a significant increase in the comprehensive CLUT index in the middle and lower reaches of the Yangtze River between 2001 and 2019. The study identified a positive aggregation effect with a 5% significance level during this period, indicating a strengthening of both spatial and functional transitions. The authors proposed that differentiated policies should be formulated by the government to promote sustainable land use through spatial and functional transitions in major grain-producing areas.

Shi and Wang (2022) utilized a PSM-DID approach to examine the association between high-speed rail (HSR) infrastructure and cropland abandonment using Chinese labor force survey data. The findings indicated a significant 20.6% rise in the extent of cropland abandonment due to HSR projects. Moreover, these effects were more pronounced in hilly areas but relatively lower in plain regions. Notably, HSR accessibility exerted a “pull” effect, prompting a shift of rural labor force from agriculture to non-agricultural sectors within the local vicinity.

Liang et al. (2022) assessed the extent of land-use conflicts (LUCs) through landscape ecological risk assessment and investigated the spatiotemporal evolution patterns and potential risks of LUCs in the urban center of Chongqing (UCC) over the past two decades. Employing hot-spot analysis and neighborhood analysis, they found that conversions between the living-production space (LPS) and other areas exhibited the highest frequency. Moreover, the out-of-control zone expanded while the controllable zone diminished. The authors emphasized the need for tailored management strategies and policy recommendations on a regional scale, targeting different LUC zones in the UCC, both at international and national levels.

Han et al. (2023) conducted an analysis on the influence of environmental decentralization on the scale of construction land supply by local governments, utilizing panel data from 30 provinces in China between 2003 and 2015. The findings revealed a positive impact of environmental decentralization on the expansion of urban construction land supply. This effect was attributed to the strengthening of land financial dependence and the distortion of land resource allocation. The study further identified that the impact was more significant in regions facing high financial pressure, economic growth pressure, and low environmental protection pressure. In light of these results, the authors provide policy suggestions to ensure a rational supply of urban construction land within the context of decentralization in China.

Zhao et al. (2023) conducted an evaluation of the Lanzhou-Xining urban agglomeration (LXUA) using a multi-dimensional assessment system that incorporated urbanization quality and ecosystem services. The assessment utilized various methodologies including the efficacy function model, entropy weight method, and Integrated Valuation of Ecosystem Services and Trade-offs (InVEST) model to quantitatively evaluate the developmental state of the subsystems. Additionally, the study employed coupling models (CD) and coordination degree (CCD) models to investigate the coupling coordination relationship and spatiotemporal change characteristics of the composite system.

Four papers in this Special Issue address the coordination of man-land systems and sustainable development:

Zhang et al. (2023) conducted an analysis of the spatial distribution and regional variations of the human appropriation of net primary production (HANPP) in China during 2015. The study also examined how HANPP and its components responded to imbalanced urban-rural development in different regions. The findings shed light on the impact of unbalanced regional development on human-induced biomass occupation, comprehensive urban ecological construction, and rural ecological restoration. Importantly, the study highlights the significance of urban-rural integration development as a means to address increasing ecological pressures in the future.

Wang et al. (2022) conducted an analysis of the elemental composition, structural organization, and functional state of China’s northwest arid areas using a human-Earth system approach. The findings revealed a lack of coupling and coordination among humans, the economy, resources, and environmental elements in these regions. However, during the anti-poverty stage, China’s northwest arid areas showed innovative efforts in establishing a human-Earth coupling mechanism. Additionally, three pathways were identified to enhance sustainable livelihood, consolidate poverty alleviation achievements, and achieve rural revitalization. Notably, it is essential to establish an endogenous growth mechanism for sustainable poverty alleviation and green development.

Cai et al. (2022) developed an evaluation index system to assess the various functions of cultivated land in oasis areas (OCL), including social, economic, and ecological perspectives. Using this framework, the study quantitatively evaluated the evolution of cultivated land functions (CLFs) and their interactions in Xinjiang from 1990 to 2018. The findings indicated that the evolution of CLFs in Xinjiang initially focused on ecological and social functions but gradually shifted toward economic functions. Additionally, the study revealed a weakening in the synergistic relationship between CLFs and an increase in trade-offs over time. This research expands our understanding of multi-functional studies related to cultivated land and provides valuable insights for decision-making regarding the sustainable utilization and synergistic management of oasis cultivated land in Xinjiang, China.

Zhang et al. (2023) assessed the rural-urban transition in China from 1980 to 2020 by utilizing socio-economic data and a rural-urban transition coordination model. They developed a comprehensive rural-urban development and integration index system to analyze the process. The findings reveal that, since the reform and opening-up, China has witnessed a gradual expansion of the rural-urban development index (URDI) across different regions, while the rural-urban integrated index (URII) initially declined before experiencing subsequent growth. Over the past four decades, the spatial distribution of URDI exhibited a “south high-north low” pattern, whereas the URII demonstrated a more balanced distribution. The study also put forth optimization strategies for each type to further enhance rural-urban integration.

Next, five papers included in this Special Issue discuss man–land system coupling and optimal regulation.

Gong et al. (2022) conducted an assessment of the multi-functions of cultivated land in the grain-producing area of Jilin Province’s cultivated black soils over the past three decades. The study employed an improved TOPSIS model to analyze the data. By utilizing the obstacle degree model and Geodetector, the researchers also identified the key limiting and influencing factors of cultivated land’s multi-functions. The findings indicated an overall increase in multi-functionality from 1990 to 2020. However, the simultaneous improvement of economic and social functions impeded progress in the ecological function of cultivated land. The analysis also highlighted spatial variations in the functions across different counties. Based on the results, the study put forward several policy recommendations, including reducing regional disparities in cultivated land functions, quantifying the multi-functional value of cultivated land, and providing subsidies for land cultivation. These measures aim to strengthen multi-functional planning and design, enhance ecological utilization, and promote the sustainable use of cultivated land.

Liang et al. (2022) conducted a study on the coupling and coordinated changes of land-use production, living, and ecological functions (PLEFs) in relation to human activity intensity (HAI) in Wanzhou District, China, spanning from 2000 to 2020. The researchers employed the coupling coordination degree (CCD) model to assess the level of coordinated development among PLEFs, while HAI was measured through the equivalent level of construction land. The synchronous development model was utilized to analyze the relationship between these factors. The findings revealed significant spatial distribution variations and evident spatial complementarity among PLEFs in Wanzhou District. Based on the synchronous development state of HAI and CCD of PLEFs, the district was categorized into three development types. This highlights the need to propose regulatory strategies tailored to regions with different development types.

Cheng et al. (2023) employed ecological niche theory, a coupling coordination model, and a trade-off synergy model to construct an evaluation index system. This system was utilized to assess the spatiotemporal evolution characteristics, trade-off synergy, and coupling coordination degree of land-use production, living, and ecological functions (PLEFs) across 38 counties in Chongqing, China. The findings revealed that over the past two decades, Chongqing’s “living-production” function transitioned from a trade-off model

to a collaborative development relationship. Additionally, the “living-ecological” function generally exhibited a collaborative development relationship.

Zhou and Jiang (2022) conducted an analysis of the influence of urban development on immigration and labor migration trends in Macau from 1992 to 2019. The study reveals that Macau exhibits a high dependence on short-term migrant workers. Consequently, the paper suggests several measures to address this issue, including reducing the costs associated with city expansion, enhancing economic diversity, and fostering closer collaboration with neighboring mainland cities. Such actions would enable Macau to effectively utilize resources, attract non-local talent, and ensure sustainable urban development.

Guo and Zhong (2023) conducted an analysis to examine the underlying meaning of rural transformation development (RTD). They also explored the spatiotemporal patterns of RTD in the Yanshan-Taihang Mountains and identified the influencing factors through the use of a geographically and temporally weighted regression model. The findings indicated that RTD is a dynamic process characterized by qualitative changes in rural regional systems, which stem from the accumulation of quantitative changes in elements. The measurement of RTD hinges on the analysis of the coupling coordination degree between the quantitative changes of these elements.

The evolution of man-land relationships is closely intertwined with socio-economic development, calling for the application of dialectical thinking and dynamic systems analysis to explore these issues in contemporary China. This Special Issue in the journal *Land* encompasses a collection of 20 papers that delve into four main themes, namely human activities and natural ecosystems, land-use conflicts/trade-offs, man-land coordination, and sustainable development. Additionally, the studies delve into man-land system coupling and optimal regulation. These research contributions expand the scope and content of man-land relationship research, providing valuable theoretical and practical insights for urban-rural integration, regional sustainable development, rural revitalization, and global poverty reduction in the new era.

Nevertheless, there remains significant potential for advancement in the examination of man-land relationships in China, especially in the context of the papers featured in this Special Issue. While current research offers policy recommendations from various perspectives to enhance regional man-land coordination and sustainable development, a more comprehensive analysis of the intricate impact of interactions between man-land systems at the urban-rural and regional levels is still lacking [6]. Therefore, further research is required to bolster the examination of intricate man-land system coupling, simulation, and prediction.

Driven by rapid economic and social development, as well as advancements in science and technology, the scope and scientific implications of man-land relationship research are expanding. Particularly in the context of economic globalization, there has been a shift in focus from regional systems to spatial network systems of man-land relationships [7,8]. The study of regional systems aims to coordinate man-land relationships, optimizing and regulating global, national, or regional systems through considerations of spatial structure, temporal processes, overall effects, and synergistic complementarity. This provides a theoretical foundation for effective regional development and management. On the other hand, studying spatial network systems emphasizes the interconnectedness and long-distance connections across regions. The increasing interconnectedness brought about by globalization and urbanization, facilitated by the flow of information, capital, goods, and population, reshapes traditional man-land relationships into a complex network.

Against the backdrop of globalization and urbanization, it is crucial to reassess and broaden the theoretical implications of man-land relationship research. Addressing the conflicts and trade-offs between humans and the environment in the modern era necessitates a systemic outlook, strategic thinking, and interdisciplinary, integrated research across multiple scales. Future research directions will involve scrutinizing shifts in perspectives, underlying assumptions, conceptual frameworks, and research methodologies.

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Appendix A

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