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# Ecological Construction Based on Land Use Zoning of Anhui Province

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**Abstract** Anhui Province is divided into 6 zones according to land use. This paper firstly introduces ranges, characteristics and problems of land use zoning in Anhui Province. On these bases, it presents the respective ecological construction mode. Huaibei Plain Zone should focus on agriculture and implement water conservancy project, ecological shelterbelt project and mining subsidence area control works. Jianghuai Hilly Zone should make breakthrough in transforming slope land, speed up restoring forest, grass and vegetation, and implement water-saving agriculture and prevention and control of soil erosion. The Yangtze River Side Plain Zone should take the opportunity of agricultural structural adjustment to implement the ecological construction mode of "reconverting farmland to forests, wetland and lakes". Western Anhui Dabie Mountain Zone should concentrate on setting apart hills for tree growing and transforming slope land, restoring and expanding forest, grass and vegetation, and implementing prevention and control of soil erosion. Southern Anhui Mountain Zone should focus on protecting natural forest, setting apart hills for tree growing, conceding the land to forestry and developing eco-tourism. Residential area should pay close attention to new urbanization construction, center on citizenship of agricultural population, push forward integration of industry and city, coordination of urban and rural areas, and interactive development of primary, secondary and tertiary industries.

**Key words** Anhui Province, Land use zoning, Ecological construction

The 17th National Congress of the CPC initially called for building ecological civilization, and the 18th National Congress of the CPC incorporated ecological civilization construction into the overall distribution of economic, political, social, cultural and ecological construction. Besides, the 9th Party Congress of Anhui Province took ecological strong province as one of the objectives of strengthening Anhui Province. Governments at all levels have taken ecological construction as fundamental guarantee of socio-economic sustainable development<sup>[1]</sup>. Ecological construction not only concerns Anhui Province, but also has great influence on socio-economic development of entire lower reaches of Yangtze River. Extending about 570 km from north to south, Anhui Province is characterized by diverse bio-climate, landform and terrain, and soil conditions, so land use patterns are different. Land use pattern determines ecological and environmental situations to a great extent, and holds sway over ecological construction and project types accordingly. In this paper, we study approaches of ecological construction on the basis of land use zoning of Anhui Province, to provide reference for policy making.

## 1 Overview of study area

Anhui Province, situated in the middle of China, is an inland province. In the transition area of temperate zone and subtropical zone, Anhui Province has warm and moist climate, four distinct seasons, and moderate rainfall. The annual temperature of the whole year is 14–17 °C and mean annual precipitation of 1 200

mm. The rainfall is more in south and less in north, more in mountain areas and less in plain areas. Anhui Province is diverse in landform and terrain, superior in geographical conditions, suitable for growth of numerous plants and breeding of animals, and favorable for comprehensive development of agriculture, forestry, animal husbandry and fishery. It covers an area of 14.012 hm<sup>2</sup>, including 31.3% plain (5.8% embanked field), 29.5% hilly area, 31.2% mountain area, 8.0% lake and marsh land, 11.233 million hm<sup>2</sup> agricultural land, 1.5987 million hm<sup>2</sup> construction land, and 1.181 million hm<sup>2</sup> unused land<sup>[2]</sup>. Most cultivated land is distributed in Huaibei Plain Zone, Jianghuai Hilly Zone and Yangtze River Side Plain Zone; forest land is mainly in Southern Anhui Mountain Zone and Dabie Mountain Zone, the area of total forest land is 4.403 million hm<sup>2</sup>, coverage rate up to 27.53%<sup>[4]</sup>; in the construction land, the rural residential area is much larger than urban land area.

## 2 Land use zoning of Anhui Province

On the basis of landform and socio-economic development conditions and *Comprehensive Plan for Land Use of Anhui Province* (2006–2020), we divide Anhui Province into 6 zones: Huaibei Plain Zone, Jianghuai Hilly Zone, Yangtze River Side Plain Zone, Dabie Mountain Zone, Southern Anhui Mountain Zone and Residential Area<sup>[2]</sup>.

### 2.1 Huaibei Plain Zone

**2.1.1 Range:** Huaibei Plain Zone is situated between north of Huaihe River master stream and south of Shaying River and belongs to southern edge of Huang–huai–hai Plain (North China Plain), including Fuyang City, Bozhou City, Suzhou City, Bengbu City, Huainan City and Huaibei City. The total land area is

3.925 million  $\text{hm}^2$ .

**2.1.2 Characteristics:** Flat terrain, deep soil, high cultivation rate, convenient traffic, rainy and hot seasons overlapping each other, annual mean precipitation more than 850 mm, annual mean temperature about  $14.7^\circ\text{C}$ . This zone is the major grain production area of Anhui Province. Labor force is abundant in this zone.

**2.1.3 Situation of land use and ecology:** With 15.263 million agricultural population and 2.138 million  $\text{hm}^2$  cultivated land (accounting for 47.8% of the cultivated land of Anhui Province), this zone is the largest agricultural area of Anhui Province and major commodity grain production in China. In addition, this zone is also one of the energy bases of China and has abundant coal resource. This zone mainly has 4 problems. (1) Drought and flood: uncoordinated space-time distribution of sunshine, heat and water resource, as well as little ecological shelter forest, leads to frequent occurrence of drought and flood; (2) Relatively low agricultural productivity: backward sci-tech level, low labor quality and insufficient reserve land result in low agricultural productivity; (3) Land subsidence: excessive use of groundwater for irrigation causes land subsidence; (4) Serious waste of land in mining areas: excessive mining of underground coal leads to large area of surface subsidence, damages ground vegetation and brings about low reclamation rate.

## **2.2 Jianghuai Hilly Zone**

**2.2.1 Range:** Jianghuai Hilly Zone is situated between Yangtze River and Huai River. Covering a total area of 3.407 million  $\text{hm}^2$ , it includes Hefei City, Chuzhou City and part of Lu'an City.

**2.2.2 Characteristics:** This zone is mainly hilly area. Yangtze and Huai River watershed crosses its middle part. It is situated in the transition area of subtropical zone and temperate zone. The annual mean temperature is  $15 - 16^\circ\text{C}$ , annual mean precipitation up to 900 – 1 000 mm, so the water and heat conditions are excellent. The capital city Hefei has high radiation capacity and developed water and land transportation. This zone is an important part of the Urban Belt along Yangtze River in Anhui Province connecting industrial transfer demonstration area.

**2.2.3 Situation of land use and ecology:** This zone is major production area of grain, oil and cotton in Anhui Province. Problems of land use mainly include drought, lack of water, low soil fertility, and serious soil erosion. Yangtze and Huai River watershed area is high in altitude and has little vegetation, so the soil erosion is worse. Sludge deposition and pollution of Chaohu Lake basin shrink the lake area, lead to eutrophication and reduce the water quality.

## **2.3 Yangtze River Side Plain Zone**

**2.3.1 Range:** Situated in the middle part of Anhui Province, crossing Yangtze River, covering an area of 2.175 million  $\text{hm}^2$ , this zone includes Wuhu City, Maanshan City and Tongling City and part of Anqing City. It is an area with large population but little land.

**2.3.2 Characteristics:** Situated in the Middle and Lower Yangtze Valley Plain, this zone has low flat terrain, low mountains

and hills, and major landform is plain. In this zone, water area is broad, rivers and lakes are densely distributed. Natural conditions are excellent. Besides, climatic conditions are favorable. The annual mean temperature is  $17^\circ\text{C}$  and the annual mean precipitation reaches 1 100 mm. In addition, it is rich in underground mineral resources, and the distribution of mineral resources is concentrated. This zone assumes the important task of transfer industries for Urban Belt along Yangtze River in Anhui Province, so it is a key industrial development area of Anhui Province.

**2.3.3 Situation of land use and ecology:** This zone is abundant in labor force, high in farmland capital construction and agricultural intensive operation, and has considerable scale of agriculture. Besides, it has large urban density, relatively high urbanization level and developed water and land transportation. Nevertheless, agricultural structure is not reasonable. Reclaiming parts of lake for use as farmland occupies much lake, river shoal, grass land and forest land, leading to decrease of groundwater level and reduction of flood prevention ability, and damage of ecological environment.

## **2.4 Southern Anhui Mountain Zone**

**2.4.1 Range:** In this zone, there are Yellow Mountain and Jihua Mountain. It is an important part of subtropical hilly area of China. It includes Xuancheng City, Huangshan City and Chizhou City. With an area of 3.039  $\text{hm}^2$ , this zone is an area of small population but much land.

**2.4.2 Characteristics:** There are various landforms in this zone. Hilly areas, mountain areas, river basin plain are in picturesque disorder. Its subtropical humid monsoon climate brings about rich rainfall (annual precipitation up to 1 100 – 1 200 mm), annual mean temperature of  $15.5 - 16^\circ\text{C}$ , so the heat and water conditions are excellent. Red soil takes up a large portion, greatly suitable for acidophilous plants. This zone is not only the important forest and tea production base of Anhui Province, but also famous scenic spot area in China.

**2.4.3 Situation of land use and ecology:** This zone is the most promising area with best eco-economic development in Anhui Province. However, there are also serious ecological security problems. For example, excessive and random lumbering reduces forest coverage, leads to serious soil erosion and frequent occurrence of geological disasters.

## **2.5 Dabie Mountain Zone**

**2.5.1 Range:** Situated in hinterland of Dabie Mountain and western area of Anhui Province, this zone adjoins to Henan Province and Hubei Province. It includes Jinzhai County, Huoshan County, and Shucheng County of Lu'an City, and Taihu County, Yuexi County and Qianshan County of Anqing City. With a total land area of 1.413 million  $\text{hm}^2$ , this zone is the smallest one among the 6 zones, and its cultivated land and the population are also the least.

**2.5.2 Characteristics:** This zone is diverse in landforms, but the major landform is mountain and hill. The terrain is high in southwest and low in northwest. With annual mean temperature of  $12.5$

℃ and annual average precipitation of 1 833 mm, this zone has temperate climate, sufficient sunshine, and abundant rainfall. Animal and plant resources are various. Therefore, it has superior condition for developing diverse operation. It is a key production base of forest, tea and fruit in Anhui Province. In addition, water energy resource ranks the first in the whole province.

**2.5.3 Situation of land use and ecology:** This area is unreasonable in land use, weak in social and economic foundation, and low in economic development level. Poverty and backwardness are not changed. Although this zone is an important forest production base of Anhui Province, the degradation trend of ecology and environment is not contained and soil erosion problem is serious due to excessive and random lumbering.

## 2.6 Residential Area

**2.6.1 Range:** This area mainly refers to people's production and living area and affiliated facility area, including towns, villages and mining enterprises, etc.

**2.6.2 Characteristics:** With socio-economic development and acceleration of urbanization, people have higher and higher demands for residential area. In 2011, the registered population of Anhui Province reached 66.759 million, permanent resident population was up to 59.68 million, and the urbanization rate reached 44.8%; permanent resident population in rural areas reached 32.94 million, accounting for 55.2% of the total population. Anhui Province has 15 539 administrative villages in total, 14 206 less than that in 2000, while it has 228 763 natural villages, 63 407 less than that in 2000<sup>[2]</sup>.

**2.6.3 Situation of land use and ecology:** Anhui Province is at the stage of accelerating industrialization and urbanization, rural population drops year by year, while the ability is strengthening in promoting agriculture through industry and driving rural areas by urban areas. However, there are problems of unstable system of residential area, imperfect support infrastructure, and weak sustainable development ability. What's worse, the construction of residential area lacks plan, so the distinct characteristics are manifested fully.

## 3 Land use zoning and ecological construction

**3.1 Huaibei Plain Zone** Firstly, this zone should focus on agriculture, develop forestry and animal husbandry simultaneously, properly adjust agricultural structure, push forward agricultural industrial system, establish favorable agricultural ecosystem. Secondly, forestry development should protect and improve agricultural ecological environment, make proper planning of shelter forest, timber forest, economic forest and forests for water and soil conservation. Thirdly, it should strengthen water-saving irrigation to improve irrigation efficiency and reduce underground water irrigation. Mining subsidence area control works should suit local conditions. In deep subsidence area formed by multiple layer coal mining, it may adopt aquaculture, while in shallow subsidence area, it may dig pools for reclamation. Besides, it is feasible to develop tourism using large water area, deep water and high water

quality subsidence area<sup>[7]</sup>.

**3.2 Jianghuai Hilly Zone** This zone should follow the principle of biological diversity. Firstly, it should restore forest, grass and vegetation and strengthen water and soil conservation, to lay solid foundation for recovery and reconstruction of river basin ecosystem. Secondly, it is recommended to actively popularize water-saving irrigation, and energetically develop "Pond Economy". Thirdly, it should implement overall plan of mountain, water, farmland, forest, road and village, and take comprehensive control, to change the situation of soil erosion fundamentally. Also, it should bring into full play potential advantage of forest production of this zone, and combine developing forestry and optimizing ecological environment, to improve the overall benefits of forest.

**3.3 Yangtze River Side Plain Zone** This zone should stick to the principle of suiting local conditions and making rational use. Specifically, it is proposed to push forward agricultural industrial adjustment, implement agricultural industrial operation, develop suburban agriculture, export-oriented agriculture and harmless agriculture. Besides, in the spirit of protecting water quality and smooth traffic of Yangtze River, this zone should implement works of reconverting farmland to forests, wetland and lake, and reduce and put an end to flood, to realize economic development in step with construction of ecological environment. Furthermore, it should build water conservancy projects, carry out ecological slope protection project for rivers, and comprehensively control soil erosion. Finally, we recommend strengthening ecological construction of lakes, control ecological environment of river basin, control discharge at pollution source area, and advocate clean production process.

**3.4 Southern Anhui Mountain Zone** Close attention should be paid to development, protection and use of "two mountains and one lake" tourism resources. Firstly, it should promote industrial structural adjustment taking ecological tourism as the objective and building this zone into a comprehensive ecological economic zone with tourism as characteristic. Secondly, agricultural structure takes the forestry as main part and considers animal husbandry at the same time. On the precondition of giving prominence to cultivated land protection and ecological construction, it is required to energetically develop mountain economy to realize the objective of "making best use of local resources". Thirdly, it should further optimize internal structure of agriculture and develop labor intensive agricultural production, to make this zone become the important forest, tea, famous, characteristic and high quality commodity production base of Anhui Province. Fourthly, it should enhance comprehensive control of soil erosion, implement strategy of conceding cultivated land to forest for slope land, and maintain and improve ecological quality of this zone.

**3.5 Western Anhui Dabie Mountain Zone** This zone should properly use and effectively protect land resource, take full advantage of various natural conditions and resources, adjust agricultural land structure, optimize ecological environment, and improve land productivity<sup>[5]</sup>. We recommend setting apart hills for tree

growing and implementing green project in barren hills, to increase forest coverage. It is proposed to actively develop small-scale hydropower stations to relieve pressure of living and production on forest area. Besides, it should control small river basin to prevent soil erosion. Moreover, it can actively develop green food and promote ecological tourism, forest tourism, water reservoir tourism, and Red tourism.

### 3.6 Residential Area

**3.6.1** Building a new urban system with integration of garden city and urban agriculture taking central city as core and key towns as satellite. It should set up the concept of regional big city and avoid the development mode of "excessive spatial expansion" in the past. Regional big city takes central city as the core and key towns as satellite, and develops urban agriculture in areas between axes formed by traffic network, to form garden city landscape and realize mutual environment of city, town and agriculture, and the pattern of suitable living, employment and travel with coordinated development of large, medium and small cities or towns.

**3.6.2** Establishing low carbon economy criterion for industrial access mechanism, to protect clear water, blue sky and green land in the process of industrialization. The criterion of low carbon economy is to quantify energy consumption of unit output value, investment of unit land, and pollutant discharge. It is required to establish and perfect land supply mechanism. Specifically, industries that are encouraged to undertake can be supplied with land firstly, those industries with certain conditions to undertake will be limited to land supply, and those forbidden to undertake will not be supplied with land. In this way, it can promote land saving and intensive land use, avoid encroaching upon agricultural land, and guarantee green land, and ensure clear water and blue sky through reducing waste water, waste gas and waste residue.

**3.6.3** Setting up interactive new socialist countryside construction platform to push forward construction of beautiful Anhui Province at fast and good speed. It should follow the principle of "whole village promotion and land consolidation" to realize residents centralizing on central villages and towns, industries centralizing on park area and agriculture moving towards to scale operation. Only setting foot of "whole village promotion and land consolidation" on "beautiful countryside construction", may it realize the dream of beautiful Anhui Province.

**3.6.4** Establishing criterion of basic public service equalization to promote integrated development of urban and rural areas. In the spirit of the 18th National Congress of the CPC, it should speed up the urban and rural integration mechanism and system, put forth

effort to give impetus to integration from urban and rural planning, infrastructure, and public services, and promote equal exchange of urban and rural elements and balanced allocation of public resources, to form the new reciprocal and integrated industrial and agricultural and urban and rural relationship through industry promoting agriculture, urban areas driving rural areas. For this purpose, it should establish assessment criterion. With assessment criterion, it may realize sustainable development. Even if a leader is substituted, the progress of integrated urban and rural development will not slow down and the direction will not change.

## 4 Conclusions

Land use zoning is the foundation of ecological construction, while the ecological construction is the guarantee for realizing socio-economic sustainable development. Therefore, in the process of pushing forward ecological civilization construction, all areas should enhance planning guidance, make scientific land use zoning in combination with local natural and socio-economic conditions, build ecological construction mode suitable for land use zone, and implement corresponding construction measures. This is the only way to build resource-saving and environment-friendly society.

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