

Article

Effectiveness Regulation of Construction Land: Does Plan Matter?

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Abstract: Nowadays the relationship between planning land use and actual land use is not so clear in general. A lot of efforts have been put in the failures of regulation for the expansion of construction land. However, it still lacks an integrated approach to study the effectiveness of land use regulation in terms of different land use types. Furthermore, the existing evaluation of land use plan mainly focuses on a general level, a detailed research on the regulation effectiveness of each construction land use type is absent. Therefore, this research tries to evaluate regulation effectiveness of land use plan, which takes Cangwu country, Guangxi Province as an example. The finding by analysis is that the total area of construction land expansion was about 3494.73 ha, nearly 1.1 times of the plan quota. Moreover, the effectiveness differs greatly in various construction land use types. Town, industrial/mining sites can be well regulated through the quota of land use plan. While, the quota regulation system is not as effective for other type of construction land. Thus, we suggest to improve the regulation effectiveness of construction land through different plan instruments.

Keywords: Regulation Effectiveness; Land Use Plan; Construction Land; China

1. Introduction

For the sake of restraining the uncontrolled expansion of construction land caused by the reform and opening-up since 1978[1-6], in the early 1990s, the Chinese government implemented the General Land Use Plan to strength the management [7]. As an important tool for the central government's macro-control of urban and rural construction [8-10], Land Use Plan plays its role effectively though two important approaches: (1) quota system[11]; (2) zoning[10, 12]. However, this plan cannot achieve its goal of effectively control the increasing of construction land both in quota and spatial control [4, 13-17]. It is very common that the newly-added construction land exceeded the quota of plan, meanwhile the location of those

projects were out of plan zoning, due to the rapid growth of urban development. Thus, land use plan poses a huge challenge because of the mismatch between the original plan intention and the actual outcomes of plan implementation that caused a huge cost in amending plan to legitimize the land use out of plan quota or zoning or a large number of illegal land use [8, 16, 18, 19]. Especially in China, it will be more uncertain in controlling the expansion of construction land, not only in the perspective of scale but also in space, in the stage of high speed developing. In this context, how to test and promote the effectiveness regulation of Land Use Plan becomes particularly important.

Although exploring the reasons for what makes plan implementation successful or failure is the foundation to make better plans [18-21], trying to understand the direct link between plan implementation and actual land use is difficult [22]. An increasing number of planners, policymakers and academic researchers have focused on outcomes of land use plan implementation in construction land in China. Considerable efforts have been undertaken to understand the process of construction land expansion [1, 3, 6, 17, 23-27] and its drivers [17, 28-31]. Furthermore, frameworks for evaluating Land Use Plan [15, 32-34] and the effectiveness of the control of construction land have been analyzed and discussed [13, 15, 16, 35, 36]. These studies have been helpful in know the dramatic process and dynamic of construction land development in the reform era in China and progress in studies of plan implementation, and they provide valuable insights that improve our understanding. However, the major focus is on process of rapid growth of construction land or plan evaluation framework and approach independently. Research from an integrated types of construction land and effects of plan implementation together is more scarce. Otherwise, a very general evaluation result cannot objectively reflect the differences regulation effectiveness among each kinds of construction land use. As a result, the delicate governance instruments of plan would be impossible to discuss.

In addition, previous studies mainly focused on the success or failure of plan and did not take the expansion process of different types of construction land and outcomes of plan implementation into account. Similar to construction land expansion, planning implementation is a spatiotemporal dynamic process, during which both the spatial expansion and the drivers change with time and space [28]. For these reasons, evaluation of land use plan cannot be understood adequately without connecting different types of construction land expansion. To measure the extent to which plan original intention are met and to distinguish the differences between the plan and actual land use is an important part to evaluate the effectiveness of plan. What's more, it will be help the government and planners to adjust measures of plan regulation according to the different outcomes of plan implementation. Nevertheless, a synthetically identifying and analysis on the relationship between different types of construction land expansion and effects of spatial control in Land Use Plan is still lacking. In order to help bridge this gap, this study will provide a more comprehensive understanding of outcomes of plan implementation according to identifying the effectiveness of regulation of different expansion types of construction land.

The objective of this research is to discuss the construction land regulation effectiveness of Land Use Plan. Specially, we attempted to figure out that the differences between results of different types of construction land expansion and control effects of land use plan in both quota control and spatial zoning. This may provide new insights for evaluating the effectiveness of

regulation of construction land and guiding to modify the approach of plan-making and management policies.

2. Materials and Methods

2.1 Methods

In this study, we conceptualize the outcomes of plan implementation. First, the dashed circle and the solid circle refer to the planning area and actual used area respectively. In practice, there would be some mismatch between these two circle. That means we can get three kinds of areas: 1. The Conformed Area; 2. The Unused Area; 3. The Exceeded Area. The Conformed Area means the actually used area lie in the planning area, while the Exceeded Area means the actually used area is outside the planning area. And the Unused Area is that the planning area hasn't been used in reality. Furthermore, there is a legitimated area inside the Exceeded Area. Because some projects that cannot be drawn on the land use map, such as the high-way road or airport. But they were listed on the Plan. If these projects are in the exceeded area after construction, these areas would be legitimized into conformed area. In addition, it should be stressed here that, almost The Exceeded has legitimized through planning adaptation by local government and approved by upper government. These three kinds of construction land block are shown in Figure 1. The combination of The Unused and The conformed is the scope of plan zoning. Meanwhile, the combination of The Conformed and The Exceeded is the actual construction land use. Three types of construction land block represent the relationship between plan zoning and actual construction land expansion.

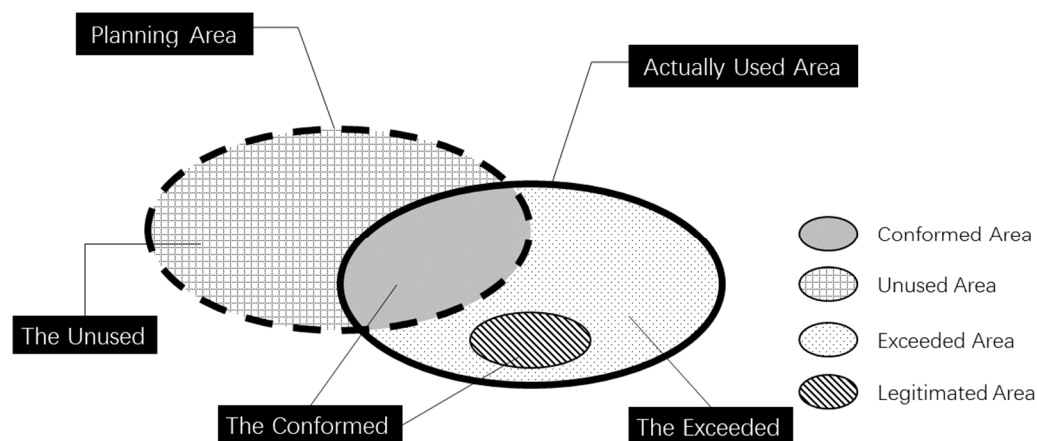


Figure 1. Three Types of Construction Land Blocks after the Implementation of Land Use Plan

Construction land in this study include town, rural settlements, industrial/mining sites, land for specials use, traffic land and water facilities. In order to figure out the specific area which above mentioned. Firstly, we overlay the construction land layers in Land Use Maps of deferent years. After that, we obtained the construction land expansion layer during the planning period. Further, combined with Land Use Plan Map (1998-2010), we got the map of Land Use Plan implementation. It should be mentioned that the map of Land Use Plan implementation only included the layer of construction land. At last, we distinguished the legitimized area according to Land Use Plan (Figure 2).

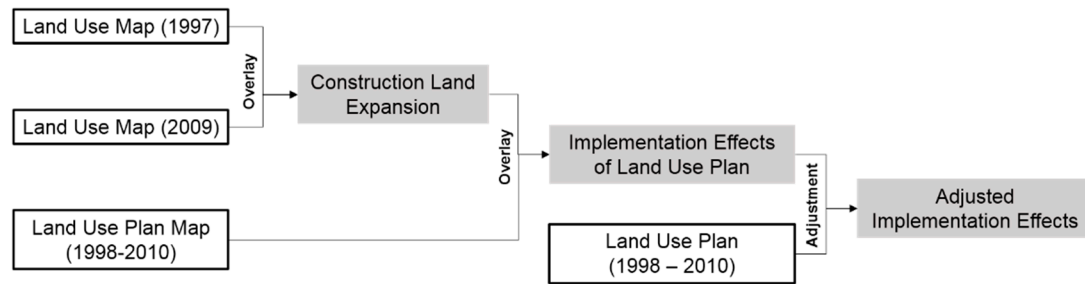


Figure 2. Analysis Framework for the Relationship between Construction Land Expansion and Land Use Plan

2.2 Study Area

Cangwu county is located at the east of Guangxi province which is 13 km away from Wuzhou city, 384 km away from Nanning city, the capital of Guangxi Province, and 350km away from Guangzhou City, the capital of Guangdong Province (Figure 3). In other words, this county plays a very important role in the connection of Nanning and Guangzhou. In general, Cangwu county is a less developed county, which is still in the junior stage of industrialization and urbanization with small land scale for urban development. Considering its current situation of urban development and the key role between Nanning and Guangzhou, there should be a fast development stage for Cangwu county in the next few years. That means it will facing the space control issues too. Thus, we chose this county as the study area for this research.

2.3 Data

This research utilized a rich combination of data sources, including: (1) Land use maps of Cangwu County in 1997 and 2009; (2) Land use planning map (1998-2010) of Cangwu County; (3) time-series data on existing land use are obtained from a survey of land-use change in Cangwu county; (4) 30m resolution Digital Elevation Model (DEM) of Cangwu County from Data Center for Resources and Environmental Sciences, Chinese Academy of Sciences(RESDC) (<http://www.resdc.cn>); (5) Demographic and other socio-economic data from the Cangwu Statistical Yearbooks.

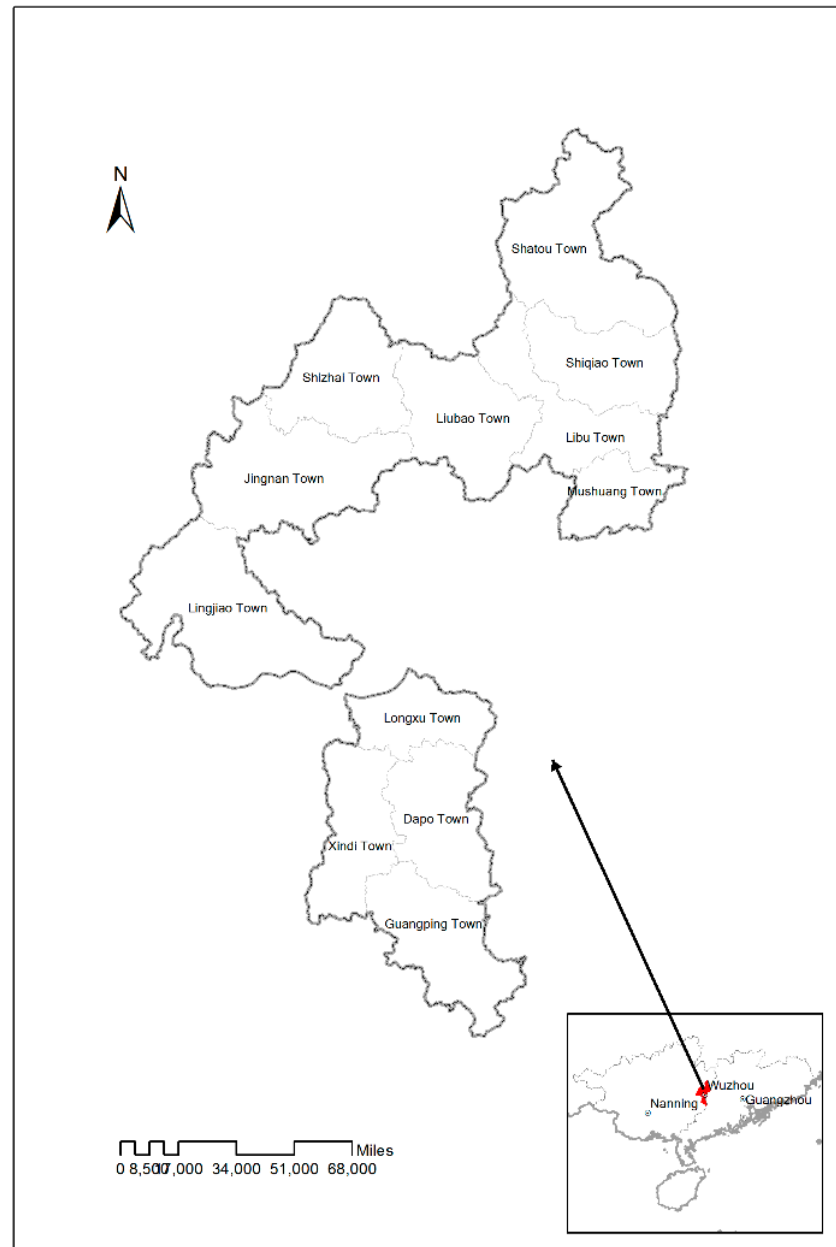


Figure 3. Location and Administrative Division of the Cangwu County, Guangxi Province

3. Results

3.1 Effectiveness of land use plan in quota control

Cangwu county experienced a rapid built-up land expansion that total area of expansion was 3494.73 ha over the period of plan implementation (Tab.1 and Figure 4). The land-use types of town (43.01%), traffic land (32.23%) and rural settlements (16.12%) are predominant. In *Cangwu County Land Use Plan (1998-2010)*, the quota of newly-added construction land was 3170.13 ha (Tab.1). In practice, the expansion of construction land has exceeded the quota of plan which is equivalent to 1.1 times of the quota in the plan. Apart from town, industrial/mining sites and water facilities, the other types of land-use were exceeded the quota of plan.

Table 1. Results of Quota Control in Plan Implementation

Types of Construction Land	The Quota (Quota system)		The Expansion			The Remaining Quota
	Area (ha)	% Total	Area (ha)	% Total	% Quota in each type	Area (ha)
Town	1519.8	47.94	1503.04	43.01	98.90	16.76
Rural settlements	42.11	1.33	563.38	16.12	1337.88	-521.27
Industrial/mining sites	220.18	6.95	178.26	5.10	80.96	41.92
Land for special use	20.66	0.65	75.29	2.15	364.42	-54.63
Traffic land	828.88	26.15	1126.45	32.23	135.90	-297.57
Water facilities	538.5	16.99	48.31	1.38	8.97	490.19
Total	3170.13	100	3494.73	100	110.24	-324.6

It is worth mentioning that although the share of town (43.01%) and industrial/mining sites (5.1%) were near a half of total expansion, the two types of land-use were in the context of control, accounting 98.9% and 80.96% respectively. On the contrary, the new increment of rural settlements and land for special use were far more than planning targets, equivalent to 13.38 times and 3.64 times of quota. In general, at the quota control level, the performance of the town and industrial/mining sites were more superior while the plan has lost control in rural settlement and land for special use.

3.2 Effectiveness of Land Use Plan in Spatial Zoning

The results of the land use plan implementation in space control can be gotten through overlaying the land use maps of Cangwu County in 1997 and 2009 and Cangwu County Land use plan map (1998-2010). Due to the uncertainty of location for rural settlement and land for special use, and for the projects site selection of traffic and water facilities, it is too difficult to considering the land use planning making and the survey of traffic land or water facilities at the same time, thus some projects of the traffic and water facilities cannot be shown on the planning map. As a result, only the quota of town and industrial/mining sites that total 1739.98 ha (Table 3) were allocated on the plan map. Therefore, the extraction of these block information can be optimized based on the plan implementation that it is recognized as the conformed that if these new traffic or water facilities projects have been reserved in Land Use Plan (1998-2010). Otherwise, it should be treated as The Exceed. And then, three types of construction land block, namely The Conformed, The Unused and The Exceeded, will be appeared (Figure 5). As for rural settlements and land for special use, because of it is hard to identify their exact locations and lack of quota for newly increased (accounting 1.33% and 0.65% respectively), there was no quota explicitly located in the Land Use Plan Map. In the end, the quota for these newly-added construction land could not be seen on the map. But, in fact, the actual expansion of these two kinds has far exceeded the plan (Tab.2 and Tab.3). Therefore, both of these two kinds of newly-added construction land can be brought into The Exceeded.

Table 2. Results of Space Control in Plan Implementation (I)

The types of construction land	The Quota (Quota system)	The Conformed			The Exceeded		
	Area (ha)	Area (ha)	% Total Expansion	% Expansion in each types	Area (ha)	% Total Expansion	% Expansion in each types
Town	1519.8	1322.43	37.84	87.98	180.61	5.17	12.02
Rural settlements	42.11	0	0	0	563.38	16.12	100
Industrial/mining sites	220.18	120.98	3.46	67.87	57.28	1.63	32.13
Land for special use	20.66	0	0	0	75.29	2.15	100
Traffic land	828.88	648.13	18.55	57.53	478.32	13.69	42.47
Water facilities	538.5	48.31	1.38	100	0	0	0
Total	3170.13	2139.85	61.23	61.23	1354.88	38.77	38.77

As is seen from the Tab.2, Tab.3 and Tab.4, the area of three types of construction land block including The Unused, The Conformed and The Exceeded separately were 296.57 ha, 2139.85 ha and 1354.88 ha. In other words, The Exceeded accounted for 38.77% of the expansion while The Conformed accounted for 61.23%(Tab.2). More than a half newly-added construction land was located within the scope of planning regulation. It can be seen that town, industrial/mining sites, traffic land and water facilities were effectively implementation.

According to Tab.2, in the perspective of expansion, most of the newly-added construction land were located within the scope of planning regulation (town, 87.98%; industrial/mining sites, 67.87%; traffic land, 57.53%). A small amount (less than 35%) of town and industrial/mining sites were located outside the planning. And also, nearly half share of the newly-added traffic land (42.47%) was The Exceeded. Because of the rapid development of regional and social economic, transport infrastructure made great progress at Cangwu in the planning period. For example, in the "Eleven-Five Planning", the Nanning-Guangzhou high-speed railway was a new key construction project. But it did not include in the *Cangwu Land Use Plan (1998-2010)*. As mentioned above, the newly-added traffic land for that situation would be classified as The Exceeded.

Meanwhile, more than half of construction land expansion were located inside the scope of zoning. As it was shown in Tab.3, The Exceeded accounted for 42.74% of the share of quota of newly-added construction land while The Conformed accounted for 67.5%. In addition, due to the majority quota of town, industrial/mining sites were explicitly located on the *Cangwu Land Use Plan Map (1998-2010)*, this two types of land-use were compliance with planning. Although a part of traffic projects did not include in the plan that caused the newly-added traffic land exceeding the zoning, 648.13 ha newly-added traffic land (accounting 78.19% of its own quota) has conformed with the plan. Therefore, it can be said that this Land Use Plan played an important role in controlling the spatial expansion of traffic land. On the contrary, the Plan has lost control not only in the scale of quota but also in zoning. As shown in Tab.2 and Tab.3, rural settlements and land for special use were 100% out of the scape of planning regulation. And more importantly, the actually expansion of this two types of land-use were

far more than the share of quota that reached 1.34 times and 3.64 times separately.

Table 3. Results of Space Control in Plan Implementation (II)

The types of construction land	The Quota	The Conformed (ha)			The Exceeded (ha)		
	Area (ha)	Area (ha)	% Total Quota	% Quota in each types	Area (ha)	% Total Quota	% Quota in each types
Town	1519.8	1322.43	41.72	87.01	180.61	5.7	11.88
Rural settlements	42.11	0	0	0	563.38	17.77	1337.88
Industrial/mining area	220.18	120.98	3.82	54.95	57.28	1.81	26.02
Land for special use	20.66	0	0	0	75.29	2.37	364.42
Traffic land	828.88	648.13	20.44	78.19	478.32	15.09	57.71
Water facilities	538.5	48.31	1.52	8.97	0	0	0
Total	3170.13	2139.85	67.5	67.5	1354.88	42.74	42.74

Table 4. Results of Space Control in Plan Implementation (III)

The types of construction land	The Quota on the Map	The Conformed (ha)		The Unused (ha)		The Exceeded (ha)	
	Area (ha)	Area (ha)	% Quota in each types	Area (ha)	% Quota in each types	Area (ha)	% Quota in each types
Town	1519.8	1322.43	87.01	197.37	12.99	180.61	11.88
Rural settlement		0	0	0	0	563.38	1337.88
Industrial/mining area	220.18	120.98	54.95	99.2	45.05	57.28	26.02
Land for special use		0	0	0	0	75.29	364.42
Traffic land		648.13	-	0	0	478.32	57.71
Water facilities		48.31	-	0	0	0	0
Total	1739.98	2139.85	122.98*	296.57	17.04	1354.88	42.74

*Due to it is hard to identify exact locations of traffic land and water facilities, only a few quotas were explicitly located on the Land Use Plan Map, the scale of the conformed will be bigger than the share of newly-added construction land on the map.

The Conformed accounted for 1.23 times in share of quota on the plan map while The Unused were only 17.04% (Tab. 4). As mentioned above, only a few quota of newly-added construction land was explicitly located in the *Cangwu Land Use Plan Map (1998-2010)* because of it is hard to identify exact locations, such as rural settlements, land for special use, traffic land and water facilities. But, it is recognized as The Conformed that if the new projects of traffic or water facilities have been reserved in *Land Use Plan (1998-2010)*. It can be seen that zoning was almost good implementation (town, 87.01%; industrial/mining sites, 54.95%) while the quota could explicitly be located on the map.

Although the scale of zoning on the plan map is less than 20% of the total quota, there is still a contradiction for the actual land use and planning. Especially to town, the scale of The Unused is closed to The Exceeded. The area of The Unused of industrial and mining area is 99.2 ha that is far more than 1 time to The Exceeded. It can be said that there is spatial mismatch phenomenon between the allocation of zoning and actual land-use.

3.3 Effectiveness of land use plan in different types of construction land-use

Based on the previous analysis, land use plan has the different effectiveness of spatial control for different types of construction land expansion. As town and industrial and /mining area that were distributed by planar-shape, most of the newly-added construction land was effectively conformed to the zoning. Therefore, the plan can control the spatial expansion of those types of land-use effectively. However, it must be pointed out that there is a phenomenon of spatial mismatch. The area of The Exceeded of these types of land-use was extremely equal to The Unused. Although it is able to relatively accurately predict the demand of these types of land-use, it is hardly to explicitly draw the zone. As a result, it has to readjust the scope of zone in order to legalize the land use of The Exceeded that caused a huge time and economic cost [13, 15, 16]. We suggest that if there is a flexible zoning with more scope of zoning, the area of The Exceeded of town and industrial/mining sites will be more effective and better regulated.

In general, the plan could control the construction land well in the expansion of traffic land too. The almost newly-added traffic land (accounting 78.19% of its own quota) was Conformed, although nearly half (42.47%) of new expansion in space was The Exceed. Considering the difficulty in arrangement a precise location for traffic projects which were affected by some external influence factors, such as politics and economics [17], in a word, there inevitably would be deviations between spatial arrangement of planning and the actual land-use caused by some uncertainties. In other words, it is not necessary to draw the zone for traffic land and water facilities which have special requirements for location.

Although there is little quota for rural settlements and land for special, the newly-added which are geared to The Exceeded were distributed as stars in the sky (Figure 5). As is seen from Tab.3, the area of rural settlements and land for special are 563.88 ha and 75.29 ha respectively which accounted separately for 1.34 times and 3.64 times of their own quota for development. Take rural settlements as an example. Like most of the plan making, its aim was to reduce rural settlements within the planning period. In fact, the expansion of rural settlements had not been effectively controlled. Because of population growth and income, rural residents were all willing to improve their living condition [28]. In this case, the demand of rural settlements was far more than plan intention. In addition, it is hard to arrange a precise spatial distribution because of the expansion of rural settlements was always dispersedly plotted in space. Therefore, the land use plan hardly plays an effective role in controlling the rural settlements and land for special both in the scale and spatial perspectives. Taking land for special as an example, projects which located in the scope of The Exceeded were readjusted the plan to legalize the land use. What's more, the location requirement of land for special is no specific routines which is according to the definitive requirements of different projects. In addition, almost The Exceeded of rural settlements was illegal because of it is lack of quota and zoning space. In addition, the spatial distributions of rural settlements are fragment. At this situation, there is a strong need to reserve adequate plan quota and draw a specific zone for rural settlements that is conducive to centralize the rural region [28, 29].

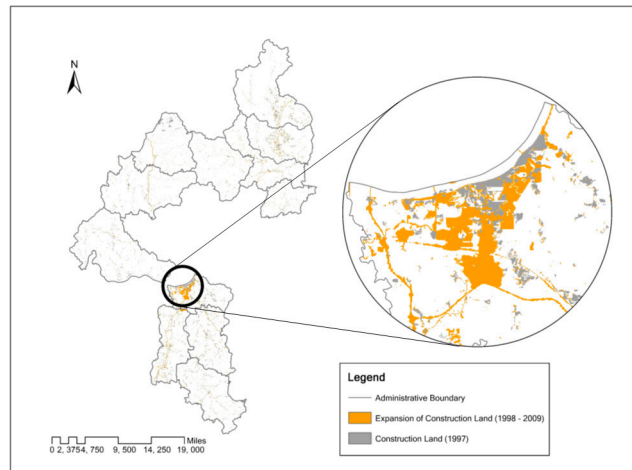


Figure 4. Construction Land Expansion (1998-2009)

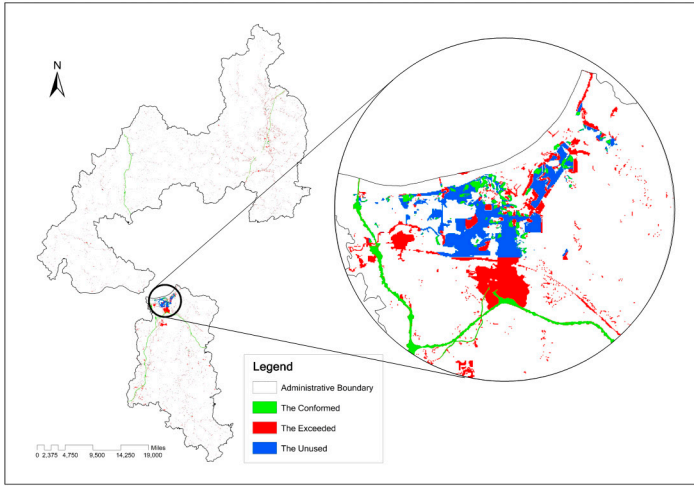


Figure 5. Results of Space Control in Plan Implementation

4. Conclusions

This study examined the effectiveness of land use plan to manage and control in construction land expansion. In the period of planning implementation, the total area of expansion was 3494.73 ha, the expansion has exceeded the quota of plan which is equivalent to 1.1 times of the quota in the plan. In general, at the quota control level, the performance of the town and industrial/mining sites were more superior while the plan has lost control in rural settlement and land for special use. The expansion of town and industrial/mining sites were in the context of control, accounting 98.9% and 80.96% respectively. On the contrary, the new increment of rural settlements and land for special use were far more than planning targets, separately equivalent to 13.38 times and 3.64 times of quota.

Obvious differences in effectiveness to manage and control in spatial zoning will be observed though overlaying the land use maps of Cangwu County in 1997 and 2009 and Cangwu County Land use plan map (1998-2010). The area of three types of construction land block, namely the Conformed, The Unused and The Exceeded, separately were 296.57 ha, 2139.85 ha and 1354.88 ha. More than a half newly-added construction land was located within the scope of planning regulation. It can be seen that town, industrial/mining sites, traffic land and water facilities were effectively implementation. And Land Use Plan played an important role in controlling the spatial expansion of traffic land. On the contrary, the Plan has lost control not only in the scale of quota but also in zoning. Furthermore, it is worth mentioning that there is spatial mismatch phenomenon between the zoning and actual land-use. Especially to town, the scale of the Unused is closed to the The Exceeded. It is worth mentioned that although The Exceeded of construction land expansion become the legal land use through adjust the plan in the implementation period, it caused a huge time and economic cost. This study strongly points out that the one-size-for-all approach could not regulate well the construction land due to the definitive requirements of different projects and uncertainty of social-economic in the period of rapid development. We suggest that it can improve the effectiveness of construction land regulation through adopt different plan instrument.

While this study provides insights into the effectiveness regulation of construction land based on three types of construction land block through land-use planning implementation, it should be considered just the beginning to understand the relationship between plan intention and implementation outcomes. Firstly, a systemic evaluation framework needs to established to identify the plan failure or implementation failure at the part of The Exceeded. Secondly, the influencing factors and mechanism should be further discussed. Finally, future studies need to explore the phenomenon of spatial mismatch and explain how it happened and how to eliminate.

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