

Article

Impact Mechanism of the Three Pilot Reforms of the Rural Land System on Rural Residential Land Use Transition: A Regime Shifts Perspective

Bangrong Shu  and Yi Qu *

School of Geography, Geomatics and Planning, Jiangsu Normal University, Xuzhou 221116, China

* Correspondence: quy.13b@jgsnrr.ac.cn

Abstract: Understanding the impact of the three pilot reforms of the rural land system (TRRLS) on rural residential land use transition (RRLUT) based on the land use transition (LUT) theory is crucial for promoting rural land system reform. However, there is still a lack of research on this, and the LUT theory also needs to be improved from a systematic perspective to eliminate the misunderstanding of LUT in academia. To address this, this study firstly attempts to deepen the conceptual model and the understanding of characteristics of LUT from a regime shifts perspective. LUT is the transformation of the land use system as one regime passes into another, where a difference in the analytical perspective of land use morphology generates different transition results. The process of LUT can simultaneously or solely involve dominant morphology and recessive morphology transitions, and there are two types of LUT: positive and negative transitions. Moreover, LUT in different regions may have pathway differences and the convergence of results. Then, a theoretical analysis framework of the pathways of RRLUT under the TRRLS is constructed to detect the impact mechanism by using Wujin district, China to obtain empirical evidence. The results reveal that the recessive morphology transition of rural residential land in Wujin under the TRRLS is significant, while the dominant morphology transition in land quantity structure and spatial distribution is relatively slow. Furthermore, two internal factors of population urbanization and migration, the demand for rural collective economic development, as well as the two external factors of the TRRLS and market factors, such as nonlocals' demand for housing and rural enterprises' demand for land, have, to a certain extent, weakened the resilience of the rural land use system and promoted RRLUT. Here, the TRRLS have, by removing the institutional barrier to RRLUT, become the key to the transition.

Keywords: land use transition; rural land system reform; transition pathway; regime shifts; Wujin district



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1. Introduction

Land use mirrors socio-economic development [1], and rural socio-economic development issues can be reflected in rural land use [2]. Farmers live and produce on rural residential land, the evolution of which is the most intuitive reflection of changes in rural industry, population, and employment brought about by the transition in rural economic development. Controlling rural residential land use transition (RRLUT) can, in turn, affect transition in rural socio-economic development [2]. Thus, it is important to explore the impact mechanism of control policies on RRLUT not only for promoting rural socio-economic development but also for understanding the human–environment interactions.

Presently, there are many problems with rural land use in China, such as the fragmented layout and the idle and inefficient use of rural residential land [3–5]. Moreover, rural residential land should decrease with population urbanization, but in reality rural residential land has increased [6], placing significant pressure on the protection of cultivated land. Thus, it has become difficult for rural residential land use morphology in

China to adapt to socio-economic developmental needs, especially as China remains in a critical period of economic development and urbanization, a state where the demand for construction land for future economic development is still strong. Therefore, the challenge of effectively managing rural residential land and promoting effective transition in its utilization morphology is of great significance to realizing urban–rural integration and rural development and revitalization.

In fact, one of the crucial reasons for the above-mentioned rural residential land problems and the lag in rural development is that the relevant systems, such as the dual land system in urban and rural areas [7], have caused land, labor, and other market elements to flow unidirectionally toward cities. To coordinate urban and rural development, the 19th National Congress report in 2017 [8] proposed a rural vitalization strategy. The No. 1 central document for 2019 [9] proposed to deepen rural land system reform; attract capital, talent, and other elements to the countryside; and address the dilemma of the nonutilization and poor utilization of rural construction land. Moreover, the Opinions on the Establishment of Sound Institutional Mechanisms and Policy Systems for Integrated Urban and Rural Development [10] proposed measures such as steadily and prudently reforming the rural homestead system and establishing the market entry system for rural collective commercial construction land (RCCCL) to promote a two-way virtuous circle of market elements. Therefore, the three pilot reforms of the rural land system (TRRLS), comprising reform of the rural homestead land use system, the marketing of RCCCL, and the rural land requisition system, were adopted to establish a unified urban and rural construction land market and promote optimal allocation of population, capital, and land. The reforms are intended as an essential channel for solving problems, such as the aforementioned rural residential land use problems and lagging industrial development, to promote rural vitalization. From the land use transition (LUT) perspective, the essence of solving the above problems is to promote RRLUT through the TRRLS. However, have the TRRLS actually promoted RRLUT? What is its mechanism of action? These critical research questions must be answered during China's ongoing rural land system reform.

Since LUT was put forward based on studies of forest transition [11–13], much research on forest transition [14–19], rangeland transition [20], and LUT [21–23] has been conducted. For example, Foley, et al. [24] proposed that the development of human society has undergone five stages of LUT. Swette and Lambin [20] analyzed the driving factors of rangelands in the American West and found that land management and policy were the main factors. However, international scholars pay more attention to forest transition, with little research on RRLUT. Since Long and Li [25] introduced LUT to China as an integrated method for LUCC research, Chinese scholars have conducted extensive research in areas such as LUT theory [7,26–29], the research framework [30,31], dominant and recessive land use transition [32–35], the ecological and environmental effects of LUT [36–38], and the use of LUT to promote rural vitalization and transition [2,27]. However, to analyze the land use system's operating rules and find the entry point for land use control measures within this system, it is necessary to deepen the concept of LUT from a systematic perspective, regarding which there are some misunderstandings of LUT in academia [28,39]. Therefore, the current concept and theory of LUT still need to be improved. Meyfroidt, et al. [40] argued that nonlinear changes in the land system and its feedback mechanisms have led to LUT, that is, the structural transformation of the land system from one dynamic equilibrium to another [21,41], and this is similar to regime shifts in complex systems theory [40]. Hence, discussing LUT from a regime shifts perspective will help to improve the theory of LUT.

Previous studies in China mainly focused on the transition of rural homesteads [26], cultivated land [30,42], rural industrial land [43], and urban and rural construction land [44]. A few studies exist on the transition of rural residential land including rural homesteads, RCCCL, etc., and these studies mainly focused on analyzing the spatial characteristics, transition modes, and formation mechanisms of RRLUT from a single morphology, such as quantity, structure, or layout [3,45–47]. For the RRLUT mechanism, especially in the context of integrated urban–rural development, the impact mechanism of rural land system

reform on RRLUT has received little attention, which will inevitably affect the theoretical support that LUT research contributes to land system reform.

The southern Jiangsu province is at the forefront of China's land system reform, and its Wujin district in Changzhou has been one of the pilot areas for the TRRLS since 2015. Taking Wujin district, which is a very typical area as mentioned in Section 3.1., as a case study, this paper aims to: (1) deepen the conceptual model and the understanding of characteristics of LUT from a regime shifts perspective; (2) establish a theoretical analytical framework for the pathways of RRLUT under the TRRLS; and (3) diagnose the impact of the TRRLS on RRLUT in Wujin district and detect its impact mechanism. The results of this study can not only improve the theory of LUT but also provide a reference for decision making related to further reform of the rural land system.

2. Theoretical Analysis Framework

2.1. An Overview of LUT from a Regime Shifts Perspective

2.1.1. A Conceptual Model of LUT

LUT refers to transforming regional land use from one morphology to another, corresponding to the transition of economic and social development stages in a certain period and driven by socio-economic change and innovation; it is a trend change in the evolution of land use morphology that occurs after reaching a particular stage [2,13,31]. Land use morphology includes dominant and recessive morphologies. Dominant morphology refers to the quantity structure and spatial pattern of land use, while recessive morphology refers to the special morphology that relies on the dominant morphology but can only be observed by testing, surveying, analyzing, and monitoring; it has attributes such as quality, property rights, management mode, and output capabilities [7,28]. In short, LUT is the fundamental transformation of the state of the land use system at different stages, and its essence lies in the complex land use system's regime shift, i.e., this transition is the shift in the land use system from one regime to another (Figure 1). Here, a land use system regime is defined as a state of quasi-equilibrium, during which the land use system has relative stability regarding overall characteristics and functions, such as land use structure and intensity [41]. Therefore, the land use system regime can be regarded as the land use morphology. From a more general viewpoint, land use morphology can be defined as the state of quasi-equilibrium regarding the land use system, corresponding to a country's or a region's socio-economic developmental state in a specific period. The essence of dominant and recessive morphologies lies in the intuitive division of the regime of the land use system.

Figure 1 shows land use morphology types A, B, and C. In type A morphology, land use change may occur in the land system due to factors such as socio-economic development. However, due to the system's resilience, land use change in type A morphology maintains dynamic equilibrium without a trend change. When the land system is affected by internal or external factors that cause its morphology to change from type A to type B, LUT occurs. This transition may be caused by stochastic events or the weakening of the land system's resilience due to potential factors. When the land system shifts from one regime or morphology to another, feedback and interaction within the system will undergo reconstruction [41], causing different morphological characteristics to appear.

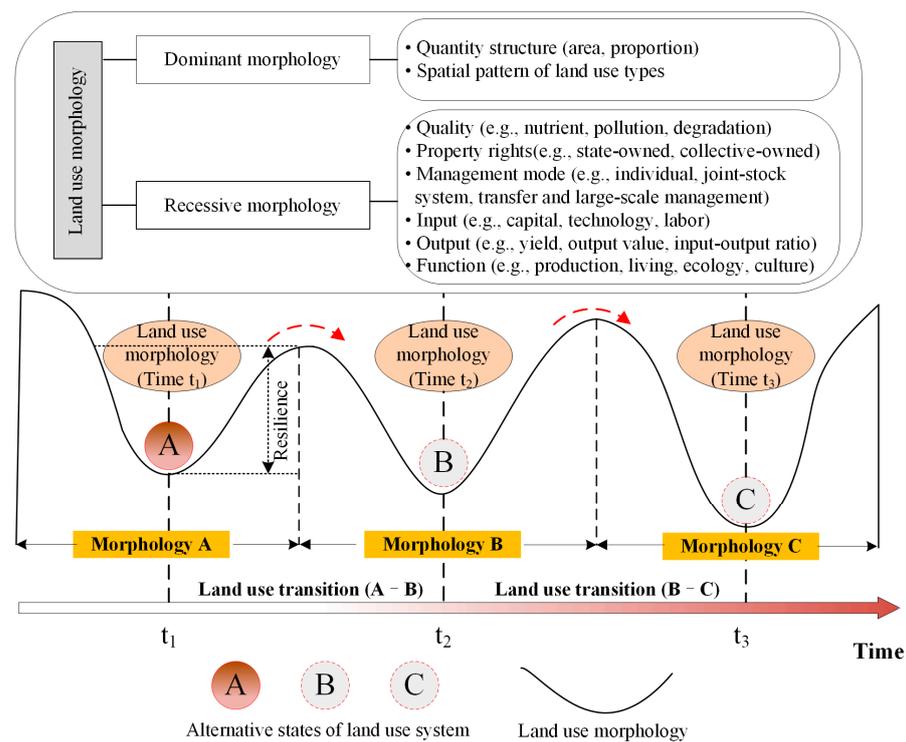


Figure 1. A conceptual model of land use transition (adapted from Long [27]). Note: A, B and C represent land use morphology types, and t_1 , t_2 and t_3 represent time points.

Land use morphology can be judged from different perspectives. When the same land use system is analyzed from different perspectives, the land use morphologies may differ. For example, there are significant differences in cultivated land output for the same type of cultivated land under different levels of mechanization or farming methods. When analyzing in terms of land use type or structure (dominant morphology), they are all cultivated land use morphologies. However, land use falls under different morphologies in the course of analysis in terms of output or intensive use (recessive morphology). Therefore, research on LUT needs to set a research perspective, and different perspectives on LUT will generate different results [31].

2.1.2. Characteristics of LUT

Both dominant and recessive morphological transitions may be present in the evolution of land use systems, or there may only be one. For example, with continuous increases in capital and technological investment in a region's industrial land, its output capacity and level of intensive utilization will qualitatively improve, but the proportion and spatial structure of the regional land use types may not change; thus, there will only be a recessive land use transition. In the process of forest transition, the proportion of forests will have changed from a decreasing trend to an increasing trend, but the output capacity of a unit of forest land will not have changed significantly. Thus, there will only be a dominant transition. When rural homesteads transition from the extensively utilized morphology of outward expansion to the intensively utilized morphology of centralized residence, the transition involves trend changes in both the utilization efficiency and the spatial structure. Thus, both dominant and recessive transitions will be observed.

Second, LUT is a two-way transition. Land use will lead to changes in the socio-economic and ecological environment. This, in turn, will produce positive or negative feedback on the land system itself, which may result in the land system not evolving completely according to human needs. Consequently, if the land use morphology changes to one that is not conducive to human needs, the LUT is a negative transition. Otherwise, it is a positive transition. For example, in the process of forest transition, a high forest coverage

rate produces a good ecological and environmental effect. However, with increased human food demand, forests are reclaimed as agricultural land, causing the forest coverage rate to decrease continuously and triggering the increased prominence of natural disasters such as floods and soil erosion. Thus, this is a negative transition. To restore the ecology and address the growth of human demand for timber, people have adopted forest protection policies to encourage afforestation and increase forest coverage, which has led to the reverse transition of forests. This transition is a positive one.

Third, there are differences in pathways and the convergence of results in the LUT process. Due to differences in various environmental factors, such as the level of socio-economic development, resource endowment, and resource management systems in different countries or regions, the stage of their respective LUT also varies, as previous studies [7,48] have confirmed. Moreover, studies have shown that forest transition also varies by country or region, with there being at least five transition pathways [21]. However, these countries or regions have finally transitioned forest coverage from continuous decline to continuous increase. Therefore, although transition pathways and timing vary, they have all achieved forest transition, demonstrating pathway differences and the convergence of results.

2.2. Rural Residential Land Use Transition Pathways

As the result of the nonlinear evolution of the land system, LUT can be caused by socio-ecological feedback and socio-economic dynamics [21]. It is the process by which different land use types conflict spatially, and then new coordination is achieved by changing the land use morphology [7]. In this study, RRLUT refers to the transition of regional rural residential land from one morphology to another corresponding to the transition of economic and social development stages in a certain period. It includes dominant and recessive morphological transitions. The dominant morphology involves attributes of quantitative and spatial structure, while the recessive morphology involves attributes of utilization efficiency and land use functions. RRLUT is a process in which new coordination occurs through rural land use morphological change. It addresses the spatial conflict between different land use types and functions caused by changes in the supply and demand of rural land due to human activities under the influence of resource ecology, socio-economic development, and policies (Figure 2).

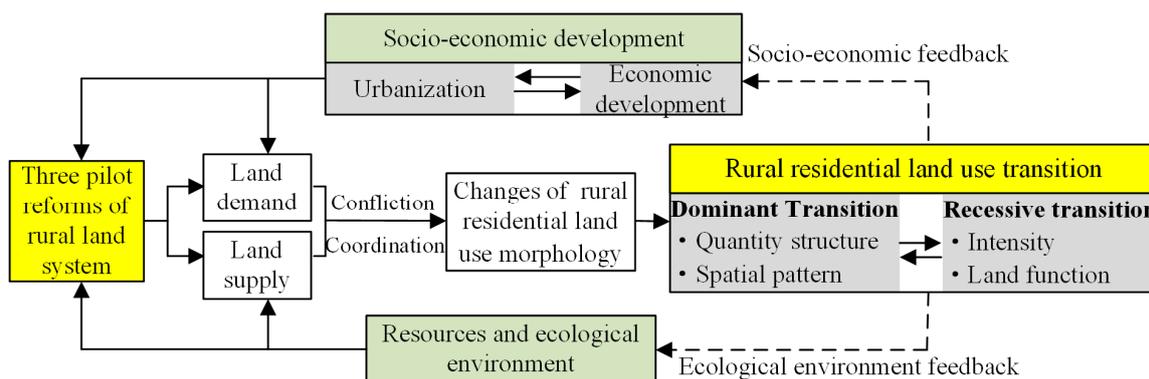


Figure 2. Analysis framework of rural residential land use transition path under the TRRLS.

With socio-economic transition, the demand for various types of land in the context of urbanization and economic development will change. For example, urbanization has increased the demand for urban land and the hollowing out of rural homesteads [49], resulting in greater demand for the consolidation of idle and inefficient lands. The development of rural industries also increases the demand for rural industrial land. However, before the TRRLS, new urban land must be met through land requisition, which is usually adjacent to existing urban land. Even when land consolidation or the policy of “increasing vs. decreasing balance” concerning urban–rural construction land was implemented, the

scale was relatively small, so changes in the quantitative structure and spatial layout of rural residential land were not significantly affected. Additionally, there was no effective exit mechanism for idle homesteads, and the potential of rural stock construction land was challenging to realize [50]. Consequently, the rural residential land use morphology was difficult to transform. Under the TRRLS, the scope of land requisition has narrowed, and the unified market for urban and rural construction land has gradually been established. The RCCCL can be directly listed on the market with the same rights as state-owned land to meet land demand for secondary industries. Moreover, the rural collective construction land can be mortgaged, financed, and transferred, thereby stimulating demand for such land for industry and revitalizing the stock of rural construction land. These have ultimately led to RRLUT. This transition will further affect socio-economic development, influencing the advancement of the TRRLS and rural land demand and forming a feedback loop. This is the path of socio-economic feedback under the TRRLS.

Due to the increasing scarcity of land and the deterioration of the ecological environment, the government determines the supply preference and quantity of different types of land depending on the status of the land resources and ecological environment [51]. Before the TRRLS, due to the land system that distinguished between urban and rural land in China, rural land was mainly used for agriculture, ecological protection, and rural settlements. Very little land was available for rural industrial development, and most of this land was stock industrial land formed in the past. Restricted by law, rural construction lands such as homesteads and RCCCL cannot be transferred and directly supplied for secondary and tertiary industries. Consequently, inefficient and idle construction land was difficult to revitalize, and the ecological environment could not be effectively controlled. Under the TRRLS, through the implementation of relevant innovation policies, the scope of land requisition has narrowed, homesteads can be withdrawn or transferred, inefficient territorial space can be comprehensively renovated, and subject to meeting plans, RCCCL can be directly marketed to industries, thereby reducing the supply of industrial land in the state-owned land market. Simultaneously, as the demand for rural construction land continues to increase, the supply of rural industrial land and the degree of adjustment in homesteads continue to increase, which can revitalize idle and inefficient rural construction land and gradually optimize their spatial layout, making rural residential land use morphology change and the ecological environment improve. These affect the promotion of the TRRLS and the further supply of rural construction land. This is the feedback path of the ecological environment under the TRRLS.

3. Case Study of Wujin District

3.1. Overview of the TRRLS in Wujin District

Wujin district in Changzhou lies in China's economically developed southern Jiangsu province. It is one of the birthplaces of township enterprises and is representative of the southern Jiangsu model [52]. Since the 1980s, township enterprises have proliferated. At the end of 2019, there were about 25,200 industrial enterprises in Wujin [53], and the area of RCCCL is about 7300 ha [54]. However, before the reform, the development of township enterprises was seriously hampered by the lack of the right to benefit from and dispose of collective land, which hindered their listing, mergers and acquisitions, and mortgage financing. Meanwhile, private transactions involving RCCCL were widespread, the market was chaotic, collective asset losses were severe, and the problem of illegal land use was prominent due to the lack of legal support. Regarding rural homestead use, local farmers are generally urbanized on the spot, and many farmers have multiple homesteads or illegally built houses, while Wujin is an area with population inflow, which makes a great demand for homestead transfer. However, due to the lack of legal support for transferring homesteads, there are many private transfers and gray transactions, and the problems of homestead idleness and abandonment are becoming increasingly severe [52]. This rural residential land use morphology has seriously restricted the sustainable development of Wujin.

The above-mentioned problems pertaining to rural residential land are relatively common in the context of China's socio-economic transition, and there is an urgent need to promote the RRLUT through land system reform. Against this backdrop, Wujin district started the reform of the rural homestead system in February 2015 and began comprehensively promoting the TRRLS in September 2016 and took the lead in completing the TRRLS nationwide. Through the TRRLS, Wujin has made great achievements. For example, as of the end of 2019, the area of RCCCL entering the market in Wujin had reached 617.33 ha, accounting for 78% of the total area of that in the 33 pilot areas [53]. Meanwhile, Wujin released about 30 related policy documents and 40 supporting documents. It was also the first among the 33 pilot areas to make 12 breakthroughs, such as taking the lead in formulating a planning system with full spatial coverage, establishing a benchmark land price system with full urban and rural coverage, and equalizing rights and prices for rural collective and state-owned land [54]. Thus, Wujin district is very typical [52] and can be used as a case study of the impact of the TRRLS on RRLUT.

3.2. Rural Residential Land Use Morphological Characteristics before and after Reforms

3.2.1. Rural Residential Land Use Morphology before the TRRLS

Before the TRRLS came into effect in 2015, rural residential land morphology A in Wujin district showed the following characteristics.

In terms of the quantity structure, the demand for new urban land must be met through land requisition and the policy of "increasing vs. decreasing balance" concerning urban-rural construction land, while the management of new rural construction land (especially for homesteads) is strict; thus, some abandoned and inefficiently used rural residential land is repurposed as agricultural land, which decreases the proportion of rural residential land in urban and rural construction land. Moreover, the type of rural residential land used for industrial, mining, and commercial services is mainly stock land assigned long ago, with little new area, while land consolidation and "increasing vs. decreasing balance" land-use policy have reduced some idle rural homesteads. Thus, the proportion of homesteads in rural residential land has been slightly reduced. For example, from 2011 to 2015, through urban-rural "increasing vs. decreasing balance" land-use policy and the reclamation of abandoned industrial and mining land in Wujin, only 632.21 ha of rural construction lands were consolidated, and 595.17 ha of cultivated lands were added [55]. The reduction in rural residential land only accounted for 1.61% of the construction land in Wujin in 2015. From 2005 to 2015, the proportion of rural residential land in construction land decreased from 37.88% to 35.90%. However, the total area of both rural residential and construction land increased, though the growth rate of rural residential land was relatively slow.

In terms of spatial structure, most farmers' houses in Wujin were built in the 1990s. However, due to the lack of scientific planning and effective management at that time, the sites of homesteads and township enterprises were chosen arbitrarily, and occupation and construction were indiscriminate, so the spatial layout of rural residential land was relatively scattered. Although the rural residential land in the project area could be consolidated through the "increasing vs. decreasing balance" land-use policy, only minor change in the scattered layout has been effected due to the small number of "increasing vs. decreasing balance" projects and the difficulty of their implementation. Moreover, it is difficult to change the current situation of the scattered spatial distribution of rural construction land due to the lack of an effective homestead transfer and exit mechanism and a market entry mechanism for RCCCL. For example, the spatial layout of homesteads and RCCCL in Dacheng village in the town of Qianhuang is interlaced and scattered. Some residential lands are small in scale and have a high degree of plot fragmentation [56].

In terms of utilization efficiency, the rate of idle homesteads is high, the average homestead area per household exceeds standards, and some households have multiple homesteads due to the high urbanization rate of the rural population and the lack of an effective homestead transfer and exit mechanism. Although there has essentially been an approval moratorium on new homesteads since 2002, farmers have housing needs, so

they choose to either construct before getting approval, construct more than approved, or construct new houses without tearing down the old ones, all of which reduce the utilization efficiency of homesteads. For example, in Pu'an village, the homestead of each household is 200–500 m², which considerably exceeds the limit of 140 m² per household [52], and 40% are owned by households with multiple homesteads. In the town of Lijia, the idle homestead rate has reached 48.3%, among which the completely deserted ones account for 18.4% of the total [57]. Regarding RCCCL, there was about 5046.67 ha of collective industrial land in Wujin in 2014, accounting for 23% of the collective construction land. Due to the unclear property rights for some of the RCCCL and the lack of transfer regulations, the transfer of RCCCL is not standardized, and there are many illegalities, rendering it impossible to generate a reasonable price through market mechanisms; hence, the land value cannot be fully reflected in the price. Statistics show that the average transfer price of state-owned industrial land in Wujin is around CNY 3.9 million/ha, while that of RCCCL is CNY 1.05–1.50 million/ha. Lower prices are bound to lead to lower efficiency.

In terms of land use functions, pre-reform homesteads were mainly used to meet farmers' production and living needs. In other words, the main function of those homesteads was for living, plus some production functions, including agricultural production functions such as gardening and nonagricultural production functions such as home-based workshops. Nonagricultural production functions are less common, while agricultural production functions are more common. RCCCL is primarily used for industrial development and has nonagricultural industrial production functions. Furthermore, the transfer of rural collective construction land was limited due to the constraints of the rural land system, leading to its weak function as an asset. Overall, land use functions prior to the TRRLS were largely singular.

3.2.2. Rural Residential Land Use Morphology after the TRRLS

In terms of quantity structure, theoretically, the proportion of rural residential land in urban and rural construction land will stagnate in the post-TRRLS period, and the proportion of homesteads in rural residential land will continue to decrease. However, because the reforms have only been in effect for a relatively short period, the trend change in the quantity structure of rural residential land is not yet noticeable. Nevertheless, relevant cases still show changes. For example, amidst the reforms, Wujin has formulated a policy of guiding and incentivizing homesteads around the three modes of "keeping, staying, and transferring", thus forming a diversified subregional system of housing security for farmers based on monetary compensation in urban centers, apartments in market towns, and homesteads allocated in rural areas. Wujin has also formulated a policy of voluntary paid exits and transfer of homesteads to guide the exit of idle homesteads and their reclamation as cultivated land. From 2015 to 2020, about 1512 households voluntarily exited their homesteads in Wujin, and the vacated homesteads were mainly reclaimed as agricultural land [53]. Moreover, the village collective can increase a certain amount of RCCCL to meet industrial development needs, subject to meeting plans. Additionally, homesteads can be transformed into RCCCL and transferred. As a result, RCCCL increased, and the proportion of homesteads in rural residential land began to decline.

In terms of spatial structure, changes have also been relatively slow due to the involvement of complex issues such as stakeholder negotiations and property rights adjustments. As mentioned above, Wujin has gradually concentrated the layout of some of the homesteads through homestead guidance and incentive policies. For example, Wujin has formulated plans for 44 self-built peasant areas, of which construction has started on 19 [53], and the homestead area for each household ranges from 80 to 140 m² [52]. This makes homesteads more agglomerated and changes the originally scattered layout. For RCCCL, the spatial layout of this type of land changes more slowly because of the difficulty of relocating industrial plants and the complexity of land replacement. However, its layout will also tend to be concentrated through off-site adjustments for market entry. Therefore,

the spatial structure of rural residential land in the research area began to concentrate and become more compact after the TRRLS.

Changes in utilization efficiency are more apparent than the dominant morphology. With the implementation of the voluntarily paid exit and homestead transfer policy, some farmers rent their idle homesteads and houses to the nonlocals, earning annual rent income as high as CNY 10,000–20,000. Under the premise of retaining the nature of homesteads, some farmers hand over their idle housing to the collective, which then rents them to tourism operators. Regarding the per capita or average homestead, following the homestead guidance and incentive policy and the remediation of idle homesteads, homesteads in centralized residential areas are built according to the standard of being no more than 30 m² per capita and no more than 140 m² per household [52]. This has significantly reduced the idle rate of homesteads and improved the intensive level of land use. For example, post-reform construction land per capita in Qianhuang township reduced from 209 m² to 120 m². Hence, the problems of idle and larger-than-standard homesteads have begun to be solved, and utilization efficiency has been significantly improved. In terms of RCCCL, by virtue of the TRRLS, these lands have the same rights and prices as state-owned land, and the average income from these lands continues to increase. For example, before the reforms, the average annual land revenue of RCCCL in Lijia township was only CNY 13,500/ha, but after the reform, revenue could reach CNY 24,000/ha, and the income of village collectives and villagers has been improved [58]. In November 2019, a total of 6173.33 ha RCCCL in Wujin were listed, and the transactions amounted to CNY 11.78 billion [53]. Before the reforms, these lands were partially leased and partially idle, and revenue was low. Meanwhile, the utilization efficiency of RCCCL has also improved. For example, after Yaoguan township transferred the land to a company by agreement, the company was listed on the Shenzhen Stock Exchange for IPO in 2017 [59], which significantly improved the utilization efficiency of the RCCCL. Additionally, the TRRLS has also solved the historical problems faced by enterprises, such as unclear ownership of land assets and the inability to transfer in the market. Solving these problems has effectively promoted the rational flow and optimal allocation of land resources [60].

In terms of land use functions, the TRRLS have increased the value of collective construction land assets and enhanced the mortgage and asset functions of homesteads and RCCCL. Among the reforms, the RCCCL market reform has boosted listing and transition for enterprises, enabling them to obtain mortgage loans, which is conducive to increasing investment and output and job opportunities, thereby increasing collectives' and farmers' assets. For example, a company in Pu'an village could not apply for mortgage loans before the reforms because it rented collective land. However, after the reform, the company bid for the land it was using, which had acquired the same rights as state-owned land, allowing the company to secure loan funds. The company then invested CNY 50 million to transition to producing auto parts for new energy vehicles [61]. In terms of homesteads, through the reform of the separation of three rights (i.e., ownership, qualification, and use rights for rural homesteads) and the issuance of temporary pilot measures for agricultural housing mortgage loans, the usage rights for homesteads and housing ownership have mortgages, guarantees, and financing functions that solve the financing problems relevant to the issues relating to farmers, agriculture, and rural areas. As of the end of October 2020, Wujin processed a total of 80 rural housing mortgage loans, amounting to CNY 122 million [62]. These provide a guarantee for converting farmers' housing rights into property rights and expanding the agricultural production scale. Moreover, the collective rents some farmers' idle houses to tourism operators for agrotourism purposes, thus expanding the use and function of these homesteads. Additionally, Wujin has alleviated poverty by exploring the use of housing for old-age care [52], such as transferring the right to use the homesteads of households enjoying five guarantees to other operators and registering the real estate, with the transfer fee retained by the village committee and dedicated to the support and funerary expenses of households enjoying five guarantees, thus enhancing homesteads' social security function. Hence, the TRRLS have manifested

collective construction land assets and the functions of rural residential land for mortgages, social security, and nonagricultural production, as assets have been significantly enhanced and diversified.

In summary, the TRRLS in Wujin have caused rural residential land use morphology to gradually shift from type A to type B (Figure 3), which has the following attributes. The rate of decline in the proportion of rural residential land in urban and rural construction land has decreased, while the proportion of nonagricultural industrial land within rural residential land has increased. The spatial structure of rural residential land has trended toward concentration, the level of intensive utilization has increased, and the functions of land use, such as mortgages, social security, nonagricultural production, and property, have been significantly enhanced.

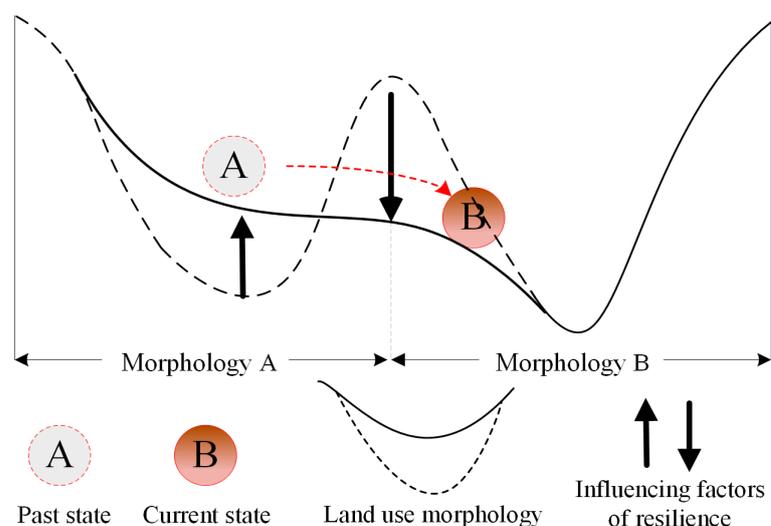


Figure 3. Rural residential land use transition under the TRRLS in Wujin. Note: A and B represent land use morphology types.

3.3. Impact Mechanism of the TRRLS on RRLUT in Wujin District

The RRLUT process in Wujin has been affected by internal and external factors, which together constitute the paths of socio-economic feedback and the ecological environment. The internal factors mainly comprise the following. First, the impact of population urbanization and migration. Given that Wujin has a developed economy and a sizeable nonlocal population, most local farmers have been urbanized, and idle homesteads are common. Objectively speaking, idle homesteads require asset value realization before withdrawal. Some farmers are unwilling to exit from their homesteads; instead, they hope to increase their income by transferring their homesteads through channels such as homestead leases or by investing in shares using homesteads. Under these circumstances, there is a real need for homestead transfer, exit, and consolidation. The second internal factor is village collectives' self-development needs. As the smallest administrative unit of economic development, village collectives need to seek economic development, and land is the basic resource. Thus, they require market access for the inefficiently used or idle RCCCL to form an effective supply for rural industries' development, so as to realize the value of land assets. The above two internal factors have weakened the resilience of the rural residential land use system under type A morphology, which promotes the dominant and recessive morphological transition of rural residential land.

External factors mainly comprise market and institutional factors. Regarding market factors, many nonlocals rent farmers' houses to reduce their cost of living, thus creating and sustaining market demand for rural homesteads and housing transfers. Meanwhile, there are many township enterprises in Wujin. However, some enterprises are on the verge of bankruptcy due to poor management, and some enterprises have idle or inefficiently

utilized land, while some are developing rapidly, but no additional land is available. In contrast, others cannot get financing or listed due to the collectively owned land, making a transition difficult. These all require that RCCCL directly goes on the market to create market supply with the same price and rights as state-owned land to achieve supply and demand coordination and land resource allocation optimization. Therefore, RRLUT in Wujin possesses strong market demand, and this demand has reduced the resilience of the rural residential land use system under type A morphology, which, in turn, has promoted the transition of rural residential land toward type B morphology.

Regarding institutional factors, homestead and RCCCL transfers are necessary with growing urbanization, whether from the perspective of farmers, village collectives, land-using enterprises, or market supply and demand. Before the reforms, there was a lack of institutional support for transferring homesteads and RCCCL, which made it difficult to revitalize inefficient rural construction land resources and effectively improve the rural residential eco-environment, so crossing the threshold from type A to type B morphology was difficult. Through the TRRLS, Wujin has issued relevant policy documents, which have removed obstacles for the exit and transfer of homesteads and the market entry of RCCCL, and promoted the effective supply and demand in the rural construction land market. For example, it is clearly stipulated that land can only be requisitioned under 21 specific categories of 6 major categories. Other projects can meet their demand for land through the RCCCL market [53], which shifts part of the land demand in the state-owned land market to the rural construction land market. The implementation of policies such as farmers' self-built areas and ecological consolidation of territorial space has comprehensively improved the rural residential eco-environment [54]. Therefore, the TRRLS in Wujin are crucial to transforming the land use system from type A to type B morphology by removing institutional barriers to RRLUT and reducing the resilience of the rural residential land use system under type A morphology. However, the transition is ongoing. Although the recessive morphological transition is significant, the dominant morphological transition is relatively slow. This is because factors such as the relatively short period for which the reforms have been in effect, the traditional rural concept of unwillingness to leave the original homestead, and the difficulty of relocating industrial enterprises have all delayed the evolution of rural residential land use in terms of scale and spatial layout. Therefore, RRLUT in the study area will continue for some time.

4. Discussion

4.1. The Reason for Expanding LUT Theory from a Regime Shifts Perspective

LUT has become a key research topic in the field of land system science [63], which focuses on studying land use changes from a land use morphology perspective. However, there is currently a limited understanding in academia that equates LUT with land use change [39]. This is because the current interpretation of the concept of LUT remains relatively abstract. Since the land use system is a complex natural ecological and economic system, it is easier to understand LUT from a systems perspective, and the land system science can provide theoretical guidance for LUT research [64]. Some studies have realized that LUT resembles regime shifts in land systems [40]. In fact, Müller et al. [41] studied the limitation of regime shifts on predicting land system change based on related research on land use systems in adjacent areas of four Southeast Asian countries and confirmed the presence of regime shifts in land use systems in three regions and that these regime shifts are essentially land use morphological transformations. As such, regime shifts and LUT can be regarded as the same. Therefore, this study uses regime shifts in complex systems theory to further expand the conceptual model and the understanding of characteristics of LUT. This can not only deepen the theory of LUT but also expand the understanding of the mechanism of LUT; that is, the land use system is resilient, and the relevant driving factors in the process of LUT can change the land use system's resilience and lead to changes in land use morphology.

4.2. Impact Mechanism of TRRLS Measures on Rural Residential Land Use Morphology

The above analysis shows that the current changes in the dominant morphology of rural residential land are not sufficiently apparent. This is because, except for the homestead changes caused by the implementation of residence centralization and consolidation, the changes in other homesteads will take decades or even longer to take effect. Additionally, land requisition is gradual, the development of rural industries takes a long time, and the potential of RCCCL stock can still be tapped. Moreover, the TRRLS have only been in effect for seven years. Therefore, trend changes in the spatial layout of rural residential land and its internal structure are unnoticeable. However, due to factors such as socio-economic development, resources and the ecological environment, and the TRRLS, the rural residential land use morphology has begun to change, with the TRRLS playing a pivotal role. Related studies have also confirmed that the TRRLS have improved rural land allocation efficiency and collective welfare in villages [65–67] while also revitalizing idle rural land resources [52], which indicates that the TRRLS have significantly affected RRLUT, especially in terms of recessive transitions.

Long et al. [7] argued that the land management system has a direct impact on the LUT, and the fact that the land use morphology does not adapt to socio-economic development reflects that relevant institutions no longer adapt to the development; thus, it is necessary to adjust the relevant systems and policies. In reality, land use morphology should have positively transitioned following the socio-economic transition during the evolution of the land system. However, as the original land system no longer fit with socio-economic development, the land use morphology underwent a negative transition that was not conducive to socio-economic development, and the unreasonable land system fortified negative land use morphology to maintain strong resilience, making the transition to positive land use morphology difficult. This institutional obstacle was eliminated only when the land system was reformed, allowing the land use morphology to transition into a positive one. The essence of the intervention of the TRRLS in the rural residential land system is to take new policy measures to intervene in land use morphologies that are not conducive to socio-economic development and transform them into morphologies that are conducive to sustainable development in the process of the TRRLS. Therefore, it is necessary to further discuss the impact mechanism of the TRRLS measures on rural residential land use morphology (Figure 4).

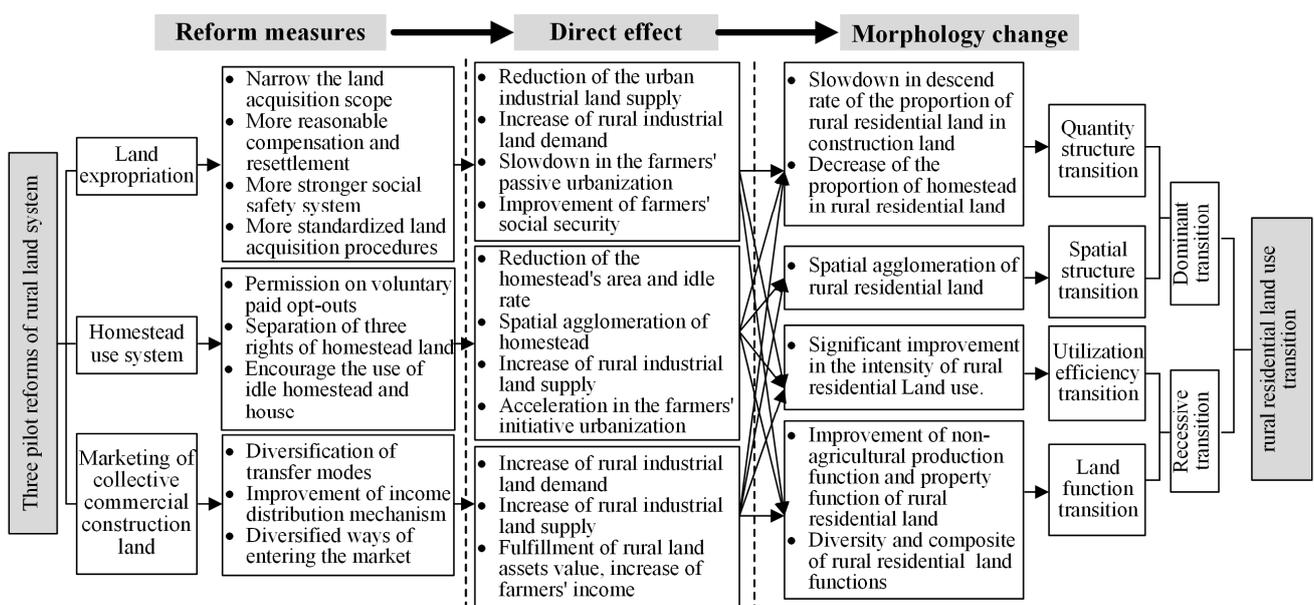


Figure 4. Impact mechanism of TRRLS measures on rural residential land use morphology.

Land requisition system reform has adopted measures such as narrowing the scope of land requisition, raising resettlement and compensation standards, improving the social security system, and standardizing land requisition procedures [68], allowing part of the land use demand outside the scope of land requisition to be satisfied through the market entry of RCCCL and encouraging the passive urbanization of farmers caused by land requisition slowdown while also stimulating demand for rural industrial land. Consequently, it slows the decline in the proportion of rural residential land in urban and rural construction land, increases the proportion of nonagricultural industrial land within rural residential land, improves the intensive utilization of rural residential land and the nonagricultural production function of rural construction land, and manifests the asset function, thus promoting the dominant and recessive transition of rural residential land.

The reform of the homestead use system involves the paid exit and transfer of homesteads and the separation of three related rights [52]. It can encourage farmers to exit vacant homesteads and actively integrate into the city, thus effectively reducing the homestead vacancy rate. At the same time, scattered homesteads are concentrated through means such as comprehensive rural land consolidation and the relocation of villages. Part of the vacated construction land quota are used for rural secondary industries and urban development [67] so as to reduce the proportion of rural residential land in construction land and that of residential land in rural residential land, as well as optimize and concentrate the spatial layout of rural residential land. Additionally, due to the consolidation of vacant homesteads, the agglomeration of rural residences, and the development of rural industries, the utilization intensity of rural residential land shifts from the previous declining trend to a continuous increase, and the land use function also changes. Therefore, the reform of the homestead system can effectively promote the dominant and recessive transition of rural residential land.

The RCCCL market entry reform allows RCCCL to enter the market directly by means of transfer, lease, etc., with the “same price and same rights” as state-owned land. This facilitates the revitalization of idle or inefficiently used land assets [69], improves the nonagricultural production and asset functions of RCCCL, and continuously increases village collectives’ and farmers’ income. Secondly, the internal structure of rural residential land undergoes significant change due to the reduction in homesteads and the increase in land for rural secondary and tertiary industries. Third, under the reform, means such as off-site adjustments for market entry to centralize the originally scattered RCCCL layout change the spatial structure of rural residential land. Fourth, following the market entry of RCCCL, land investment and income will significantly increase due to higher land prices, which will, in turn, significantly increase intensive land utilization. Therefore, RCCCL market entry reform can promote the dominant and recessive transition of rural residential land in terms of quantity structure, spatial structure, utilization efficiency, and land use functions.

4.3. Limitation and Future Research

From the perspective of regime shifts, this paper analyses the impact mechanism of the TRRLS on RRLUT by using Wujin district as a case study. Although the results show that the TRRLS have played a great role in the process of RRLUT, the relevant policies and institutions in the current reform are still not perfect, and there are also many problems in the reform process [68]. In particular, different regions are at different stages of economic development with different resource endowments and social characteristics, and the regional land use morphology may be different accordingly [7]. As a result, the effects of the TRRLS on RRLUT in different regions will be different to a certain extent. Therefore, it is necessary to carry out a comparative case study on the effect of the TRRLS on RRLUT in different regions in the future.

Meanwhile, as data related to the TRRLS are considered sensitive [70], even though we collected data through multiple means such as field surveys, interviews, and the Internet, some detailed data are impossible to obtain. Thus, it is difficult to quantitatively analyze

the specific characteristics of dominant and recessive transitions. Consequently, the RRLUT mechanism is only qualitatively analyzed in this paper, and in-depth research is required. Additionally, based on the expanded LUT theory presented in this study, it is necessary to analyze in depth the resilience and tipping points of the land system to reveal the mechanism and laws of LUT at a deeper level so as to provide a basis for land system and policy optimization.

5. Conclusions

LUT is an important research element of the Global Land Project, and the improvement of its theory is crucial for carrying out related studies. As the land use system is a typical complex system, it is necessary and feasible to improve the LUT theory from the perspective of regime shifts in the complex systems theory. Meanwhile, the transition of rural residential land, which is one of the important parts of LUT, has a profound impact on sustainable development in a country, especially in developing countries. Thus, how to promote the effective and positive transition of rural residential land use morphology is an important issue that must be considered in a country's land system reform and policy formulation.

Our goal in this study was to improve the LUT theory via deepening the conceptual model and the understanding of characteristics of LUT from a regime shifts perspective of complex systems. We constructed a theoretical analysis framework to detect the impact mechanism of the TRRLS on RRLUT by taking Wujin district in Changzhou, China as a case study. From the perspective of regime shifts, LUT can be understood as the transition of the land system from one regime to another, and the research on LUT needs to set a perspective because land use morphology can be judged from different perspectives. Moreover, three characteristics were proposed, i.e., the LUT process can simultaneously involve dominant and recessive morphology transitions or solely involve either one; the types of LUT can be divided into positive and negative transitions; and LUT in different regions may show processual differences and convergence in results due to differences in the socio-economic characteristics and resource endowments. Empirical evidence shows that, under the TRRLS, rural residential land in Wujin district has undergone a significant transition in recessive morphologies such as land use efficiency, optimal allocation, and land function improvement. In contrast, the transition in dominant morphology in terms of land quantity structure and spatial distribution is relatively slow. Moreover, the two internal factors of population urbanization and migration and the demand for rural collective economic development, as well as the two external factors of the TRRLS and market factors such as the demand for housing for nonlocals and the demand for land for rural enterprises have together weakened the resilience of the land use system under type A morphology, which is conducive to transitioning rural residential land from type A to type B morphology. However, removing the institutional barriers to transition through the implementation of the TRRLS is key to RRLUT in the study area.

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