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Operation Modes for Land Consolidation in Central Anhui Based on Beautiful Countryside Construction

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Abstract Firstly, the background of beautiful countryside construction was elaborated. The operation modes for land consolidation in central Anhui were divided into five areas: northern Anhui, central Anhui, area along Yangtze River, western Anhui, and southern Anhui. Through empirical analysis of land consolidation in Changfeng County, it came up with recommendations with reference to practice in Changfeng County and discussed the beautiful countryside construction in central Anhui.

Key words Beautiful countryside construction, Central Anhui, Land consolidation, Operation modes

The 18th National Congress of the Communist Party of China stated that faced with increasing resource constraints, severe environmental pollution and a deteriorating ecosystem, we must raise our ecological awareness of the need to respect, accommodate to and protect nature. We must give high priority to making ecological progress and incorporate it into all aspects and the whole process of advancing economic, political, cultural, and social progress, work hard to build a beautiful country, and achieve lasting and sustainable development of the Chinese nation. The CPC Anhui Province Committee and the People's Government of Anhui Province decided to promote the beautiful countryside construction. This decision raised the curtain of beautiful countryside construction in Anhui Province. The beautiful countryside construction is different from countryside construction in the past. It is not simple new countryside construction, but to realize the overall objective of "ecological living, beautiful villages, and enriching the people, and harmonious and civilized countryside". Based on this, taking central Anhui as study object, we studied practice, achievement and experience of beautiful countryside construction, in the hope of providing reference for beautiful countryside construction in Anhui Province.

1 General situations of central Anhui

1.1 Range of central Anhui The Plan for Beautiful Countryside Construction in Anhui Province (2012-2020) divided Anhui Province into five areas: northern Anhui, central Anhui, area along Yangtze River, western Anhui, and southern Anhui. It set forth differentiated beautiful countryside construction paths according to natural conditions, resource endowment and economic and social conditions. Central Anhui includes Hefei City, Lu'an City

(excluding Huoshan County and Jinzhai County), Huainan City, and Tongcheng City. This area takes consolidation of countryside environment, intensive land use, and industrial development of countryside as major points, guides farmers to flow to urban areas, strengthen countryside construction and land consolidation, speed up development of urban agriculture and modern facility agriculture, and accelerate building high quality characteristic agricultural and sideline product production base.



Fig. 1 Range of central Anhui

1.2 Natural, economic and social conditions of central Anhui

1.2.1 Natural conditions. Central Anhui is situated in transition area from subtropical zone to temperate zone. The annual temperature is about 15°C, the frost-free period is as long as 210-220 days, and water and sunshine conditions are superior, favorable for developing agriculture, forestry and animal husbandry, especially rice and wheat planting. The land resource is abundant and the land area is 2362832.8 hectare, accounting for 16.86% of the total land area of Anhui Province (according to statistical data of Second National Land Survey in 2009). Thus, it has huge poten-

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tial for development of many kinds of operation. Besides, central Anhui has large area suitable for developing forestry. Also, there are many lakes, reservoirs, dykes, suitable for developing fishery, and grass slope and land suitable for developing grass feeding livestock. This area is complex in terrain, has hillocks, plain, and hills. Rock types are various. In addition to human activities and damages, predatory reclamation of land, unordered alternation of agriculture and forestry, the grass and forest resources are damaged in a great deal. Land fertility declines and soil becomes barren. Water and soil loss situation is serious and water and soil loss areas are widely distributed.

1.2.2 Social and economic conditions. In central Anhui, social economy grows steadily and rapidly, industrial structure gets constantly optimized, consumption structure upgrade is accelerating, and the urbanization process is quickening. In this area, Hefei is the capital city of Anhui Province. It is political and economic center of Anhui province, regional transportation hub of China, important scientific research and education base, modern manufacturing base, sci – tech innovation and new and high technological industrial base, and modern service industry base, and the regional tourism and exhibition center, trade and logistic center, and finance and information center. In this area, Lu’an City develops slowly. In the golden opportunity of Pan – Delta Economic Area Cooperation and central rise, Hefei Economic Circle is speeding up the process of Hefei – Lu’an integration and Hefei economic center is enhancing its radiation range.

2 Empirical analysis of beautiful countryside construction in central Anhui through land consolidation

2.1 Study area Changfeng County is situated in suburbs of Hefei City. It is representative in central Anhui. Thus, we took it

as an example.

2.1.1 Current land use situation and structure. According to land use change survey data in 2010 and land use base data conversion result, we made statistical analysis and reached the conclusion that the total land area of Changfeng County is 192223.99 hectare, the agricultural land area is 157407.99 hectare (accounting for 81.89% of total land area of Changfeng County), and the construction land area is 32986.66 hectare (accounting for 17.16% of total land area of Changfeng County), and other land area is 1829.34 hectare (accounting for 0.95% of total land area of Changfeng County). In the land structure, agricultural land is the largest, next is construction land, and the minimum is unused land, indicating high land use degree.

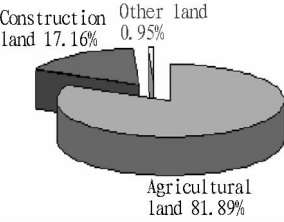


Fig.2 Land use structure of Changfeng County

From Table 1, we can see that in agricultural land of Changfeng County, farmland is the largest, forest land ranks the next, grass land is the minimum, showing dominant position of farmland in agricultural land. In the construction land, the urban and rural construction land takes up the largest portion (69.97%), the next is transportation and water land, other construction land has the minimum area, so the land consolidation has high potential. Other land area is 1829.34 hectare, accounting for 0.95%, so it is essential resource for development and use of reserve farmland resource.

Table 1 Land use structure of Changfeng County Unit: Hectare

Area of agricultural land	Farmland	Garden land	Forest land	Grassland	Other agricultural land
157407.99	114737.7	113.6	8350.49	24.28	34181.93
Percentage in agricultural land area	72.89%	0.07%	5.30%	0.02%	21.72%
Area of construction land	Urban and rural construction		Transportation & water conservancy		Other construction
32986.66	23081.89		9238.43		666.34
Percentage in construction land	69.97%		28.01%		2.02%
Other land area	Water		Natural reserved area		
1829.34	1827.35		1.99		
Percentage in other land area	99.89%		0.11%		

2.1.2 Characteristics and problems of land use. Changfeng County has superior natural condition, rich land resource, complex land terrain, and diversified land use types. At the same time, land use efficiency is high, land use has distinct regional difference, and rural residential area is large, so it has high potential of land consolidation. Through survey and analysis, land use in Changfeng County has following problems: frequent occurrence of natural disasters and high risk of agricultural development; lack of reserved land and restricted development space; backward agricultural infrastructure and outstanding three issues

concerning agriculture, farmers and rural areas; weak self blood making function and many uncertain factors of development; unreasonable construction land distribution, scattered residential area, and unreasonable village distribution, and unordered construction.

2.2 Operation modes for beautiful countryside construction in Changfeng County through land consolidation According to landform features, current land use situation, and economic development degree, we divided land development and consolidation of Changfeng County into 6 areas: wavy plain consolidation area,

valley plain consolidation area, hillock consolidation area, village and town land consolidation area, unused land development area, and waste land reclamation area. Through discussing operation modes of these 6 areas, we hope to provide reference for promoting beautiful countryside construction in central Anhui through land consolidation.

2.2.1 Wavy plain consolidation area. The wavy plain consolidation area refers to agricultural area of wavy plain with altitude of 25–75 m. It is distributed in north of Yangtze River and Huai River watershed. This area mainly adopts "wave-platform land consolidation mode", use and maintenance combined land development measure. At macroscopic level, it still keeps original landform to save labor, material and fund; at microscopic level, it levels the hillock top, to properly reduce elevation and enlarge the consolidation area. If condition permits, it may reduce the hillock top to middle field. The consolidation result: hillock and middle field are situated in a platform. Major consolidation points of this area: increasing land input, raising intensification of land operation, combining land use and maintenance, reasonably using land resource, developing diversified operation in accordance with local conditions, strengthening water management, improving irrigation project, taking full advantage of irrigation projects, receding farmland to forest, and planting trees and grass, and improving land conditions.

2.2.2 Valley plain consolidation area. The valley plain consolidation area refers to the alluvial plain formed in the action of Chi River, Yao River, Zhuangmu River, Dongfei River, and Pei River. The altitude of this area is below 30 m, the groundwater level is high, but water drainage is not smooth. This area mainly adopts strip type land consolidation mode and flood control land development measure. Specially, the direction is along the river bank, and the width is outer edge of natural bank to the bottom of secondary bench. The major point of this area is to prevent and control flood and the next is to change land use.

2.2.3 Hillock consolidation area. The hillock consolidation area refers to area situated in two sides of Yangtze River and Huai River watershed, with altitude of 50–90 m, and 15–50 m in two sides. The terrain is complex in this area. There are three kinds of hillocks: high hillock, low hillock and slope hillock. This area includes Zhuxiang, Xiatang, Yangmiao, Buli, Luoji, Taohu and Taolou towns. This area mainly adopts "plain-plateau" land consolidation mode, forest-oriented land development measure. Specially, low or slope hillocks in two sides of the watershed adopts plain land consolidation mode, while the top area of high hillock adopts plateau consolidation mode, similar to loess plateau, planting greens in two sides to protect water and soil, and the paddy field in hill side adopts consolidation measure similar to wavy plain. Major points of land consolidation of this area: strengthening tree planting and afforestation, implementing agriculture, forestry, animal husbandry and fishery in corresponding area, integrating coordinated development of human and nature, establishing suburban agricultural system, developing vertical ecological

agriculture, sightseeing agriculture, and harmless agriculture.

2.2.4 Village and town land consolidation area. Village and town land consolidation area refers to land for farmer building houses, and town and market town land. Land consolidation of this area should focus on transformation of hollow villages and relocation and merge of villages, to reduce the per capita homestead area below 150 m², realize centralization of residents to towns and central villages, forming beautiful ecological and rural living environment. Changfeng County follows the principle that village distribution should be favorable for organization of agricultural production and facilitate demand of farmers for modern and well-off living, and village and town distribution should suit local infrastructure condition and agricultural mechanization level. Besides, it should take full consideration of requirements of different natural geographical conditions, such as mountain, hill, plain, and water network, make overall arrangement, give prominence to local characteristics, and build village and town system into central market town - (general market town) - central village - grass-roots village (resettlement point) three (or four) level structural system. All villages should have unified planning and implementation by steps. In addition, Changfeng County should protect rural ecological environment, improve farmers' living conditions, value the study of rural landscape characteristics, and keep and increase value of rural landscape.

2.2.5 Land development area. The land development area mainly refers to unused land. Major points of consolidation in this area are field ridge, waste grassland, naked land, and mud flat, excluding rivers and lakes. This area should focus on reducing field ridge coefficient, increasing area of arable land, managing mud flat well, building green belt, and strengthening flood prevention projects.

2.2.6 Land reclamation area. The land reclamation area includes all waste land, such as industrial and mining land, soil taking, water damage, and polluted land. This area should focus on taking engineering measures and biological measures to restore all waste land to usable state and realize the purpose of land.

2.3 Achievements of land consolidation in Changfeng County

With gradual implementation of land consolidation plan, Changfeng County has obtained great social, economic and ecological benefits in the process of beautiful countryside construction. Firstly, through land consolidation, it speeds up the new socialist countryside construction. Through unified planning and design, new villages and market towns and farmers' new houses improve rural house pattern and manifest new rural scene. Secondly, it promotes agricultural modernization construction. Land consolidation is to build high standard farmland according to demands of multi-form agriculture and modern agricultural production, and ensure standardization of farmland. Thirdly, it improves rural environment, promotes rural spiritual civilization construction and improvement of farmers' cultural quality, which are favorable for long-term stability and comprehensive development of rural areas. Besides, through calculation, the developed and consolidated

farmland can increase yield about 900 yuan/hectare (the original farmland was 110608.65 hectare and the total output value after consolidation reached 99.5478 million yuan); after land consolidation, it increased farmland about 4349.15 hectare. According to "rice-oil crop" cropping system, the annual agricultural output value is about 16200 yuan/hectare, and the annual value increase is about 70.4562 million yuan (about 170.094 million yuan in total). Finally, the construction of farmland shelter forest and water conservancy projects in the land consolidation will form excellent shelter forest system, increase the forest network coverage, improve farmland microclimate, and enhance the ability of flood prevention and resistance. According to estimation, the wind velocity in the effective range of farmland shelter forest network can drop 30–50%, the soil evaporation capacity can drop 20–30%, and the water content of soil can increase more than 10%. Comprehensively using engineering and biological measures and land reclamation, it improved ecological condition of subsidence area and waste land about 19.8 hectare subsidence and waste land, developed saline and alkaline land, sand land, reduced use of chemical fertilizer and pesticide through soil improvement and other biological engineering measures, improved soil environment, effectively reduced soil degradation area, reduced water and soil pollution, and promoted development of ecological agriculture. Furthermore, Changfeng County built projects for prevention and cure of schistosomiasis, improved ecological benefit, improved ecological landscape function of farmland, optimized spatial pattern, and built beautiful and harmonious living environment.

3 Building proper operation modes for beautiful countryside construction through land consolidation based on empirical example in central Anhui area

The primary objective of land consolidation in central Anhui is to reinforce control of water and soil loss in slope land area, strengthen land consolidation of broken, fragmentary and wavy land, increase sci-tech input of land consolidation, improve agricultural production condition, develop high efficient ecological agriculture, and energetically promote old town transformation and clearance of idle construction land, and strengthen effect of conserved and intensive land use pilot cities. With reference to practice of land consolidation in Changfeng County, we came up with following recommendations focusing on beautiful countryside construction in central Anhui.

3.1 Farmland consolidation: suit measures to local conditions, divide zones, and implement differentiated consolidation modes Central Anhui has complex terrain and diversified landform. For farmland consolidation, it can draw lessons from experience of Changfeng County in land consolidation. According to landform characteristics, current land use situation and economic development level, it divided land development and consolidation into different regions and took different consolidation modes according to different landform. For example, for low hill and areas with better irrigation condition, it is recommended to plant rice

and high value cash crops, promote interplanting, increase application of organic fertilizer, extend technology of ecological use of straws, strengthen water management, improve irrigation projects; for high hill areas with better irrigation condition, it is recommended to plant some rice, but the effort should be focused on developing fruit and cash crops suitable for drought; hillock and middle field areas may focus on cultivate fertilizer and improve soil condition, apply trace element fertilizer, make intensive and meticulous farming and proper deep ploughing, improve physical and chemical property of soil, enhance water conservancy construction, raise the ability of drought resistance, and develop diversified operation according to actual conditions. If condition permits, it is required to build level terrace and change field with water, soil and fertilizer loss to field with protection of water, soil and fertilizer.

3.2 Hillock garden and forest land consolidation: integrating three benefits through combining fruit and forest trees and water and soil loss control

Agricultural production of central Anhui is mainly distributed in hillocks and hills. Water is insufficient and farming is extensive, and there is much distribution of four types of waste land, the plant coverage is low, and it lacks effective water drainage system, leading to prominent ecological problem of water and soil loss. Besides, in central Anhui, the landform is complex and there are many gentle slopes. The frost-free period is long and water and sunshine condition are superior, suitable for developing forest and fruit industries. The afforestation period is long but benefit is low. Thus, it is recommended to maintain forest using fruit trees, protect fruit trees with forest, and control water and soil loss, explore a new way of developing fruit and forest, take long-term protection, combine short-term economic benefit and long-term ecological and social benefits, plant fruit trees at hilly areas, to form pattern of mountain top forest and slope fruit, and promote benign cycle of water and soil conservation.

3.3 Rural community construction: making overall implementation, combining centralized and decentralized, and developing rural construction land consolidation mode with characteristics of Yangtze River and Huai River area residents

Central Anhui is situated between Yangtze River and Huai River. For convenience of agricultural production, most farmers live in plain areas. The residential areas are scattered. According to characteristics of this area, the consolidation of spatial distribution of rural residential points should follow the principle of "focusing on centralization and combining centralization with decentralization" and take the mode of relocation and merge of villages. However, the terrain condition determines that it is not suitable for building large hollow villages. It is required to suit measures in accordance with local condition according to characteristics of agricultural production, manifest characteristics of Yangtze River and Huai River residents, not suitable for constructing buildings reflecting rivers and lakes of Huizhou construction style. For example, government may guide residents to concentrate, reduce the proportion of scattered residents, improve traffic condi-

tion, and raise the gathering ability of rural residents. It is recommended to clear those old villages with no people living, reclaim some land to agricultural land, reduce area of field ridges, and merge scattered parcels of land, and divide farmland ownership again.

3.4 Ecological restoration: promoting land consolidation mode with development of high efficient ecological agriculture as objective

It is recommended to suit measures to local conditions, and take advantage of regional natural resources, to promote development of high efficient ecological agriculture. Chaohu Lake valley has large water area and abundant living aquatic resources, suitable for developing silverfish, shrimp and long tail anchovy; hilly areas belong to moist monsoon climate zone, have suitable temperature and sunshine, rain and high temperature are in the same season, and plentiful rainfall, excellent conditions for biodiversity development; central Anhui has high potential for development cash crops with high value, such as forest, fruit, tea, and vegetable, for example, it is feasible to combine water and soil protection with planting economic forest, forming compound forest production base. Besides, it is recommended to take advantage of new science and technology, enhance farmland water conservancy construction, promote construction of high quality commodity grain base, integrate and innovate upon compound high efficient ecological agricultural technology system, make breakthrough in key technologies for modern water-saving agriculture, "grain - feed - livestock - processing", "fruit - grass - livestock - processing" industry development, and build high-efficient agricultural development mode with characteristics of hilly areas in central Anhui.

4 Conclusions

The beautiful countryside construction in Anhui Province should follow the principle of suiting measures to local conditions, such as development foundation, population size, resource endowment, and folk custom, strengthening diversified land consolidation, strictly implementing farmland protection system, and ensuring capital farmland area. Besides, it should put the ecological protection in the first place, manifest local characteristics, take rural ecological construction as major point of building powerful ecologi-

cal province, energetically implement planting trees, and strengthen rural ecological protection and restoration, to realize harmony of human and nature. Land consolidation should suit farmers' production and living modes, give prominence to rural characteristics, keep rural scenery, manifest regional culture, and pay attention to rural cultural inheritance, rather than copy urban construction mode, to prevent one style of many villages. Situated between Yangtze River and Huai River, central Anhui has diversified landforms. This area should focus on rural environment consolidation, intensive land use, and rural industry development. Village consolidation should rely on resources, determine suitable development mode in accordance with local conditions, and orderly guide farmers to move to urban areas. The building pattern should integrate characteristics of southern Anhui and northern Anhui residents. In addition, it should attach importance to development of urban agriculture and modern facility agriculture, and accelerate building high quality characteristic agriculture and sideline product production base.

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