

Agricultural Resource and Environment Zoning in China

Xu Erqi

Key Laboratory of Land Surface Pattern and Simulation, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing 100101, China

Abstract: Problems associated with the agricultural resources and the environment have become increasingly prominent in China, with distinct resource and environmental constraints for regional agriculture. Based on regional differences between the agricultural resources and the environmental characteristics, the country was subdivided in this study into 10 first-level zones, and in 57 second-level zones at the county scale. The first-level zones were identified according to regional differences in climate and geotectonics, while for the second-level zones their water resources, land resources, and environmental conditions were considered. The agricultural production, the types of resources and their combinations, the environmental production conditions, and the problems existing in these zones were analyzed. The strategies for “optimizing the spatial layout of eastern, central, and western regions” and “improving Northeast China, regulating North China, and recovering South China” are proposed in this study. Twenty-seven second-level zones which supply major agricultural products in China were identified and labeled as “major agricultural development regions in China”. Development directions and construction measures for the major agricultural developing regions in China were suggested in order to maintain and improve the health and sustainability of China’s agricultural production system.

Keywords: resource and environment; optimal spatial layout; major agricultural developing regions; China

1 Introduction

Increasingly prominent resource limitations and environmental problems have constrained the Chinese agricultural production. The main issues include the shortage of agricultural irrigation water supply, low efficiency of agricultural water use, a continuous decrease of farmland resources, worsening of farmland soil quality, and contamination of water, soil, and air in agricultural production areas. Due to the vast territory of China, these resources and environmental issues occur in a variegated regional distribution. The zoning of agricultural resources and the environment was performed for the Chinese territory according to the *Chinese Agriculture Zoning* [1], the *Atlas of China’s Land Resources* [2], and *China’s 1:4 Million Geomorphic Map* [3]. Issues concerning the resources and the environment, and the characteristics of the agricultural production in various zones were analyzed. Finally, the spatial layout and the directions of development for a rational utilization and protection of the agricultural resources and the environment in China were proposed.

2 Zoning scheme of agricultural resources and environment

The county boundary was taken as the minimum mapping unit for the Chinese agricultural resource and environment zoning. The zoning consisted of two levels, with 10 first-level and 57 second-level zones being

Received date: September 10, 2018; **Revised date:** September 18, 2018

Corresponding author: Xu Erqi, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, associate research fellow. Main research fields include land utilization, spatial pattern, and ecological and environmental effects. E-mail: xueq@igsnrr.ac.cn

Funding program: CAE Advisory Project “Research on Key Strategic Issues of Agricultural Resource and Environment in China” (2016-ZD-10)

Chinese version: Strategic Study of CAE 2018, 20 (5): 057–062

Cited item: Xu Erqi. Agricultural Resource and Environment Zoning in China. *Strategic Study of CAE*, <https://doi.org/10.15302/J-SSCAE-2018.05.009>

identified (Table 1). The first-level zones were identified according to regional differences in climatic and geotectonic conditions, while the second-level zones were differentiated according to water resources, land resources, and environmental conditions.

Table 1. Characteristics of the Chinese agricultural resource and environment zoning.

Serial number	Zoning name	Agricultural resources and environmental problems
I	Northeast China region	
I ₁	Sanjiang Plain zone	Flood, slight soil erosion, water pollution, low irrigation
I ₂	Greater Khingan Mountain zone	Steep slopes, low irrigation, water pollution
I ₃	Lesser Khingan Mountain zone	Steep slopes, low irrigation, water pollution
I ₄	Baekdu Mountain zone	Steep slopes, heavy clay of albic soils, low irrigation
I ₅	Songnen Plain zone	Reduction of black soil thickness, sandy desertification, salinization, environmental pollution, low irrigation
I ₆	Hilly and mountain zone of Liaoning	Water shortage, soil erosion, water and soil pollution, steep slopes
I ₇	Central and southern Liaoning	Water pollution, heavy metal pollution, water shortage
I ₈	West Liaohe River zone	Water shortage, soil erosion, sandy desertification, water pollution, low irrigation
I ₉	Hulunbuir grassland zone	Grassland degradation, sandy desertification, salinization, water pollution, low irrigation
II	Inner Mongolia and region along the Great Wall	
II ₁	Eastern Xilin Gol grassland	Thinning soil layer, grassland degradation, sandy desertification, low irrigation
II ₂	Western Xilin Gol desert steppe zone	Desertification, grassland degradation, water shortage, soil depletion
II ₃	Yin Mountain and region along the Great Wall	Water shortage, desertification, steep slopes
II ₄	Hohhot–Baotou Hetao zone	Overloading water resource, secondary salinization, slight soil erosion
II ₅	Ordos Plateau zone	Desertification, water shortage, thinning soil layer, soil depletion
III	Huang–Huai–Hai region	
III ₁	North China Plain zone	Extreme water shortage, water pollution, heavy metal pollution
III ₂	Shandong hilly zone	Water shortage, thinning soil layer, steep slopes, water pollution, slight soil erosion
III ₃	Huang–Huai Plain zone	Extreme water shortage, drought, water and soil pollution
III ₄	Bohai Gulf zone	Extreme water shortage, water pollution, heavy metal pollution, decreasing area of farmland
IV	Loess Plateau region	
IV ₁	Shanxin–Henan earth-rock mountain zone	Soil depletion, extreme water shortage, steep slopes, soil erosion
IV ₂	Fenhe River and Weihe River valley zone	Water shortage, drought, flood, water pollution, slight salinization
IV ₃	Loess Plateau gully zone	Severe soil erosion, sandy desertification, water shortage, steep slopes
IV ₄	Hilly and sandy land in northern Shaanxi and eastern Ningxia	Severe sandy desertification, water shortage, soil depletion
IV ₅	Loess hilly and gully zone	Severe soil erosion, water shortage, grassland degradation, soil depletion
V	Northwest arid region	
V ₁	North slope zone of Tianshan Mountain	Overdeveloping water resources, severe sandy desertification and salinization, soil depletion
V ₂	Yili River Basin zone	Steep slopes, grassland degradation, desertification
V ₃	Ertix–Ulungur River Basin zone	Severe sandy desertification, soil depletion
V ₄	Tarim Basin zone	Drought, over-exploited water resources, severe desertification
V ₅	Eastern Xinjiang zone	Severe sandy desertification, water shortage, soil depletion
V ₆	Alxa–Ejina Plateau zone	Severe sandy desertification, water shortage, soil depletion
V ₇	Hexi Corridor zone	Over-exploited water resources, severe desertification, frequent agricultural disasters
V ₈	Yinchuan Plain zone	Water shortage, salinization, sandy desertification, water pollution
VI	Plain and hilly region in the middle and lower reaches of the Yangtze River	
VI ₁	Yangtze River Delta	Decreasing farmland, environmental pollution, depleted agricultural water
VI ₂	Yangtze–Huaihe zone	Frequent disaster, water pollution, heavy mental pollution

Table 1 (continued)

Serial number	Zoning name	Agricultural resources and environmental problems
VI ₃	Plain zone of the Mid-Yangtze River	Water pollution, heavy metal pollution, flood
VI ₄	Plain and hilly zone of Henan, Anhui, and Hubei	Slight soil erosion, thinner soil layer, locally steep slopes
VII	Hilly and mountain region in the south of the Yangtze River	
VII ₁	Middle and upper reaches of the Gan River Basin	Steep slopes, slight soil erosion, environmental pollution, soil acidification
VII ₂	Middle and upper reaches of the Xiang River Basin	Steep slopes, environmental pollution, desertification, soil acidification
VIII	Southeast China region	
VIII ₁	Coastal plain and hilly zone in Zhejiang, Fujian, and Guangdong	Decreasing farmland, environmental pollution, frequent disasters, locally steep slopes
VIII ₂	Pearl River Delta zone	Decreasing farmland, pollution from acid rain, heavy metal, water
VIII ₃	Hilly zone of western Guangdong and southern Guangxi	Steep slopes, heavy metal pollution, low irrigation
VIII ₄	Hainan Island zone	Frequent disaster, steep slopes, heavy metal pollution
VIII ₅	Taiwan Island zone	Steep slopes, frequent disaster, soil depletion
VIII ₆	Coastal hilly zone in Guangdong and Guangxi	Frequent typhoon, steep slopes, pollution from acid rain
VIII ₇	Hilly and mountain zone in Zhejiang and Fujian	Steep slopes, pollution from acid rain, slight soil erosion, thinning soil layer
VIII ₈	Hilly and mountain zone in northern Guangdong and northern Guangxi	Steep slopes, low irrigation, pollution from acid rain, soil depletion
IX	Southwest China region	
IX ₁	Qinling, Funiu, and eastern Sichuan Mountain zone	Low temperature, steep slopes, low irrigation, soil depletion
IX ₂	Sichuan Basin zone	Decreasing farmland, soil erosion, environmental pollution, disasters
IX ₃	Karst hilly and mountain zone in Guizhou and Guangxi	Steep slopes, severe karst desertification, soil erosion, low irrigation, environmental pollution
IX ₄	Yunnan Plateau zone	Steep slopes, frequent drought, soil water erosion
IX ₅	Hilly and mountain zone in southern Yunnan	Steep slopes, soil water erosion, soil depletion
IX ₆	Mountain zone in the upper reaches of the Yangtze River	Steep slopes, severe soil erosion, pollution from acid rain
IX ₇	Garz–Ngawa Plateau zone	Steep slopes, low temperature, frequent geological disasters, low irrigation
X	Qinghai–Tibet Plateau region	
X ₁	Qaidam Basin zone	Water shortage, severe sandy desertification, severe salinization
X ₂	Sanjiangyuan and surrounding zone	Fragile pasture, frequent disasters, steep slopes
X ₃	Northern Tibetan Plateau zone	Alpine climate, soil depletion, low irrigation, severe desertification
X ₄	Midstream of the Yarlung Zangbo and two tributaries in southern Tibet	Desertification, frequent disasters, environmental pollution, steep slopes, soil depletion
X ₅	Hengduan Mountain zone	Steep slopes, low temperature, soil erosion, frequent geological disasters

3 Regional development directions and measures for agricultural production

3.1 Optimizing the spatial layout of eastern, central, and western regions

The eastern coastal region is the pioneer area of the international grain trade and of the export-oriented modern agriculture. Three metropolitan regions, the Bohai Gulf, Yangtze River Delta, and Pearl River Delta zones are the most developed economic and social areas, and also the main areas consuming agricultural products. To meet the needs of the urban consumption of agricultural products, the agricultural development must work towards a capital and technology-intensive agriculture, and towards building an international trade market and a grain reserve base. The Yellow River Delta, the coastal regions of the Jiangsu, Zhejiang, Fujian, and Guangxi provinces, and Hainan Island could take advantage of their coastal ports and accelerate the development of a highly efficient, high-quality, and export-oriented agriculture focusing on horticultural products, livestock, and aquatic products.

The central region links the eastern and western regions and has the advantage of developing modern plains agriculture. China's agricultural production zones are mainly located in the central region and include the Sanjiang, Songnen, Huang-Huai-Hai, and Jiangnan Plain zones, the Poyang Lake and the Dongting Lake Plain zones, and the Yangtze-Huai zone. The direction of development of these regions is towards supporting the development of an industry that processes the agricultural product, strengthening the construction of large-scale intensive farmlands, and establishing agricultural modernization. These measures include the protection of farmlands, the adjustment of planting structures, and the reduction of crops that are highly dependent on irrigation.

The development direction of the western region is the eco-agriculture and the characteristic agriculture. The western region is an ecologically fragile region in China, with a conflict between water and land resources. On the basis of natural resource benefits and the protection of the agricultural production environment, the agricultural development strategy is to follow both the environmental protection and the development. Agricultural development in the northwestern region would strengthen grassland construction, develop grassland livestock husbandry, save water for dryland farming and high-quality characteristic agriculture, and accelerate the transformation of low- and medium-yield fields and the reduction of saline-alkaline soils. The southwestern region should highlight a comprehensive watershed management, develop and utilize grassland resources, construct water shortage engineering countermeasures, strictly protect Pingba paddy fields, and develop water-saving irrigation agriculture, animal husbandry, and tropical and subtropical characteristic agriculture.

3.2 Improving Northeast China, regulating North China, and recovering South China

The main regions of agricultural production are located in central and eastern China. These regions include Northeast China, the Huang-Huai-Hai drainage basin, plains and hills in the middle and lower reaches of the Yangtze River, hills and mountains in the south of the Yangtze River, and the Southwest China regions. The Northeast China region is the production area of commodities, with the highest yields and the largest potential for increasing grain production in China. The North China region (Huang-Huai-Hai drainage basin) is the largest grain production region but has the most significant conflict between agricultural resources and the environment. The South China region is the largest rice and sugar production area but also the most contradictory area of food supply and demand in China. Based on these regional characteristics and problems concerning the resources and the environment, the overall strategy of "improving Northeast China, regulating North China, and recovering South China" was presented.

The Northeast China region, specifically the Sanjiang and Songnen Plain zones, were suggested as areas to build China's largest commercial grain and agricultural specialization base. Four measures were devised. First, it was suggested to enforce an agricultural cropping pattern reform. This included establishing a comprehensive dry agriculture pattern, a compound agricultural model with grain-soybean rotation, grain-grass (feeding) rotation, and a combination of planting-breeding recycling modes. Second, stabilization and protection were suggested for the rice production base in the Northeast China region, including appropriately reducing the corn planting area in the "sickle bay" area. The third measure was to promote the construction of agricultural production and processing bases, taking advantage of the superior location for agricultural production. This would include developing the entire production chain that would consist of standardized planting, fine processing, and high-efficiency logistics. Finally, the sustainable utilization of the black soil project was suggested, in order to support the sustainable agricultural development of the Northeast China region, through the implementation of a comprehensive management of salinization, desertification, and grassland degradation in the ecologically fragile regions.

In the North China region, it was suggested that the North China Plain zone be the key rehabilitation area, and the Huang-Huai Plain zone be the key agricultural production area. This would require comprehensively regulating the agricultural resources and the environment to achieve a sustainable development of the largest grain production base in China. The first measure was to adjust the planting configuration, including a north-to-south shift for the winter wheat sown area, and moderately reducing the wheat planting area in North China, an area where groundwater has been severely over-exploited. The second measure was to intensify the comprehensive management of water resources, including developing regulated deficit irrigation techniques, promoting the sprinkler irrigation, drip irrigation, and water-fertilizer integration irrigation techniques, and comprehensively adjusting and planning water systems and groundwater recovery projects, with the opportunity of a south-to-north water diversion project. The third measure was to comprehensively regulate the agricultural eco-environment, involving the adjustment of regional industrial structures and population distribution structures to alleviate pressures on the environment, preventing atmospheric, water, and soil pollution, and implementing restoration

measures.

The South China region includes the plains and hills in the middle and lower reaches of the Yangtze River region, the hills and mountains in the south of the Yangtze River, and the Southwest China region. Different regional directions with four improvement measures were suggested for improving a sustainable agricultural development. The middle and lower reaches of the Yangtze River would focus on the protection and development of the main rice production region, and the southeast coastal region would develop export-oriented modern agriculture. The first measure was to protect the farmlands, stabilize the cultivated areas of double cropping rice, increase the production of feed grain, and expand the scale of the north-south food production and tropical crop industry. The second measure was to take advantage of the location and technology in the southeast coastal region, develop export-oriented agriculture such as flower, vegetable, potted plant, and fruit production, promote agricultural intelligence, efficiency and precision, and vigorously develop modern agriculture. The third measure was to promote the comprehensive development of agriculture-forestry-fruit and agriculture mechanization and to develop a stereo ecological agriculture in the hilly and mountainous regions. The fourth measure was to intensify the source control of acid rain and heavy metal pollution, and carry out remediation of contaminated soil.

3.3 Construction measures of the major agricultural developing regions in China

According to agricultural production data at the county level in 2014, twenty-seven main agricultural production zones for China's supply of agricultural products were analyzed. The total area of these zones was 64.43% of the national cultivated area. The production of rice, wheat, corn, soybean, potato, oil, cotton, sugar, vegetables, and fruit accounted for 81.88%, 91.61%, 79.65%, 61.75%, 60.19%, 81.75%, 96.27%, 95.54%, 80.54%, and 67.90% of the total national production, respectively. The development directions and construction measures of the major agricultural production regions were proposed in Table 2.

Table 2. Directions and measures of China's major agricultural production regions.

Zoning name	Agricultural development direction	Agricultural construction measures
I ₁ Sanjiang Plain zone	Constructing China's main commodity grain base, establishing a model based on agriculture and industrial support, developing high quality rice and high-oil soybean, and appropriately reducing the corn planting area	① Implementing irrigation control measures in the rice-growing area ② Controlling wind erosion, water erosion and local desertification, and increasing the intensity of returning grain to forest, grassland, and marsh ③ Focusing on flood and drought control, and developing irrigation and water conservancy
I ₅ Songnen Plain zone	Building China's corn belt base, consolidating its importance as a commodity grain base, developing farming-grazing agriculture and grass-crop rotation	① Converting the longitudinal ridge to cross ridges or sloping ridges, and implementing grass-crop rotation to increase soil fertility ② Comprehensively managing salinization, desertification, and grassland degradation
I ₈ West Liaohe River zone	Consolidating its importance as a grain production base, limiting livestock capacity based on grassland carrying capacity, and promoting the coordinated development of agriculture and husbandry	① Promoting water-saving agriculture and dry farming techniques, and improving water use efficiency ② Implementing grass-crop rotation to increase soil fertility and promote herbage industrialization ③ Strengthening and improving natural grasslands with better soil and water conditions
I ₉ Hulunbair grassland zone	Reasonably utilizing and protecting the natural grasslands, strengthening the construction of a forage feed base, and constructing the national main production base of wool, skin, meat and milk products	① Implementing rest grazing and rotation grazing, and strengthening the management and protection of natural pastures ② Constructing an artificial grassland and forage basis, and carrying out semi-grazing and semi-feeding systems ③ Compressing the irrigated corn planting area and restoring the drought-tolerant crop planting area
II ₁ Eastern Xilin Gol grassland zone		
II ₄ Hohhot-Baotou Hetao Zone	Consolidating the grain production base, and developing agricultural modules for efficiently using water resources and regulating water and salt transportation	① Developing water-saving agriculture and constructing field water-saving projects ② Comprehensively preventing and controlling soil salinization and erosion

Table 2 (continued)

Zoning name	Agricultural development direction	Agricultural construction measures
III ₁ North China Plain zone	Developing efficient water-saving irrigation with water-fertilizer integration, and appropriately reducing the winter wheat sown area	<ul style="list-style-type: none"> ① Promoting the “Sansanzhi” planting structure, and developing herbivorous livestock ② Comprehensively promoting high-efficiency water-saving technologies, including micro-irrigation and pipeline watering irrigation, and implementing an irrigation quota system ③ Reducing the amount of groundwater extraction and fertilizer application, and retiring winter wheat in the groundwater overdraft area
III ₂ Shandong hilly zone	Constructing national aquatic product and fruit bases and rationally promoting the adjustment of the agricultural structure, including grain-cash-feed crop and the plant-husbandry-fishery structures	<ul style="list-style-type: none"> ① Enhancing the production and processing advantage of aquatic products and fruit ② Promoting the adjustment of agricultural structure and expanding the area of forage crops and characteristic economic forests
III ₃ Huang-Huai Plain zone	Consolidating and improving the status of national wheat production bases, and adjusting the planting structure	<ul style="list-style-type: none"> ① Developing rice-wheat and soybean-wheat rotation systems ② Promoting water-saving engineering and agronomic water-saving measures ③ Consolidating and building a wheat production base in the Huaibei Plain
IV ₂ Fenhe River and Weihe River valley zone	Consolidating and improving the regional grain-cotton-oil base and developing the compound agro-forestry system	<ul style="list-style-type: none"> ① Implementing a water-saving irrigation project and river ecological management project to build a characteristic economic forest base and artificial forage material base ② Developing compound agriculture systems, such as the forest-grain, forest-fruit, forestry-grass and forest-medicine pattern
V ₁ North slope zone of Tianshan Mountain	Coordinating planting-husbandry structures, and creating a modern agricultural demonstration region on the northern slope of Tianshan Mountain	<ul style="list-style-type: none"> ① Converting from a sole cotton system to a compound grassland-cotton-grain-feeding system, and implementing grass-crop rotation ② Protecting dryland and improving production planting capacity, and establishing a dryland water-saving and soil-preserving farming module
V ₂ Yili River Basin zone	Establishing green economy agriculture, and promoting the development of animal husbandry	<ul style="list-style-type: none"> ① Building a grain-cash-feed crop pattern, and a planting-feeding-processing agricultural structure, and accelerating the restructuring of livestock and poultry farming ② Strengthening the grassland protection project, implementing different developing strategies, including grazing prohibition, grazing rest, grazing rotation and grass and livestock balance
V ₄ Tarim Basin zone	Building a high-efficiency and intensive cotton-planting base, and accelerating the large-scale production and intensive management of cotton	<ul style="list-style-type: none"> ① Optimizing the planting structure of the main cotton production areas, maintaining a moderately stable production scale of cotton, and promoting the cotton-grain-grass-fruit planting structure ② Developing the membrane-based drip irrigation and water-fertilizer integration technology, and establishing a water-saving dryland agriculture
V ₇ Hexi Corridor zone	Establishing a regional commodity grain base, and developing a water-saving characteristic agriculture	<ul style="list-style-type: none"> ① Optimizing the agricultural structure, and planning a water-based planting scale ② Controlling sandy desertification, constructing grassland, transforming saline-alkali land, and promoting pasture-grain and paddy field-dryland rotation
V ₈ Yinchuan Plain zone	Adjusting the oasis agricultural structure, and implementing the grass-rice rotation system	<ul style="list-style-type: none"> ① Reducing water usage from the Yellow River, rationally developing groundwater resources, and efficiently saving irrigation water

Table 2 (continued)

Zoning name	Agricultural development direction	Agricultural construction measures
		② Implementing eco-agriculture, and reducing environmental pollution
		③ Controlling soil salinization and sandy desertification
VI ₁ Yangtze River Delta zone	Stabilizing the food production base, and building urban agriculture, intensive capital and technologically modern agriculture	① Strictly protecting farmland, and preventing excessive agricultural recession
		② Implementing intensive and industrial-scale farming and intelligent mechanization farming
VI ₂ Yangtz–Huaihe zone	Focusing on the production of grain, cotton and oil, and promoting the comprehensive development of a rural commodity economy	① Consolidating and improving rice-based grain production, increasing the sown area of rice and rapeseed, and moderately developing cotton planting
		② Strengthening the construction of irrigation and water conservancy and high-quality farmland
VI ₃ Plain zone of Mid-Yangtze River	Stabilizing the double cropping rice area and consolidating the national status of a commodity grain production base	① Promoting the development of modern agriculture with mechanized and standardized production
		② Protecting farmlands, building permanent basic farmland protection areas, and improving the utilization efficiency of farmland resources
		③ Adjusting the industrial structures, and implementing the restoration and prevention of atmospheric and soil pollution
VI ₄ Plain and hilly zone of Henan, Anhui, and Hubei	Consolidating the status of grain and oil production bases, and developing characteristic agriculture	① Developing mechanized agriculture in low-hilly areas, and comprehensively developing stereo eco-agriculture
		② Preventing and controlling soil erosion, including forest and grass planting in mountains, regulating economic forests in mountainside belts, and governing the sloping cropland in hillside slopes
VII ₁ Middle and upper reaches of Gan River Basin	Stabilizing the double cropping rice area, consolidating and improving the rice production base, and comprehensively developing plant–forestry–husbandry in hilly and mountainous areas	① Strengthening the construction of basic farmland in gullies, controlling agricultural non-point source pollution, and alleviating regional soil acidification
VII ₂ Middle and upper reaches of Xiang River Basin		② Controlling pollution in mining areas, and strengthening restoration of the water and soil environment
		③ Continuing soil and water conservation
		④ Promoting the comprehensive development of agriculture–forestry–fruit and hill agriculture mechanization, developing stereo ecological agriculture in the hilly and mountainous regions
VIII ₁ Coastal plain and hilly zone in Zhejiang, Fujian, and Guangdong	Constructing a technologically-intensive and labor-intensive, export-oriented agricultural production base	① Promoting the standardization of agricultural production, and enhancing the specialty industry advantages and international competitiveness of flower, vegetable, potted plant, and fruit
		② Improving the service system of agricultural production, management and circulation, and developing an export-oriented agriculture
VIII ₂ Pearl River Delta zone	Building an urban agriculture and a stereo eco-agriculture, and establishing a modern agricultural demonstration base	① Stabilizing the existing cultivated land area, transforming the traditional pond agricultural mode, and developing modern urban agriculture and stereo eco-agriculture
		② Adjusting the industrial structure, and implementing the restoration and prevention of water, atmosphere and soil pollution
VIII ₃ Hilly zone of western Guangdong and southern Guangxi	Stabilizing the national sugar cane production base and vigorously developing the sugar industry	① Promoting and developing mechanization according to local conditions
		② Strengthening the construction of irrigation and water conservation

Table 2 (continued)

Zoning name	Agricultural development direction	Agricultural construction measures
VIII ₄ Hainan Island zone	Consolidating and developing a highly efficient tropical agricultural base	③ Introducing various cost-saving technologies in the sugar industry ① Developing high-efficiency tropical crops and fruits according to local conditions, and promoting the scale and industrial development of the rubber industry ② Building disaster prevention and mitigation measures to improve resilience to typhoons, floods, and droughts
IX ₂ Sichuan Basin zone	Constructing a comprehensive national agricultural commodity base with swine, rapeseed, rice, citrus, and sericulture	① Protecting cultivated land, building stable and high-yield basic farmland, and developing grain production
IX ₅ Hilly and mountain zone in southern Yunnan	Building a plateau granary, developing mountain husbandry, efficient forestry, and open agriculture	① Enhancing traditional characteristic product production of tobacco, sugar, tea, and rubber, and developing emerging agricultural products ② Strengthening agricultural disaster prevention and mitigation capabilities, enhancing the control of drought and flood, and improving irrigation and drainage systems

Acknowledgement

The author wishes to thank the Academician Shi Yulin for his careful guidance and valuable advice on the zoning strategy.

References

- [1] Agricultural Regional Planning Group in National Agricultural Regional Committee of China. China agriculture zoning [M]. Beijing: China Agricultural Press, 1981. Chinese.
- [2] Shi Y L. Atlas of China's land resources [M]. Beijing: China Land Press, 2006. Chinese.
- [3] Li B Y, Li J Z. China's 1:4 million geomorphic map [M]. Beijing: China Science Publishing & Media Ltd., 1994. Chinese.