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Research Article

The Effect of Rural Comprehensive Food Planting Land Consolidation on the Ecological Landscape in Hilly and Mountainous

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Abstract: The effect of comprehensive food planting land consolidation on the regional ecological landscape is multifaceted. In this study, by comprehensive food planting land consolidation project in DaLu town to be example, comment on change of ecological environment and the rural landscape in research area. Shown that: (1) through rural comprehensive land consolidation, ecological environmental levels on the rise in the study area. (2) After the consolidation, the total number of plaques reduces 837, average shape index decreased to 1.98. Indicate the originally bent changeable plaques boundaries have become straight, conducive to mechanized farming; Also the arable land from 63.75% (3) After the consolidation, landscape fragmentation reduces 0.0008, aggregation indices increased 0.03, show through rural comprehensive land consolidation, making the overall pattern tends to be simple. But while this landscape pattern reduces species diversity and may accelerate the spread of pests and diseases. In summary, through rural comprehensive land consolidation, help to improve the productivity of the land, raise the level of regional ecological environment. At the same time, the effects of which on regional landscape ecological Positive and negative effects.

Keywords: Ecological, landscape, on hilly and mountainous, rural comprehensive land consolidation

INTRODUCTION

In recent years, Chongqing has launched a number of agricultural projects, For example, land development and consolidation project, every village project, the low yielding farmland, the construction of new socialist countryside and so on (Long *et al*., 2010, 2009). However, rural comprehensive food planting land consolidation different of traditional food planting land consolidation mode, it is to improve the quality of land, improve rural ecological landscape and ecological environment as the main purpose (Bonfant, 1997; Zhao, 2007). In this study, the Bishan road rural comprehensive food planting land consolidation project as an example, study on the effect of rural comprehensive food planting land consolidation on the ecological landscape, Through the comprehensive improvement of the rural land, the construction of clean and tidy village, the beautiful environment of the new socialist countryside, explore the new mode of food planting land consolidation in Hilly and mountainous areas.

MATERIALS AND METHODS

Study area: The research object of this study is comprehensive food planting land consolidation pilot area in DaLu town, which located in the Bishan county north part, away from the main city of Chongqing 68 km. DaLu town located in low mountain valley area, it altitude of 400 m. It is in the subtropical humid monsoon climate region, the annual average sunshine hours in 1100-1300 h, the annual average temperature at 17-18°C and annual range of temperature at 20°C. The town area of 11592.92 hm^2. In which, agricultural land has 10045.58 hm^2, accounting for 86.65% of the total land area; construction land has 1268.63 hm^2, accounting for 10.94% of the total land area; unused land has 278.71 hm^2, accounting for 2.4% of the total land area.

Data sources: The original data mainly comes from DaLu town land use change survey data in 2013, DaLu town 2013 Statistical Yearbook and the author's practical survey, use Bishan County Planning Bureau, trade and Economic Cooperation Bureau, agriculture bureau and other departments data for supplementary.

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Research methods:

- The evaluation methods of rural comprehensive food planting land consolidation on the ecological landscape.

  In this study, the pressure-state-under the framework of the response, select the evaluation factors, proposed evaluation system (Liao, 2008; Petr, 2006), use AHP definite index standard value and weight of ecological environmental impact (Table 1).

  Calculate ecological environment situation before and after comprehensive land consolidation:

$$F_i = \sum_{j=1}^{n} X_{ij} \times W_{ij} \quad (1)$$

$$F_t = \sum_{i=1}^{3} F_i \times W_i \quad (2)$$

  In the formula 1 and 2,
  F_i = Value of the criterion level
  F_t = The overall level of the ecological environment
  X_{ij} = Value of the criteria layer
  W_i = The weight
  n = Number of indexes

- The landscape diversity index calculation method:

$$S = 0.25 L_i / 2\sqrt{A_i} \quad (3)$$

  In the formula 3,
  S = The average shape index
  L_i = The perimeter of landscape type *i*
  A_i = The area of landscape type *i*:

$$H = -\sum_{i=1}^{m} P_i \log_2 P_i \quad (4)$$

  In the formula 4,
  H = Landscape diversity degree index
  m = The total number of landscape types
  P_i = Landscape types *i* in the total area ratio:

$$E = H / \log_2 m \quad (5)$$

  In the formula 5: *E is* the evenness degree index, *m* is the total number of landscape types, *H* is landscape diversity degree index. Among them, when E approaches 1, the evenness of maximum:

$$D = \log_2 m + \sum_{i=1}^{m} \log_2 P_i \quad (6)$$

  In the formula 6,
  m = The total number of landscape types
  D = The dominance index
  P_i = Landscape types *i* in the total area ratio:

$$Rc = 1 - C / C_{\max},\ C = -\sum_{i=1}^{m}\sum_{i=1}^{m} \lg(P_{ij}),\ C_{\max} = m \ln(m) \quad (7)$$

  In the formula 7,
  Rc = Aggregation degree
  C = Complexity index
  P_{ij} = j Element adjacent *i* element in the total area ratio
  C_{max}= The maximum possible value of C:

$$F_N = (NP - 1) / N_c \quad (8)$$

  In the formula 8,
  F_N = Fragmentation degree
  N_P = The total number of landscape types
  N_c = Expressed by the grid number of landscape area

Table 1: The index standard value and weight

Criterion level	Index layer	Unit	Before	After	Weight
Pressure indicator P	Per capita arable land P_1	hm^2/per	0.37	0.40	0.23
Weight 0.3	Erosion control rate P_2	%	0.66	0.82	0.11
	Treatment rates fields P_3	%	0.62	0.79	0.14
	The population density P_4	Per/hm^2	0.81	0.73	0.08
	Non-agricultural population P_5	%	0.60	0.94	0.06
	Per capita water resources P_6	kt/per	0.68	0.89	0.11
	Water quality P_7	-	0.61	0.82	0.12
	Coordination water and soil P_8	%	0.67	0.81	0.15
Status indicators S	Economic density S_1	Ten thousand/hm^2	0.72	0.89	0.15
Weight 0.36	Rural electricity consumption S_2	kw/per	0.81	0.88	0.13
	Land reclamation coefficient S_3	%	0.69	0.79	0.21
	Land use S_4	%	0.68	0.86	0.22
	Grain yield S_5	kg/hm^2	0.71	0.84	0.18
	Woodland cover S_6	%	0.72	0.75	0.11
Response dictators R	Biodiversity R_1	-	0.77	0.86	0.25
Weight 0.34	Small climate change R_2	-	0.55	0.77	0.17
	Disaster bearing capacity R_3	-	0.57	0.89	0.12
	Farmers' income R_4	Ten thousand/per	0.65	0.95	0.27
	Degree of mechanization R_5	kw/hm^2	0.64	0.88	0.19

Table 2: The level of ecological environmental in study area

Evaluation unit	Pressure indicator	Status indicators	Response dictators	Level of ecological environmental
Before	0.5955	0.7174	0.6533	0.6590
After	0.7280	0.8414	0.8817	0.8211

Table 3: Landscape patch diversity of whole village propulsion

Type	Status	Number	Area (hm^2)	Circumference (km)	Avg. shape index
Paddy field	Before	528	3813.51	481.73	0.98
	After	320	4070.25	328.60	0.64
Dry land	Before	720	3577.25	486.10	1.02
	After	410	3786.75	374.02	0.76
Garden	Before	96	310.25	203.51	1.44
	After	247	406.25	182.37	1.13
Woodland	Before	432	847.51	216.70	0.93
	After	311	1047.51	180.61	0.70
Meadow	Before	264	462.32	100.11	0.58
	After	219	389.11	80.56	0.51
Urban village and	Before	880	1103.25	259.10	0.98
industrial	After	552	572.75	194.89	1.02
Traffic land	Before	120	142.33	112.15	1.18
	After	264	377.75	134.43	0.86
Waters and water	Before	288	422.50	182.29	1.11
facilities land	After	360	637.30	126.19	0.62
Other land	Before	576	914.00	453.31	1.87
	After	384	305.25	104.75	0.75
Total	Before	3904	11592.92	2495.00	2.90
	After	3067	11592.92	1706.42	1.98

Avg.: Average

Table 4: The changes of landscape diversity index

	Landscape type		
Status	Diversity degree index	Dominance degree index	Evenness degree index
Before	1.57	0.76	75.21
After	1.41	0.95	66.32

Table 5: The changes of landscape pattern index

	Landscape pattern	
Status	Aggregation degree	Fragmentation degree
Before	0.67	0.0021
After	0.70	0.0013

RESULT ANALYSIS

Effect of comprehensive food planting land consolidation on the ecological environment: Research shows that the three main parameters were improved significantly after consolidation. Among, response indicators increase the maximum amplitude, will be increased by 0.2282, followed by pressure index, will be increased by 0.1325, the final status indicator, will be increased by 0.1240. Further analysis of the single parameter, specific circumstances visible (Table 2). On the whole, the level of ecological environmental is rising thought rural comprehensive food planting land consolidation in study area, the level of ecological environmental is 0.6590 before consolidation, after consolidation to reach 0.8211, level of ecological environmental significant progress.

Effect of comprehensive food planting land consolidation on the rural landscape:

Impact analysis of the landscape patches diversity: The research results show that has a variety of changes landscape patches in study area (Table 3). After consolidation the total number of patches decreased from 3904 to 3067, reduced 837. The total patches circumference from the 2495 km reduced to 1706.42 km, average shape index from the 2.90 reduced to 1.98. After consolidation the patch shape tended to be simple, to facilitate mechanized farming, improve the utilization efficiency of agricultural machinery, thereby reducing the cost of agricultural inputs. But on the other hand, from the perspective of landscape ecology, straight boundary reduces the contact area between patches, may reduce the patches and logistics degree (Miranda *et al*., 2006).

From the change of patches area in the study: After consolidation the paddy field increase 256.74 hm^2, the dry land increase 209.50 hm^2, the garden increase 96.00 hm^2, the woodland increase 200.01 hm^2, the meadow reduce 73.21 hm^2, this is inseparable from the study area of industrial planning. In addition, urban village and industrial, traffic land, waters and water facilities land increased more. The landscape matrix of still dominated by arable land in study area.

Analysis of the landscape types diversity: Changes of landscape diversity is relatively obvious, see the results of landscape diversity (Table 4). After consolidation the index of landscape diversity decreased from 1.57 to 1.41, change 10.19%, the evenness index decreased, dominance degree index increased significantly. Though the landscape type adjustment, while improving the productivity of rural landscape, but also produced some negative effects, such as landscape heterogeneity reduced, the increase in proportion to the difference among different landscapes, landscape

homogenization, increase the degree of monotonous landscape and so on, make landscape functioning were limited.

Analysis of the landscape pattern diversity: After consolidation the fragmentation degree decreased from 0.0021 to 0.0013, reduced by 0.0008, the aggregation degree increase from 0.67 to 0.70, increased by 0.03. This shows that the overall pattern tends to be simple after consolidation. The landscape pattern of the landscape within the overall interaction to some extent weakens, to reduce the spread of regional species diversity and may accelerate plant diseases and insect pests (Table 5).

CONCLUSION

In this study, the Bishan road rural comprehensive food planting land consolidation project as an example, evaluate of rural comprehensive food planting land consolidation on the Ecological Landscape changes, the main conclusions as follows:

- The level of ecological environmental is rising thought rural comprehensive food planting land consolidation in study area, the level of ecological environmental is 0.6590 before consolidation, after consolidation to reach 0.8211, level of ecological environmental significant progress.
- After consolidation the total number of patches decreased 837. Average shape index reduced 1.98. The patch shape tended to be simple, to facilitate mechanized farming, improve the utilization efficiency of agricultural machinery, thereby reducing the cost of agricultural inputs. But on the other hand, the landscape matrix of still dominated by arable land in study area.
- After consolidation, the index of landscape diversity decreased from 1.57 to 1.41, change 10.19%, the evenness index decreased, dominance degree index increased significantly. The fragmentation degree decreased from 0.0021 to 0.0013, the aggregation degree increase from 0.67 to 0.70. This shows that the overall pattern tends to be simple after consolidation. The landscape pattern of the landscape within the overall interaction to some extent weakens, to reduce the spread of regional species diversity and may accelerate plant diseases and insect pests.

In summary, through the rural comprehensive food planting land consolidation improves land. To improve the productivity of land, improve the ecological environment of the region level. At the same time, influence of regional landscape ecological effects.

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