

Research Progress on Land Use Conflict: Content and Methods (Postprint)

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Abstract

The scarcity of land resources and the multi-functionality of land use constitute the fundamental causes of land use conflicts. The emergence of such conflicts intensifies the contradictions among economic benefits, ecological benefits, and social benefits. Research on land use conflicts holds significant importance for realizing the integration of multiple plans and the delineation of three zones and three lines in territorial spatial planning. Building upon an elaboration of the concepts and types of land use conflicts, and addressing the current characteristic of relatively dispersed research on such conflicts, this study reviews recent domestic and international research advances from the dual perspectives of research content and research methods. Regarding research content, it analyzes the identification and spatiotemporal dynamics of land use conflicts, synthesizes the primary driving factors of these conflicts and the coordination and trade-offs under different driving factors, and summarizes the application practices of conflict research. Concerning research methods, it evaluates the suitability of participatory surveys, game theory, the Pressure-State-Response (PSR) model and its extended variants, multi-objective evaluation, and landscape ecological risk assessment in land use conflict research. Future research on land use conflicts should focus on improving theoretical frameworks, expanding methodological approaches, emphasizing conflict dynamics, and serving territorial spatial planning.

Full Text

Preamble

Land Use Conflict Research Progress: Content and Methods

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Abstract: The scarcity of land resources and the multi-functional nature of land use constitute the root causes of land use conflicts. Such conflicts exacerbate contradictions among economic interests, ecological benefits, and social benefits. Research on land use conflict holds significant importance for achieving “multi-plan integration” and delineating the “three spaces and three lines” in national territorial spatial planning. Building upon an elucidation of the concept and types of land use conflict, and addressing the currently fragmented state of conflict research, this paper reviews relevant domestic and international research progress in recent years from both content and methodological perspectives. Regarding research content, we analyze the identification and spatiotemporal dynamics of land use conflict, summarize the main driving factors of land use conflict and the coordination and trade-offs under different driving factors, and review the practical applications of conflict research. Regarding research methods, we evaluate the suitability of participatory surveys, game theory, the Pressure-State-Response (PSR) model and its extended models, multi-objective evaluation, and landscape ecological risk assessment in land use conflict research. Future land use conflict research should improve theoretical systems, expand research methods, emphasize conflict dynamics, and serve national territorial spatial planning.

Keywords: conflict type identification; spatiotemporal dynamics; driving factors; conflict trade-offs; territorial spatial planning

1.1 Concept of Land Use Conflict

The essence of “conflict” is the interaction state of behavioral and psychological opposition and contradiction arising from disagreements among different interest subjects regarding the disposition of a specific object. In the process of land use, the subjects are stakeholders, the object is land, and the disposition of land includes land use patterns and quantity allocation. Land use conflict arises from disagreements among different stakeholders regarding land use purposes, often involving land’s asset and property rights characteristics as well as its production, living, and ecological functions. The manifestations are complex and diverse. Currently, land use conflict lacks a unified definition. Campbell et al. [16] believe that land use conflict in Kenya’s Kajiado District is manifested in the competition for scarce water and soil resources among pastoralism, agriculture, and wildlife, reflecting resource competition contradictions arising from the simultaneous production and ecological functions of the same land unit. Pacheco et al. [17] argue that land use conflict occurs when the actual use of land contradicts its ecologically suitable use, focusing on unsustainable states manifested by unreasonable land use. Wehrman [18] considers land use conflict a social phenomenon of interest conflict arising from land property rights disputes. Yu Bohua and Lü Changhe [8] believe that land use conflict represents inconsistencies and disharmonies among stakeholders regarding land use patterns and quantities during land resource utilization, as well as contradictions between

land use patterns and the ecological environment. In summary, although scholars' descriptions of land use conflict vary in emphasis, they all reflect competition among stakeholders for scarce land resources. Land use conflict represents land use contradictions arising in the process of stakeholders pursuing their respective interests, an unsustainable state based on land characteristics and functions.

Land use conflict is closely related to land use contradiction and land use competition. The process of stakeholders changing land use patterns under the drive of expected benefits is land use competition [19]. Against the backdrop of limited land resources and multi-suitability of land use combined with diverse human needs, multiple land use patterns may compete intensely on the same plot, leading to land use conflict. Therefore, land use competition forms the basis of land use conflict. Both land use contradiction and land use conflict manifest as opposition and disharmony among stakeholders regarding land disposition during land use processes. However, in land use conflict, this opposition is more intense. When land use contradiction develops to a certain extent and causes significant negative impacts, it may transform into land use conflict.

1.2 Types of Land Use Conflict

Based on differences in conflict subjects, stakeholders, and conflict timing, land use conflict can be classified into different types: (1) According to conflict subjects, conflicts can be divided into human-human conflicts and human-nature conflicts. When different stakeholders have disagreements over the property rights or use patterns of the same land, human-human land use conflicts occur, with complex and diverse manifestations including competition for the same plot by different land use patterns [25], disputes caused by negative externalities of land use [11], and conflicts over land property rights [14]. When human demand for land exceeds the carrying capacity endowed by natural conditions or destroys the natural ecological functions of land, human-nature land use conflicts occur [20]. In human-human land use conflicts, stakeholders defend clear interests; in human-nature land use conflicts, ecological benefits are often less prominent than economic and social benefits, and due to the "tragedy of the commons," awareness of defending ecological benefits is insufficient, placing ecological benefits at a disadvantage. Therefore, human-nature land use conflicts require particular attention. (2) According to differences in land functions pursued by stakeholders, conflicts can be divided into economic benefit conflicts (conflicts between different production functions), economic-ecological benefit conflicts (conflicts between production and ecological functions), and economic-social benefit conflicts (conflicts between production and living functions) [21]. (3) According to conflict timing, conflicts can be divided into current land use conflicts and potential land use conflicts. Current land use conflicts generally refer directly to land use conflicts, measuring the intensity and describing the characteristics of existing conflicts. Potential land use conflicts refer to the high probability of land use conflict occurrence in a region under intense competition among different land use patterns, facilitating prevention of conflicts that

have not yet occurred. Additionally, conflicts can be classified by content and manifestation into land social conflicts, land cultural conflicts, and land spatial conflicts, or by region into urban land use conflicts, rural land use conflicts, and urban-rural land use conflicts [10].

2 Research Content of Land Use Conflict

As a product of socio-economic development processes, the manifestations of land use conflict change with socio-economic development, and correspondingly, research focus on land use conflict also varies. Early research originated from single-case analyses, primarily involving contradictions and conflicts between humans regarding land property rights and use patterns, limited to conflict identification and qualitative analysis. With socio-economic development and urbanization, frequent land use conflicts regarding urban expansion, farmland occupation, and ecological destruction have attracted increasing attention. Research content has further deepened from case analysis to theoretical summarization and improvement. In recent years, research on land use conflict has focused on conflict type identification, spatiotemporal dynamic analysis, driving factor revelation, coordination and trade-offs, and application practice (Figure 1).

[Figure 1: see original paper] The research system of land use conflict

2.1 Conflict Type Identification

Land use conflict identification forms the foundation of conflict research. Currently, many studies focus on specific conflict cases, but the conflicts identified in cases show a trend toward type diversification. Regarding land characteristics involved, due to improved land management systems, conflicts based on land assets and property rights have decreased. However, as people pay more attention to living environment and sensory pleasure, conflicts have expanded from assets and property rights to engineering characteristics. Disputes caused by negative externalities of land use have gradually attracted attention, where different engineering constructions and their impacts on surrounding residents' lives trigger interest contradictions, such as logistics park construction increasing regional traffic pressure and causing conflicts between surrounding residents and market managers [11]. Vonderdunk et al. [11] used cluster analysis to classify peri-urban land use conflicts into six categories based on their causes: noise pollution, visual barriers, health risks, nature conservation, historical preservation, and neighborhood change. Regarding land functions involved, previous land use conflict research focused on conflicts between production and living functions [10]. With increasing environmental awareness, more studies now incorporate ecological functions, with some research even treating ecological function damage as the main conflict manifestation [17]. Regarding land use objectives, research no longer focuses solely on conflicts among construction land, agricultural and pastoral land, forestry land, and mining land, but also analyzes and weighs special land use needs. For example, Xu Jiancun et al. [23] analyzed spatial conflicts between urban ventilation corridors and land use structure based

on urban haze control needs, while Calvert and Mabee [24] assessed potential land use conflicts between solar farms and bioenergy crops in Ontario, Canada, based on renewable energy technology needs. The increasing diversity of conflict types indicates that land use conflict research is becoming more universal and detailed.

Early land use conflict identification research was limited to qualitative analysis. The “Land Use Conflict Identification Strategy (LUCIS)” proposed by Carr and Zwick [25] in 2005 represents the first systematic quantitative identification method in this field. This method measures conflict intensity and identifies spatial locations through suitability analysis, land use preference identification, and conflict mapping. After 2010, land use conflict research reached a new height [26]. As the foundation and focus of conflict research, identification and quantitative measurement studies became more common during this stage, including improving LUCIS models by introducing population and planning factors to identify conflicts between human land use tendencies [27], measuring conflicts between spatial development and ecological protection based on differences in landscape value and land use preferences [22,27], and estimating conflicts between agricultural land use and nature protection using land suitability and soil loss potential [28]. In diverse conflict identification research, the urban-rural interlaced zone has become a prominent hotspot, primarily because the world’s population is increasingly urbanized, and rapid urbanization inevitably means significant modification of urban-rural interlaced zones [29]. Meanwhile, the urban-rural interlaced zone is also a high-incidence area for construction land encroaching on agricultural land, and attention to food security has also brought more focus to conflicts in this zone. Additionally, rural areas once served as buffer zones between densely populated urban areas and many high-risk facilities, while urbanization pushes the urban-rural interlaced zone closer to existing high-risk facilities, easily generating land use conflicts [11].

2.2 Spatiotemporal Dynamics of Conflict

Due to significant differences in land resource conditions and socio-economic development levels among regions, land use conflict manifestations necessarily vary across different regions and periods [30]. Analyzing conflict changes in time series and differences in spatial patterns can both grasp the socio-economic environment development status of a region and help identify reasons for these changes and differences, thereby seeking solutions targeting the dominant factors causing conflict. Land conflict is both a social phenomenon and a geographical phenomenon [13]. Due to spatial autocorrelation and heterogeneity of geographical phenomena, spatial statistical analyses such as spatial autocorrelation analysis and semi-variance analysis are used as important methods for land use conflict spatial pattern analysis. Understanding the nature of land use conflict and its intensity changes in space is an essential requirement for regional planning strategies. On the temporal scale, conflicts undergo transformation from potential to manifest states. Early land use conflict research focused on

interest contradictions among different subjects based on land assets and property rights, manifested directly in intense forms such as confrontation, dispute, and contention—that is, conflicts in manifest states. Correspondingly, early conflict dynamic analysis mainly involved mathematical statistics of conflict case numbers [31]. However, in recent years, people have gradually realized that estimating the possibility of conflict occurrence is an important step in making reasonable land use decisions, as it can identify potential disagreements in land development and provide opportunities for conflict negotiation and resolution [32]. Therefore, potential land use conflicts have become a focus of attention [33], with two main research approaches: one measures conflict probability based on the degree of disagreement in land use preferences and plot value [34]; the other identifies potential conflicts when multiple land use patterns have simultaneous suitability for the same plot [35]. Attention to potential conflicts means people are no longer limited to social phenomena that have already occurred but begin to focus on potential trends of conflict and the entire dynamic evolution process of conflict occurrence and development. However, most current research still analyzes the “results” caused by conflict rather than the “process” of conflict evolution [13]. Since changes in natural environment and socio-economy are reflected on land, causing complex and variable land use conflicts, and land use conflict in turn affects changes in natural environment and socio-economic development, the conflict response under land use change and landscape pattern evolution is significant [13,26]. Focusing on conflict evolution processes can avoid neglecting long-term sustainable development of environmental resources for short-term economic benefits, and spatiotemporal dynamic analysis of land use conflict may also uncover development trends or potential patterns, enabling prediction of conflict occurrence under different future scenarios [36]. Meanwhile, the emergence of new scientific technologies provides good technical support and development opportunities for capturing spatiotemporal dynamics of land use conflict. GIS technology has become an essential tool for conflict spatial location identification and temporal trend monitoring, while combining Markov models and other methods to simulate conflict spatiotemporal dynamic evolution represents a research frontier in the conflict field [37].

2.3 Revealing Conflict Driving Factors

The multi-suitability of land resources and limited land supply are the root causes of conflict, while population and demand growth are the main driving forces for conflict occurrence and development [8]. Therefore, land use conflict arises from the combined effects of internal factors (natural factors) and external factors (human factors) (Figure 2). Natural driving factors of land use conflict mainly include limited land quantity and suitability. Both natural environment maintenance and human production and life depend on land. On land with limited quantity, choices must be made among different land use patterns and functions, leading to land use conflicts [38]. Therefore, limited land quantity is the basic cause of land use conflict. Conflicts driven by land suitability generally include two situations: one occurs when a plot unit simultaneously

has suitability for multiple land use types, and different use patterns compete for the plot unit under external demand growth [39]; the other occurs when an unsuitable use pattern or development intensity is selected for a plot unit that inherently lacks suitability for a certain land use type or whose development intensity has exceeded land carrying capacity, which is unfavorable for ecological environment sustainability and forms land use conflict [40].

Humans are important stakeholders in land use conflict, so human factors in land use conflict mainly derive from different human needs for production, living, and ecological environments (although ecological needs involve the natural ecological environment, their fundamental purpose is human survival and development, serving as a demand type to ensure long-term socio-economic development, thus ecological needs are also classified as human driving factors). For example, in Africa, due to large populations and underdevelopment, imperfect property rights systems and blind land occupation lead to frequent land competition driven by living needs [41]. Negative externalities from mining, such as pollution and forced relocation, are direct causes of land use conflicts between residents' living needs and mining enterprises' production needs [42]. Since different social classes have different land use pursuit goals, conflicts easily occur between different planned uses of the same land. As a product of special stages of socio-economic development, multi-plan conflict is a major problem in current Chinese urban-rural planning management, seriously weakening planning guidance for land resource use and causing multiple demands for living, production, and ecology to compete for limited land resources [43]; similar phenomena occur abroad, where governments and related institutions implement contradictory development strategies causing land use contradictions and shortages [31,42]. In reality, driving factors causing land use conflict are not single but often result from combined natural and socio-economic factors, though a dominant factor often exists and becomes the entry point for land use conflict management.

Revealing driving factors causing conflict is fundamental to solving land use conflict from its roots. Many case studies of land use conflict analyze their driving factors, but this incidental analysis is limited to specific land use types. Since qualitative analysis exceeds quantitative analysis in land use conflict research, corresponding driving factor exploration also features more qualitative than quantitative methods. Overall, quantitative research focusing on conflict driving factors is extremely rare, even in incidental explanations of driving mechanisms in conflict cases, where quantitative methods are relatively simple, mainly including grey correlation analysis and regression analysis based on the correlation degree of change trends between driving factors and conflict intensity [31,43]. Due to the complexity and interweaving of land use conflict driving factors, systematic sorting, clear definition, and contribution degree of driving factors remain relatively blank research areas. However, existing incidental analyses provide a good foundation for targeted research on driving factors, and recently, scholars have begun analyzing land use conflict driving factors based on literature data. For example, Dadashpoor [14] organized spatial measurement, surrounding environment, and public infrastructure driving factors into three

groups, using the Analytic Hierarchy Process (AHP) and Decision-Making Trial and Evaluation Laboratory (DEMATEL) methods to determine hierarchical structure and weights of driving factors, thereby constructing a conflict driving factor index to assess conflict driving intensity and distinguish the importance of various factors. Dadashpoor [14] also used meta-analysis methods with clear intentions and reproducibility to comprehensively review existing scattered and diverse land property rights conflict studies, attributing land property rights conflict causes to three factors: interests, power, and institutions.

2.4 Conflict Coordination and Trade-offs

Coordinating production development, livable living, and ecological security to achieve production, living, and ecological goals of land functions is the primary task of regional land use conflict coordination and reconciliation. As an important approach to alleviating or resolving land use conflict, conflict coordination and trade-offs have always been necessary steps in conflict research. Corresponding trade-off and coordination methods have been widely proposed for different driving factors of land use conflict. The limited quantity and suitability of land mainly originate from natural constraints, where human modification 余地 is relatively limited, but intensive land use is an effective measure to address scarce land resources. When different use patterns compete for land, game and trade-off analysis of various land use patterns helps find optimal solutions in land use competition [44]. For conflicts driven by socio-economic development under “production-living-ecological space” demands, common management methods include improving legal systems, reasonable compensation, communication and mediation, participatory co-management, and multi-plan integration. For conflicts arising from imperfect property rights systems, identifying legal loopholes and improving relevant laws and institutions is key. For conflicts caused by negative externalities or blind occupation of land use, providing reasonable compensation to affected stakeholders is an important method to ease contradictions, and compensation should not be limited to economic means—combining non-economic compensation can better promote stable harmony. Additionally, communication and mediation among stakeholders and participatory co-management can coordinate interests and fully utilize local residents’ indigenous knowledge, considered effective mechanisms for solving land use conflict [45]. For conflicts among multiple plans, coordinating various planning goals and principles to achieve “multi-plan integration” is an inevitable choice [43]. Due to diverse manifestations and complex driving factors of land use conflict, coordination often involves comprehensive and diversified governance combining multiple methods based on actual conditions.

Although research on conflict coordination and trade-offs has always existed, corresponding methodological updates have not kept pace with developing conflict identification methods and spatiotemporal dynamic analysis, still remaining in traditional qualitative analysis. Against the backdrop of gradually maturing spatiotemporal dynamic analysis technology, scenario simulation of land use

conflict has become possible, with potential for application in effectiveness evaluation of differentiated trade-off and coordinated governance strategies in conflict regions [46]. Conflict occurrence is an inevitable result of human demand for multiple land use functions; therefore, exploring trade-off and synergy relationships among land functions and investigating land use multi-functionality represent new approaches for conflict coordination and trade-offs [47].

2.5 Application Practice of Conflict Research

Land use conflict occurrence inevitably leads to numerous negative impacts. Coordinating and trading off conflicts aims to prevent conflict recurrence and avoid negative impacts from their roots. For existing land use conflicts, reducing negative effects and avoiding their impact on socio-economic development requires practical application of conflict research results. Existing research has repeatedly pointed out the application potential of land use conflict in planning management and environmental management [28,43], but since land use conflict research itself is still in its infancy, practical application cases of conflict research results remain relatively few.

In planning management, corresponding trade-off principles are generally formulated based on land use purposes to allocate land use in identified conflict zones. Especially during comprehensive socio-economic transformation and development, quantitative conflict detection helps continuously revise plans at the initial stage of spatial planning, reducing land scale matching errors and making conflict research a basis and reference for land use planning formulation. For example, Ran Na et al. [48] proposed delineation schemes for basic farmland protection redlines, urban development boundaries, and ecological protection redlines based on ecological priority and compact concentration principles for coupling coordination of various conflict zones. Nantel et al. [46] determined rare plant protection zone ranges based on the principle of minimizing land use conflict index. In environmental management applications, after identifying conflict zones, different regions' environmental quality-related indicators are typically measured to compare environmental conditions across different conflict levels, thereby analyzing land use conflict impacts on the environment and facilitating corresponding governance strategies, such as impacts on soil loss [28], water quality [49], ecosystem conversion [48], and ecosystem services [50]. Urban planning itself is also a product of continuous conflict, coordination, and integration [51], and moderate land use conflict can promote integrated utilization of regional land resources. Therefore, scientifically and reasonably applying conflict research results represents a highly valuable research direction in land use conflict studies.

3 Research Methods of Land Use Conflict

3.1 Participatory Survey

The participatory survey method generally uses questionnaires and semi-structured interviews as implementation means [22]. Applying participatory surveys to land use conflict research can provide relatively accurate and in-depth understanding of stakeholders' land resource use goals and interest demands, thereby identifying the root causes of land use conflict from internal mechanisms and effectively diagnosing conflicts [22]. Meanwhile, participatory surveys emphasize public participation, giving stakeholders voice, analysis rights, and decision-making power, which facilitates effective formulation of corresponding land use conflict management measures. However, the participatory survey method is a qualitative analysis method with strong subjectivity and difficulty in achieving quantitative analysis of land use conflict intensity and structure. Additionally, since land use conflicts are often sensitive, some stakeholders may be unwilling to cooperate, leading to difficulties and low efficiency in practical implementation. Due to workload limitations, participatory surveys are generally used in small study areas, but if combined with quantitative methods, they can serve as auxiliary methods for conflict diagnosis in large study areas.

3.2 Game Theory

Game theory is often applied to study decision-making and equilibrium problems when rational decision-makers' behaviors interact [6]. In land use conflict research, introducing stakeholders' interests into game analysis and establishing relevant mathematical models to analyze interest differences when stakeholders make different land use choices can identify the most reasonable land use strategies. Game theory has strong logic and can deeply explore the internal mechanisms of land use conflict from stakeholders' game behaviors. However, game theory is based on the rationality assumption of stakeholders and does not apply to possible irrational behaviors in conflicts. Meanwhile, interests in land use are often difficult to quantify, making game analysis results in land use conflict somewhat uncertain. Compared with other methods, game theory focuses more on analyzing strategies after conflict occurrence, which is beneficial for seeking the most suitable land use conflict management methods.

3.3 PSR Model and Its Extensions

The PSR model, or "Pressure-State-Response" model, was first proposed by the Organisation for Economic Co-operation and Development for environmental system analysis [52]. In land use conflict research, selecting three types of indicators—pressure, state, and response—can yield an index reflecting the comprehensive situation of land use conflict. Pressure indicators reflect the adverse effects of human activities on limited land resources; state indicators reflect the current conditions and characteristics of land use under existing pres-

asures; response indicators reflect management measures and regulatory methods adopted by people to address existing pressures and improve current land states. Based on the PSR model, scholars have expanded it to obtain extended models such as “Pressure-Actors-State-Impact-Response (PASIR)” and “Driving Forces-Pressure-State-Impact-Response (DPSIR),” though their core ideas are basically similar [53].

As a quantitative method, the PSR model can effectively reflect land use conflict intensity. Moreover, through the integration of three indicator types, PSR model diagnosis provides more comprehensive land use conflict results, reflecting not only current land use status but also potential future changes in land use conflict. Meanwhile, since the PSR model enables separate measurement of three indicator types, comparing the three indicators can attribute land use conflict and identify local land use problems for targeted solutions. However, the PSR model also has obvious defects: first, it relies heavily on large amounts of socio-economic statistical data, and since evaluation units are often administrative units, results can only reflect relative conflict strength at the administrative unit level, not accurately pinpointing specific conflict locations; second, PSR model application requires accurate understanding of land use conflict in the study area and clear identification of pressure sources to select reasonable pressure indicators. Since pressure sources of land use conflict show obvious regional differences, they can be selected in combination with correlation analysis or participatory survey methods [54].

3.4 Multi-Objective Evaluation

The basic idea of multi-objective suitability evaluation is to identify conflict zones by evaluating suitability differences of plot units for multiple use patterns, treating plots with equal and high suitability for multiple patterns as conflict areas [25], reflecting competition for limited land resources among multiple land use patterns. Whether land use conflict occurs depends not only on land multi-suitability but also on the strength of land conversion driving forces. Therefore, based on multi-objective suitability evaluation, combining land conversion driving force indicators forms a comprehensive land use competitiveness index as the basis for conflict zone identification. Additionally, some scholars compare plot suitable use patterns with actual use patterns, using digital coding for measurement—the greater the difference between actual and suitable use patterns, the greater the conflict intensity [55]. Multi-objective evaluation focuses on the potentiality of land use conflict, can grasp future trends of land use conflict, and enables spatial identification of potential conflicts. Meanwhile, since this method identifies conflict zones based on suitability and driving force differences, it can clarify conflict causes and provide references for land use management. Since multi-objective indicator selection also involves subjectivity, it must closely combine with local actual conditions to identify main limiting factors for land suitability and main driving forces for land conversion, thereby selecting reasonable and representative evaluation indicators.

3.5 Landscape Ecological Risk Assessment

Land use pattern changes create varying degrees of risk to regional ecological security [56]. Therefore, some scholars measure land use conflict through landscape ecological risk assessment [28,57]. Generally, the smaller the landscape ecological risk caused by land use change, the smaller the land use conflict intensity. In landscape ecological risk assessment, land use disturbance index, vulnerability index, and stability index are generally used to characterize risk sources, risk receptors, and risk effects of landscape ecological risk, respectively, and “disturbance degree + vulnerability - stability” is used for comprehensive measurement of land use conflict. Landscape ecological risk assessment, based on landscape index construction, emphasizes spatial characteristics of land use conflict, generally diagnosing conflicts based on grid scales, and can accurately identify conflict locations. Meanwhile, since adopted landscape indices are relatively objective, this avoids subjectivity in evaluation indicator selection. However, this method considers socio-economic factors indirectly, and evaluation results have difficulty reflecting conflict causes, often requiring grey correlation analysis or regression analysis with socio-economic factors to further reveal conflict driving forces.

4 Future Research Directions

4.1 Improve Theoretical Basis and Integrate Existing Research Systems

Currently, land use conflict research has made considerable progress in both content and methods, but overall, the land use conflict research system remains immature [10]. In its initial stage, land use conflict research currently focuses more on conflict type identification and spatiotemporal dynamic analysis, while driving factor revelation, coordination and trade-offs, and application practice still have great development potential. Different scholars have varying emphases in understanding land use conflict connotations, and coupled with complex and diverse conflict manifestations, relevant basic theories and research methods are relatively scattered, lacking authoritative and unified theoretical systems. Land use conflict is a composite concept; different research methods can reveal land use conflict from different perspectives, but how these perspectives relate to each other and how the revealed conflict situations can be integrated remain issues for further discussion due to the lack of a systematic research theoretical system. Compared with land use change research and land use suitability analysis research, land use conflict research emphasizes relationships between land use patterns, actually reflecting interest trade-offs among stakeholders. Therefore, studying land use conflict addresses practical needs for resolving interest contradictions in socio-economic development processes, aiming to specifically solve social problems triggered by diversified land use demands and scarce land resources. Improving the land use conflict research system is of great significance.

4.2 Expand Research Methods to Address Diversified Conflict Types

Previous mathematical statistical analyses of conflict events collected conflict data through questionnaires and media reports [31], involving heavy workloads and low efficiency. With information technology development, future research could attempt to apply web crawlers, big data analysis, and other methods to conflict data acquisition. Currently, the use of geographic spatial databases and GIS tools has promoted conflict research development, with quantitative research gradually increasing and the advantage of combining quantitative and qualitative analysis becoming more prominent. Although existing main research methods inevitably have their respective advantages and disadvantages, integration and expansion of research methods can achieve complementary advantages to some extent. Combining participatory survey methods with PSR models and multi-objective evaluation can incorporate qualitative analysis advantages on the basis of quantitative analysis, facilitating understanding of land use conflict internal mechanisms and providing guidance for quantitative analysis indicator selection. Expanding grey correlation analysis or regression analysis on the basis of landscape ecological risk assessment models can establish connections with economic and social characteristics while emphasizing landscape ecological natural characteristics. Applying game theory to potential conflict land use patterns based on multi-objective evaluation can seek optimal land use strategies while grasping conflict risks, achieving effective coordination of land use conflict. Meanwhile, since land use conflict has different manifestations at different scales—for example, at micro scales, conflict may only manifest as individual disputes, while at macro scales, conflict may reflect as sudden area changes and spatial conflicts of certain land use types—seeking suitable research methods at different scales to more systematically and comprehensively reveal land use conflict represents an important future research direction.

4.3 Emphasize Conflict Dynamics and Deeply Explore Driving Mechanisms

With deepening land use conflict research, the focus is no longer limited to revealing current conflict states but increasingly emphasizes conflict development dynamics. On the spatial scale, the spatial homogeneity, spatial heterogeneity, and scale effects of land use conflict deserve attention as important content for fully revealing land use conflict characteristics. On the temporal scale, grasping land use conflict development trends provides references for land use planning management. Land use conflict dynamic change research is often an important entry point for revealing conflict driving mechanisms. Conducting land use conflict scenario simulation research helps provide decision-makers with social-environmental effects that various land use decisions (scenarios) may bring. Good conflict scenario simulation must be based on mature conflict measurement and in-depth driving mechanism exploration; therefore, both land use conflict spatiotemporal dynamic characterization and conflict mechanism exploration research urgently need improvement. Additionally, since land use

conflict simultaneously possesses spatial characteristics of geographical phenomena and complexity of social phenomena, its driving factors and mechanisms are often multiple and intricate, requiring integrated application of interdisciplinary knowledge. The multidisciplinary collaborative design concept implemented in the recent “Future Earth” plan provides development opportunities for such research.

4.4 Focus on Application Practice to Serve Territorial Spatial Planning

In recent years, with continuous improvement of China’s industrialization and urbanization levels, problems of unreasonable land resource utilization and land supply-demand contradictions have become increasingly prominent. Emphasizing macro-control and unified management of land use by territorial spatial planning is an inevitable national development need. Land use conflict reflects land use games played by different land planning stakeholders according to their values and land use objectives. Coordinating and trading off conflicts to manage land use conflict and coordinate differences in land use pursuit goals among governments at all levels is a good approach to solving “multi-plan conflicts” in urban planning, land use planning, ecological protection planning, and achieving “multi-plan integration.” The 19th National Congress report emphasized “building a territorial space development and protection system” and “completing the delineation of three control lines: ecological protection redlines, permanent basic farmland, and urban development boundaries.” The interest contradictions among urban development, agricultural production, and ecological protection are concrete manifestations of land use conflict. The delineation of “three spaces and three lines” requires prioritizing ecological security bottom lines and national food security strategies while controlling uncontrolled urban expansion, coordinating contradictions among urban space, agricultural space, and ecological space, and achieving win-win resource development and ecological protection. Land use conflict research provides a scientific basis for delineating “three spaces and three lines.” Therefore, deeply revealing spatiotemporal characteristics and driving mechanisms of land use conflict and seeking solutions to land use conflict are important practical applications for land use conflict to serve territorial spatial planning and achieve sustainable land resource utilization.

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