

Appraisal of typical rural development models during rapid urbanization in the eastern coastal region of China

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Abstract: The sustainability of regional rural development depends on the integrated status and the coordination between rural resources-environment conditions and rural socio-economic development. In this paper a diagnostic indicator system is proposed to appraise four representative rural development models such as Mentougou model, Taicang model, Yueqing model and Qionghai model in the eastern coastal region of China from the integrated perspective of population, resources, environment, and development. In conclusion, the formation and evolution of these diverse rural development models are the direct response to the very different characteristics in the environment, market demand, and regional culture. These models are common in that their sustainability depends on the scientific guidance of the regional development functional positioning, strong intra-regional interactions, and self-adaptability to the external conditions.

Keywords: rural development model; urbanization; coordinated development degree; the eastern coastal China

1 Introduction

Urban and rural areas are the two entities that interact with and mutually influence each other in regional development. The maintenance of a reasonable equilibrium and interactive relationship between them is the fundamental prerequisite of accomplishing coordinated development of urban and rural areas (Wu, 2001; Liu, 2007). Historically, the urban and rural areas have been separated as two unrelated entities in Chinese economic development. Consequently, the gap between rural and urban China is gradually enlarged. For instance, the income ratio of urban residents to rural residents was 2.37:1 in 1978, 2.79:1 in 2000 and 3.33:1 in 2007. Associated with this income gap are the different living standards, life quality, and public service. How to coordinate and harmonize the relationship of urban and rural

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areas is an important topic in ensuring the healthy development of national economy. Differential and uncoordinated development between urban and rural areas has taken place at various development stages not only in highly developed countries such as the U.S. and the U.K. but also in newly industrialized countries such as South Korea. In the worse case villages were withered with the advent of “empty villages”. The main solution to these problems lies in new rural regional policies and plans aimed at revitalizing rural areas.

Over the last few decades many scholars had interest in studying farmer income and non-agricultural employment (Rozelle, 1996; Mukherjee, 2002), the migration of rural labor force (Sharma, 2006; Tao and Xu, 2007; Chen *et al.*, 2008), the multi-functional agriculture in Europe (Potter and Tilzey, 2007; Marsden and Sonnino, 2008), the allocation of rural resources (Xie *et al.*, 2005), and the nature and process of change in rural China at different scales and from a variety of perspectives (Xu and Tan, 2001; Long *et al.*, 2009). However, how to categorize rural development is the core topic in the current research agenda of agriculture and rural development. A literature survey reveals that most studies on rural development have focused mainly on classification, evolution, and analysis of the characteristics of typical models rather than a comprehensive and systematic diagnosis of typical models (Liu *et al.*, 2005). Such systematic studies require an interdisciplinary approach that involves social science, resource and management science, geography, and economics. This approach emphasizes natural and socioeconomic factors in the evolution and functioning of rural development models, such as geographical bases and process, and hence requires the integrated consideration of the process with the outcomes of development (Liu *et al.*, 2008).

Categorization of rural development models is fundamental to theorizing rural development models and to identifying the most appropriate model for regions with similar environmental and economic settings (Liu, 2007). The purpose of this study is to theorize representative rural development models in the eastern coastal China by tracking their evolutionary trajectory so as to identify the factors for their success and the barriers ahead. The geographical characteristics of all representative models are systematically summarized and generalized. Through this comprehensive appraisal, this study aims at revealing the barriers that must be overcome before they can be applied successfully elsewhere for constructing “new countryside” in China, and points out the direction of further model optimization.

2 Study area and data sources

2.1 Study area

The eastern coastal region of China covers ten provinces and municipalities of Beijing, Tianjin, Hebei, Shandong, Shanghai, Jiangsu, Zhejiang, Guangdong, Fujian and Hainan. This region lies at the forefront of economic reform and opening up to the outside world. It has also been selected as a key demonstrative base to implement a number of rural development strategies, and to construct a new countryside in China (Long *et al.*, 2009). In this region diverse kinds of rural development models have been experimented, each having its own unique characteristics. These models are the important objects of study and resources for searching for the most appropriate rural development model for a given region.

There are huge disparities between urban and rural areas in their development level in the eastern coastal region. Such disparities dictate the complexity of rural development characteristics and the diversity of their development models. In accordance with the principle of capturing different rural development models, adequate representation of the three main regions (Bohai Rim Region, Jiangsu–Zhejiang–Shanghai Region, Fujian–Guangdong–Hainan Region) in the appraisal, and a frame to compare different models within the same geographic area, the following four distinct rural development models have been theorized as the typical cases in this research: The Mentougou model is proposed to represent the rural development model of ecologic rehabilitation in the mountainous area of Beijing; The Taicang model is proposed for collective economy in southern Jiangsu Province; The Yueqing model of Zhejiang Province is theorized for individual enterprises-dominated economy; The Qionghai model in Hainan is proposed for tropical agriculture dominant economy (Figure 1).



Figure 1 Location of the study area

2.2 Data Sources

All socioeconomic data used in this study were derived from the 2007 statistical yearbook of respective cities. The water resources data were collected from the “Natural Resources Database of China” and the statistics of local Water Affairs. Data on land use were gleaned from the reconnaissance investigation into land utilization in 1990, and detailed investigations in land use and land change in 1996 and 2006, and other data gathered from relevant surveys.

3 Appraisal methods

3.1 Establishment of an appraisal index system

Analysis of the rural development system shows that resources and the environment are the backbone system, while rural socioeconomic system is the carrier (Zhang and Liu, 2008). The rural socioeconomic system exerts a certain pressure on the resources-environment system that is opposite to its supporting force. In the process of rural development, humans pursue socioeconomic development via incessant extraction of resources from the natural environment system that may cause pollution or devastation to it. Based on the level and intensity of the interactions between the socioeconomic system and the resources-environment system, four scenarios of regional rural development have been generalized, namely, elementary development stage, fast development stage, optimally adjusted stage, and highly harmonized development stage (Figure 2). Each scenario has its own unique characteristics and corresponds to a certain rural development strategy (Table 1).

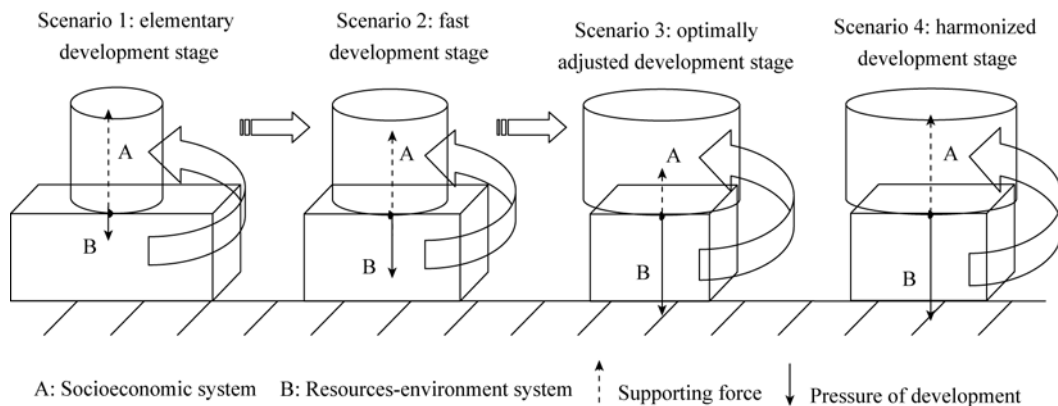


Figure 2 The evolutionary process of regional rural development stages

Table 1 Characteristics and adjustment directions of different rural development evolutionary stages

Scenarios	Types	Relationship of driving forces	Fundamental characteristics and adjustment directions
Scenario 1	Elementary development stage (Socioeconomic development lagging behind type)	$A \ll B^*$	This stage has a relatively great potential for development. Development should aim at accelerating the pace of incubating new industries, and strengthening the exploitation of natural resources in order to maximize rural socioeconomic development using the regional strategies.
Scenario 2	Fast development stage (Socioeconomic development lagging behind type)	$A < B$	At this fast development stage, the supporting capability of resources-environment is slightly reduced, and the development potential is diminished. Development strategies should attempt to protect the resources-environment during exploitation via enacting relevant policies and engineering projects, elevate self-supporting capability, and promote harmonized and coordinated development of the rural system.
Scenario 3	Optimally adjusted stage (Resources-environment lagging behind type)	$A > B$	In this form development is unsustainable. Excessive depletion of the resources-environment far exceeds the carrying capacity. Thus, high energy consuming industries should be replaced with circular economy. Besides, the resources-environment should be protected. The supporting capability should be lifted with the assistance of intra-regional transfer of technologies and capitals so as to broaden the space for regional development.
Scenario 4	Harmonized development stage (Synchronized socioeconomic development and resources-environment type)	$A \approx B$	After optimal adjustment the rural development system evolves to the highly harmonized mutually beneficial stage. Guided by the philosophy of circular economy, rural industries are dominated by eco-agriculture, new industries and eco-tourism. Rural industrial layout is composed of industrial park areas and large-scale agricultural areas, in addition to communal residential areas.

*: A and B are defined in Figure 2.

Each development model is matched with distinct rural resources-environment conditions and socioeconomic development level. Regional rural development is essentially a process in which the socioeconomic system is increasingly and progressively strengthened while the resources-environment system is constantly eroded. The process continues until socioeconomic development reaches a moderate level while the resources-environment system is being gradually protected until the highly harmonized stage at which both systems of socioeconomic development and the use of resources-environment are mutually harmonized. An

appraisal indicator system of regional rural development models has been constructed based upon the consideration of model maneuverability, dynamics, scientific validity, and comprehensiveness.

3.2 Data standardization and weighting

The raw data were standardized, and the Delphi method in combination with the Analytic Hierarchy Process (AHP) was used for determining weights assigned to each appraisal indicator in three rounds (Table 2).

Table 2 The appraisal indicator system and weight assignment in regional rural development models

Target stratum	Criterion stratum	Indicator stratum
Regional rural development models	Condition of rural resources-environment	Water availability per capita (0.32)
		Cultivated land per capita (0.19)
		Proportion of forest coverage (0.24)
		Use of fertilizers equivalent per unit cultivated area (0.14)
		Use of pesticides per unit cultivated area (0.11)
		Proportion of urban population (0.08)
	Condition of rural socio-economic development	Income ratio of urban to rural areas (0.10)
		Engel coefficient of rural residents (0.15)
		Gross income of rural areas (0.23)
		Net income per farmer (0.21)
		Output of primary industry (0.05)
		Output of rural industries (0.12)
		Proportion of forestry, animal husbandry, fishery, and tertiary industry in the gross output of agriculture (0.06)

A questionnaire containing more than 22 indicators that were deemed important and relevant to rural development was sent to 20 experts in geography and agro-economy to solicit their feedback on the significance of these indicators. Also contained in the questionnaire were suggestions for more important indicators. The results of the first round were fed back to the experts to confirm their identification. After this round a total of 13 indicators in two broad categories were determined (Table 2). The importance of these selected indicators was ranked. In the third round, a weight was assigned to each of the 13 selected indicators, with all the weights summing up to 1.

3.3 Appraisal aspects

The diagnosis of regional rural development can be accomplished from the following four aspects: rural socioeconomic development and resources-environment, overall effect of rural development, coordination between rural socioeconomic development and resources-environment, and comprehensive level of rural development overall effect and coordination degree (or sustainability of rural development models appraisal model) (Zhang and Liu, 2008).

- (1) Appraisal of rural socioeconomic development and resources-environment

$$F(x) = \sum_{i=1}^m w_i f_i \quad G(y) = \sum_{i=1}^n p_i g_i \quad (1)$$

where f_i and g_i stand for the standardized values of rural socioeconomic development and rural resources-environment appraisal indicator, respectively; w_i and p_i stand for their weight, m and n are the numbers of evaluation indicators, respectively; $F(x)$ and $G(y)$ are the results of rural socioeconomic development and rural resources-environment appraisal functions, respectively.

(2) Appraisal of overall effect of rural development

$$T = \alpha \times F(x) + \beta \times G(y) \quad (2)$$

where T stands for the value of overall effect of rural development appraisal model, α and β are unknown coefficients; since rural socioeconomic development level and resources-environment level are equally important in rural development, $\alpha = \beta = 0.5$;

(3) Appraisal of coordination degree between rural socioeconomic development and resources-environment

$$C = \left\{ \frac{F(x) \times G(y)}{[(F(x) + G(y)) / 2]^2} \right\}^K \quad (3)$$

where C stands for the coordination degree between rural socioeconomic development and resources-environment; K is a coefficient with a general value of $2 \leq K \leq 5$. In this study $K = 2$;

(4) Appraisal of comprehensive level of rural development overall effect and coordination degree (or sustainability of rural development models)

$$D = \sqrt{C * T} \quad (4)$$

where D stands for the comprehensive level of rural development, including the rural development overall effect and coordination degree. It reflects the sustainability of rural development models indirectly.

4 Results and analysis

4.1 Appraisal results

(1) The Mentougou model

This region has a very good overall condition, with a high degree of coordination (0.2454) between rural resources-environment and rural socioeconomic development. However, the overall effect of rural development is not significant. In particular, the level of rural socioeconomic development needs further improvement. In recent years the ecoenvironment of the rural area in Mentougou has been considerably improved after restorative ecoenvironmental projects were implemented in the mountainous areas, with the rapid development of urban, ecological, characteristic industries. Its rural area is currently at the fast development stage, and has a very large potential for further development (Figure 3).

Analysis of the contribution rate of various rural development elements shows that the area has a favorable rural ecoenvironment, with a contribution rate as high as 54.83% thanks to the completion of the ecological rehabilitation projects. Such an ecoenvironment becomes

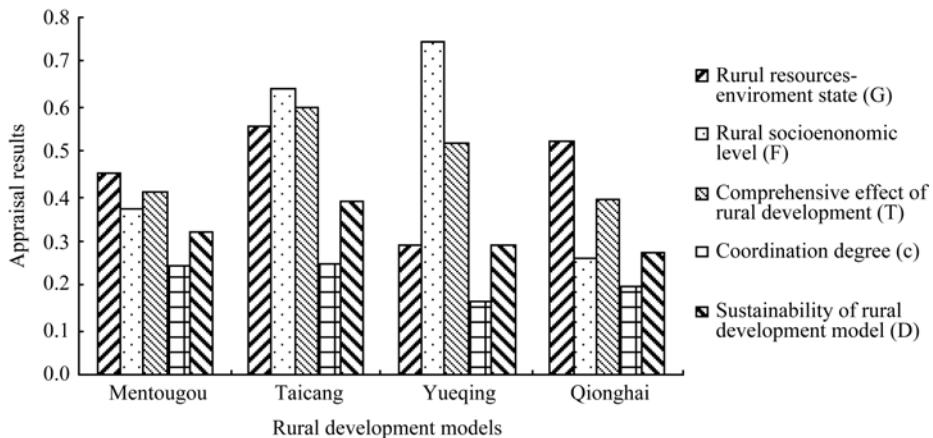


Figure 3 Appraisal results of four rural development models in the eastern coastal region of China

the highlight of this model and a critical element for further economic development. Meanwhile, various characteristic ecologic industries have been gradually growing at a healthy pace, which has significantly lifted the development level of the rural economy with a contribution rate of 31.10%. Both the proportion of urbanized population and the living standard of rural residents are relatively high owing to the impetus from the surrounding metropolitan zone. The Engel coefficient of rural residents is 32.90%. Nevertheless, the income gap between urban and rural residents with a ratio of 2.12:1 in 2006, which is only lower than Qionghai City, remains to be narrowed. Of particular notice are the poor conditions of rural natural resources, such as the limited amount of cultivated land resources per capita, a severe shortage of water availability, and the scarcity of space for expanding both agricultural production and urban development. These limitations will impose a severe hindrance on the rapid socioeconomic development in the future.

In future development the emphasis should be placed on the rehabilitation of the ecologic condition based on rural natural resources. The distinct features of the ecoenvironment should be cultivated in order to further enhance the overall effect of rural development, especially the level of rural socioeconomic development. The main optimal adjustment direction of this model is to steer the development of the countryside towards the highly harmonized stage. In addition, more efforts should be made to remedy social inequality in rural areas, and to explore means for centralized intensive and efficient utilization of land and water resources.

(2) The Taicang model

Of all the economic development models in China, the Taicang model spurred by collective economy is one of the most vibrant. The overall effect of rural development (0.5974), coordination degree (0.2477), and comprehensive level of coordinated development (0.3847) of this model are much superior to those of other three models. Its rural development has reached the optimally adjusted stage of the resources-environment lagging behind type.

The Taicang region is located in the Yangtze River Delta plain where there are abundant water and arable land resources. They lay a favorable resources foundation for rural development as testified by the high contribution ratio (28.69%) of rural resources. The collective economy model originating from southern Jiangsu Province has a very strong and powerful

base in the countryside. It has created a wonder in the history of rural development in China. The high contribution ratio (40.94%) is the most noticeable strength of this model. By comparison, both the rural social development condition and the environmental condition need further improvement. The income ratio of urban to rural areas is 2.06 in 2006, which has some distance from the overall strategic objective of coordinated development between urban and rural areas. Besides, a relatively large quantity of chemical fertilizers and pesticides are used. And there is a relatively low proportion of forest coverage.

In the future the philosophy of development should be gradually transformed. This regional development model should be adapted and optimized in accordance with the regulations of the market economy. Small-scale, disorganized, and inefficient production projects in the rural area should be phased out so as to integrate the spatial distribution of rural industries. A new industrial system featuring the interactions between urban and rural areas, and the linkage between agriculture and industry should be constructed. Moreover, the resources-environment should be strictly protected even further. More emphasis should be placed on remedying the rural social inequality issue and construction of the ecoenvironment, and lifting the overall supporting capability of the resources-environment to reach the advanced stage of harmonized development between rural resources-environment and socio-economy.

(3) The Yueqing model

The appraisal results of this model indicate that region's rural socioeconomy is highly developed (0.7455), the highest among all four models. Owing to the very poor rural resources-environment condition (only 0.2929), and the low level of coordination between rural resources-environment and socioeconomy (0.1640), the rural comprehensive coordination has a low degree of development. Rural development has entered the fast development stage of the resources-environment lagging behind type (Figure 3).

The outstanding characteristic of this model is the highly prospering rural economy that has a contribution ratio as high as 58.16%. Rural industries are well developed, creating an output valued at 7624.4 million yuan. The gross income of rural areas is high at 7245.0 million yuan, and the net income per farmer stood at 9332 yuan in 2006, the highest in China. However, the rural resources infrastructure is rather inadequate, having a contribution ratio of only 8.98%. In particular, there is a dire scarcity of arable land. These two are the chief weaknesses of this model.

The Yueqing model has not only activated the huge potential of rural development, but also pioneered a new path of rural development by means of integrating essential productive forces such as the rural labor force, capitals, and other basic production elements for a long period. In this model local cultural traditions of doing business have been fully exploited. Economic growth is driven by following the market-oriented and export-oriented development path. This model can serve as a useful reference for rural development in other areas where the resources condition is even poorer. In the future attention should be directed at establishing a spatially congregated arrangement of rural individual industries and a coordinated spatial layout of regional industries so that limited land resources can be economically and intensively utilized. The issue of social inequality in the development needs also redress.

(4) Qionghai model

The Qionghai model is dominated by tropical agricultural production that has a low level

of development. Its rural development overall effect is about the average (0.3927), and its rural socioeconomic development lags especially behind (only 0.2601). There is a low level of coordination between rural resources-environment and socioeconomic development (0.1963). However, it has an advantageous rural resources-environment (0.5253), which is far better than the socioeconomic development level. The countryside lies at the elementary development stage, having a socioeconomic development lagging behind type. Thus, it has a great potential for further development (Figure 3).

Of the four rural development factors, rural resources foundation makes the largest contribution to rural comprehensive development (49.90%), followed by rural social development condition (26.74%), environmental condition (16.98%), and economic development level (6.38%). Located in the subtropics, this area has abundant water resources. As a consequence of delayed industrialization and urbanization, most cultivated land has been well preserved. These two aforementioned strengths supply favorable supports for rural development. Rural development faces the major problem of a relatively low level of economic development. In particular, rural industries have barely developed. The living standard is rather low with a large gap between urban and rural areas, the income ratio of urban to rural residents being 2.11:1.

The chief strength of this model lies in the favorable natural resources-environment and the great potential for rural development. Its weakness is that the rural socioeconomic development is still at the initial stage. In particular, non-agricultural industries have a rather low level of development. In the future the pace of industrialization and urbanization should be accelerated so as to stimulate rural development. Agricultural structure should be adjusted with strengthened efforts to transform the traditional agricultural production based solely on farming into a comprehensive modern agricultural system that includes farming, animal husbandry, aquaculture, and forestry. Efforts should be directed at establishing and promoting brands of characteristic agricultural products, and developing a brand-oriented economy. The industrial production system should be further expanded to develop agricultural industries and to foster rural industrial development, and ultimately to accomplish the overall prosperous development of rural industries. At the same time the distribution network of agricultural products should be further perfected.

4.2 Analysis of commonality, external environment and inner drivers of the models

The evolution and functioning of different rural development models are an outcome resulted from the interactions of different kinds of internal variables with the external environment. These models have not only their own unique characteristics but also share certain commonalities among them. Based on the above appraisal results, the differences and commonalities of the four models are summarized in Table 3. It serves as an important and useful reference for developing new types of rural development models and for modifying existing models.

5 Conclusions and discussion

- (1) In this paper the rural development models during rapid urbanization in the eastern

Table 3 Dissimilar external conditions and internal drives, and commonalities of rural development models

Models	Dissimilarities		Commonalities
	External environment	Internal drives	
Mentougou	External demand of its regional development functional positioning, powerful market demands of the Beijing metropolis	Favorable ecological environment conditions, strong regional cultural traditions	Scientific guidance of regional development functional positioning
Taicang	Gradient shift of international industries, huge demand of the external market, radiative drive from Shanghai City	Favorable humanistic traditions and resources condition	
Yueqing	Enormous market demands from home and abroad	Favorable humanistic tradition	Strong intra-regional interactions
Qionghai	Superior geographic location, requirement of regional development functional positioning, and huge market demands of tropic agricultural products	Superior tropic agricultural production environment, eco-environment conditions, diverse and exotic folk cultures, and rich scenic tourism resources	Sound adaptability and self-adjustment ability to the external environment

coastal region of China are theorized from the comprehensive perspective of regionalism, dominance and constraints. A total of 13 factors in two categories of condition of rural resources-environment and condition of rural socioeconomic development were used to diagnose four representative development models. An appropriate appraisal indicator system is proposed for the quantitative evaluation of these models. Diagnostic analysis of these four typical models reveals the functional strengths and weaknesses of each model, with the commonalities, disparities, external conditions, and the internal drives of various rural development models summarized, categorized, and compared with one another. The geographical characteristics of each model and its evolutionary trajectory are elucidated. This study has diversified the methodology and enriched the content of theoretical research on rural development.

(2) The Mentougou model has a good overall performance, but the level of rural socioeconomic development remains to be improved. The Taicang model is the most vibrant, with its overall effect of rural development, coordination degree, and comprehensive level of coordinated development superior to those in other three models. However, the condition of rural social development and environment needs further improvement. The rural social-economy guided by the Yueqing model is highly developed. Nevertheless, its rural resources-environment condition is poor, and it has a low level of coordination with rural development. Therefore, further development effort should concentrate on rationalizing the layout of rural individual-owned enterprises, and centralizing the efficient utilization of land resources. The Qionghai model lies at an early stage of low level development. Its rural socioeconomic development lags behind, in huge contrast to its favorable rural resources-environment. It has a great potential for further development. Thus, the development emphasis should focus on acceleration of modern tropical agricultural industries, and expanding the distribution network system for agricultural products. These models can serve as the demonstrative case for “constructing new countryside” in geographic regions of a similar condition. It serves as an important and useful reference for developing typical types of rural development models in different geographic areas on the basis of their unique settings and advantageous resources.

(3) Sustainable rural development models cannot be achieved without the scientific guid-

ance of the regional development functional positioning. These models must possess a strong component of spatial rationalization and exhibit flexible environmental adaptability. The diversity in the characteristic of rural development models stems from the difference in the natural and cultural settings of a region, the demand of the external market, and the drives of internal factors.

(4) Rural development models are diverse and complex. They vary considerably in their evolutionary background and characteristics of functioning mechanism. Such a complexity and diversity makes it highly challenging to theorize every possible model, and carry out diagnosis for each of them. The establishment of the appraisal indicator system and selection of the appraisal method needs further improvement in the future by considering more diagnostic factors and more precise assessment of their importance in the diagnosis. Besides, the categorization and analysis of geographical characteristics of each rural development models also require further improvement.

References

- Chen H Y, Jia B S, Lau S S Y, 2008. Sustainable urban form for Chinese compact cities: Challenges of a rapid urbanized economy. *Habitat International*, 32(1): 28–40.
- Liu Yansui, 2007. Rural transformation development and new countryside construction in eastern coastal area of China. *Acta Geographica Sinica*, 62(6): 563–570. (in Chinese)
- Liu Y S, Wang D W, Gao J, 2005. Land use/cover changes, the environment and water resources in Northeast China. *Environmental Management*, 36 (5): 691–701.
- Liu Y S, Wang L J, Long H L, 2008. Spatio-temporal analysis of land-use conversion in the eastern coastal China during 1996–2005. *Journal of Geographical Sciences*, 18(3): 274–282.
- Long H L, Heilig G K, Li X B *et al.*, 2007. Socio-economic development and land-use change: Analysis of rural housing land transition in the transect of the Yangtze River, China. *Land Use Policy*, 24(1): 141–153.
- Long H L, Liu Y S, Wu X Q *et al.*, 2009. Spatio-temporal dynamic patterns of farmland and rural settlements in Su–Xi–Chang region: Implications for building a new countryside in coastal China. *Land Use Policy*, 26(2): 322–333.
- Marsden T, Sonnino R, 2008. Rural development and the regional state: Denying multifunctional agriculture in the UK. *Journal of Rural Studies*, 24(4): 422–431.
- Mukherjee A N, Kuroda Y, 2002. Convergence in rural development: Evidence from India. *Journal of Asian Economics*, 13(3): 385–398.
- Potter C, Tilzey M, 2007. Agricultural multifunctionality, environmental sustainability and the WTO: Resistance or accommodation to the neoliberal project for agriculture. *Geoforum*, 38(6): 1290–1303.
- Rozelle S, Boisvert R N, 1995. Control in a dynamic village economy: The reforms and unbalanced development in China's rural economy. *Journal of Development Economics*, 46(2): 233–252.
- Sharma D K, Ghosh D, Alade, J A, 2006. A fuzzy goal programming approach for regional rural development planning. *Applied Mathematics and Computation*, 176(1): 141–149.
- Tao R, Xu Z G, 2007. Urbanization, rural land system and social security for migrants in China. *Journal of Development Studies*, 43(7): 1301–1320.
- Wu Chuanjun, 2001. Problems of the Sustainable Development of Agriculture and Rural Economy in China: Case Studies of Agricultural Areas of Different Types. Beijing: China Environmental Science Press. (in Chinese)
- Xie Y, Yu M, Tian G *et al.*, 2005. Socio-economic driving forces of arable land conversion: A case study of Wuxian City, China. *Global Environmental Change*, 15(3): 238–252.
- Xu W, Tan, K C M, 2001. Reform and the process of economic restructuring in rural China: A case study of Yuhang, Zhejiang. *Journal of Rural Studies*, 17(2): 165–181.
- Zhang F G, Liu Y S, 2008. Quantitative appraisal on ecological carrying capacity in coastal rapid developing region of Hainan Province. *Chinese Journal of Population, Resource and Environment*, 6(2): 87–92.