Nature Environment and Pollution Technology
An International Quarterly Scientific Journal

ISSN: 0972-6268	Vol. 13	No. 4	pp. 795-800	2014

Original Research Paper

Eco-Agriculture Demonstration Park Planning-A Case Study Qi River Ecological Agriculture Park, Hebi, China

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Nat. Env. & Poll. Tech.
Website: www.neptjournal.com
Received: 26-2-2014
Accepted: 21-3-2014

Key Words:
Eco-agriculture park
Qi river
Functional zones
SWOT analysis

ABSTRACT

Agricultural structure adjustment is an important measure to promote the development of ecological agriculture by the Chinese government, and the construction of ecological agriculture demonstration park is an important part of the agricultural structure adjustment. This paper studied the Qi River ecological agriculture demonstration zone located in Hebi, China, and formulated the overall planning program based on the SWOT analysis, ecological suitability analysis and market demand analysis. The results are the following: Nine functional zones are established based on its development positioning, namely, eco-harvesting zone, leisure village, fun farm zone, facility agricultural zone, technology demonstration zone, recreational zone, Qi River original ecological experience zone, agribusiness incubator zone, and development reserve zone. Special planning for road transportation system, water system, and infrastructure should be fully integrated. Eco-agriculture demonstration zone is an important direction of Chinaôs modern agricultural development, and its rational planning can help to improve the sustainability of the parkôs development.

INTRODUCTION

China is a developing and also a large agricultural country. Agriculture in China is facing challenges from population, resources, ecological environment and food safety (Tian 2002). However, China's economic development has raised higher requirements for agricultural development, that is, the transition of agricultural production from quantity to quality-oriented mode of development and the transition of agricultural growth mode from extensive to intensive management (Tian & Roderic 2005). In order to inject new vitality into the development of China's modern agriculture, Chinese government has increased its policy support for eco-agriculture demonstration parks, and actively encouraged the innovation of agricultural management mechanisms in demonstration parks. This mode tries to break the bottleneck of small-scale operation, dispersed investments and financing difficulties, and explores to build a new agriculture park featured by intensification, specialization, organization, and socially oriented. In recent years, China's ecological agriculture parks have enjoyed rapid development. Various types of eco-agriculture parks effectively promote the development of agriculture in China. However, since the eco-agriculture park is an emerging industry, the reasonableness of its planning will directly affect the sustainability of the park. The research on eco-agriculture park planning is very rare. For the purpose of a more rational planning, studying the planning of eco-agriculture parks has important practical significance.

PROJECT AREA AND PLANNING METHODS

Project Area

The project area is located near Qi River in Hebi City of Henan Province, China (Figs. 1, 2), with a total area of about 339 hectares. Located in central China, Hebi City has a warm humid monsoon climate, with four distinct seasons, abundant sunshine, and large temperature differences. Qi River, which is adjacent to the project area, is the mother river of Hebi City and bears the important responsibility as the urban water source. Surrounded by urban freeways, the project area has convenient transportation. Wheat, peanuts, cotton and other crops are grown in the project area, along with a small amount of fruit trees and greenhouse vegetables.

Planning Methods

SWOT analysis: SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis is a way to analyze the conditions of the project area objectively and accurately. Internal resources and external environments are combined to clearly determine the advantages and disadvantages of resources in the agricultural park (Yoav Gal 2013). The opportunities and challenges facing the park are studied to ensure that the development goals of the park are met through the adjustments of planning and design. As an effective tool in decision analysis, SWOT method is widely used in tourism, planning and design, and other fields (Anita Reihanian et al. 2012, de Graaf & Dewulf 2010).

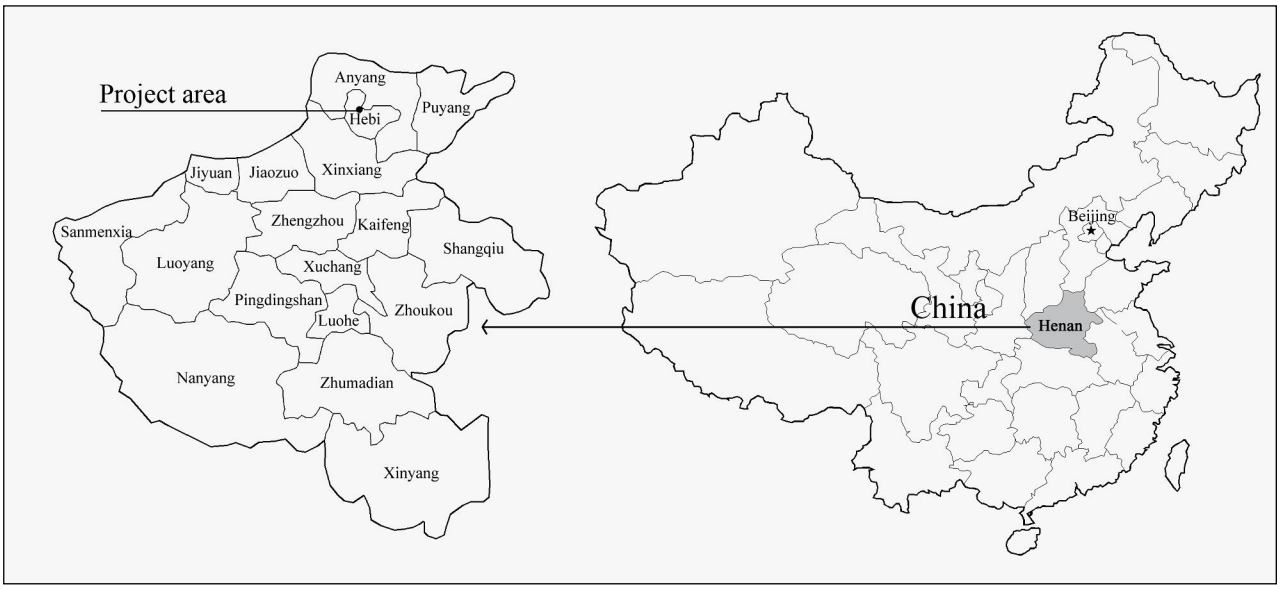

Fig. 1: Diagrammatic sketch of geographical location.

Ecological suitability analysis: Ecological suitability analysis (Valentina & Silvia 2013) uses ecological principles to study the sensitivity and stability of ecosystems involved in the development of the agricultural parks. It benefits the understanding of possible constraints of the ecological potentials of natural resources on the park's development, which in turn guides the devising of a rational development strategy in spatial planning. This method is widely used in the field of land use planning (Liu Jie 2010).

Market demand analysis: Market demand analysis can estimate the market size and the potential demand of the products, determine the target markets in the geographic regions concerned as well as the constraints of development. Finally, the decision that can meet the market demand is made.

Planning methods: The planning of the agricultural park as a complex system should reasonably set its goals in economic, social and ecological benefits, based on the consideration of the ecological, social and market environments. The systematic planning should make a rational use of land resources in the park based on the local conditions. The planning should also consider the coordination between different systems to enhance the overall benefits (Fig. 3).

RESULTS

Analysis

SWOT analysis: SWOT analysis shows that the development of the project area has the following advantages: First, superior geographic location. Only 5 km from the downtown area of Hebi, the project area is surrounded by free-

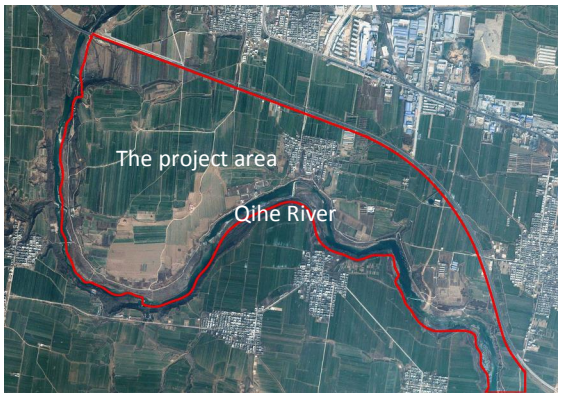

Fig. 2: The project area (from Google).

ways, and therefore, the traffic is very convenient. Second is the beautiful environment of Qi River. Without any contamination, the river is the water source of Hebi City, and its good ecological environment is highly beneficial for the development of ecological agriculture. The development of the project area has the following disadvantages: First, poor infrastructure. The poor agricultural infrastructure in the project area is only suitable for ordinary farming. However, the project area is now facing the precious development opportunity. The national, provincial and municipal governments attach great importance to the development of modern agriculture. A series of measures and preferential policies have been launched to encourage the construction and development of ecological agriculture parks. In addition, by changing the old decentralized management mode through

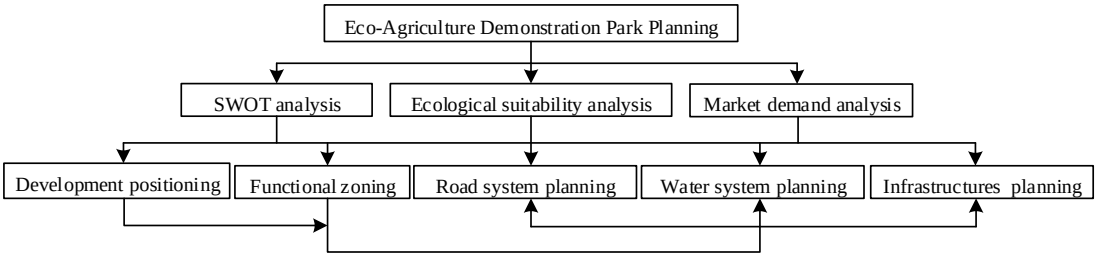

Fig. 3: Sketch map of planning method.

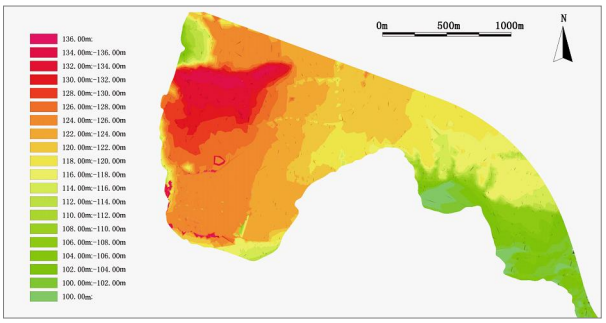

Fig. 4: Analysis chart of elevation.

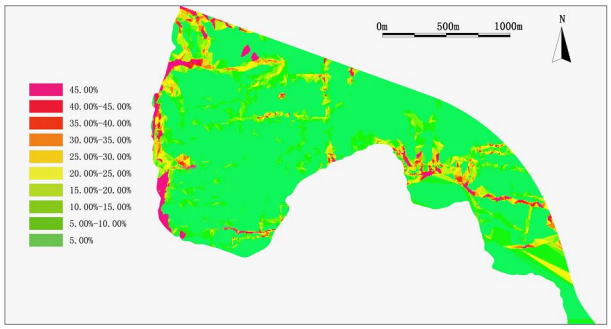

Fig. 5: Analysis chart of elevation slope.

land transfer, the park is on the road towards centralization, industrialization and standardization, with bright prospect for development. The project area has the following threats: Modern agricultural investment has certain market risks, and errors in positioning may result in huge losses. In addition, the development of ecological agriculture park requires high-tech support, adequate funding and efficient management.

Ecological suitability analysis: Ecological suitability analysis of the project area includes the analysis of temperature, light, precipitation, soil, hydrology, topography, slope and aspect and other ecological factors (Hai-sheng Chen et al. 2010). This analysis can determine the suitability and constraints of the project area's development, and thus, provides the basis for zoning and special planning. The average annual temperature in the project area is 14.2-15.5°C, annual precipitation is 349.2-970.1mm, and annual sunshine hours are 1787.2-2566.7. All these are very suitable for growing crops and fruit trees. The terrain and slope analyses reveal that the park is relatively flat with small changes in elevation, and is therefore, easy for intensive production and management (Figs. 4, 5).

Market demand analysis: There are various market demands for the project area. First, a demand from the government exists. There is an overall need to adjust the agricultural structure, which is the reconfiguration of various production factors in the agricultural production process in accordance with the principle of optimization to maximize efficiencies in agricultural production. This adjustment can contribute to the development of agriculture and rural economy as well as increase the farmers' income. The government also hopes to encourage farmers to transfer their contracted and dispersed land to modern agricultural enterprises, cooperative farms and agricultural parks, for the purpose of developing large-scale agricultural businesses (Xu Hengzhou 2011). Second, there is a need to increase the farmers' income. China's urban-rural dual structure hinders the development of China's rural economy, and the farmers' income is generally low. The construction of this eco-agriculture park will allow farmers to get the rent from their transferred land while finding employment near their home. Then the farmers will be transformed from freelancers to workers in the agricultural industry with higher income. Third, investments in China's agricultural industry are mostly long-term and stable. That is to say, the payback period is long, but the returns are stable. Thus, ecological agriculture is very attractive to investors. Fourth, there is a public need. By using the sites of agricultural production, agricultural natural environment, and agricultural humanistic resources, the project area is a comprehensive region with the functions of both agricultural production and rural leisure tourism through careful planning and design (Zhenshan Yang 2011, Baoren Su 2011). By improving the quality of tourism and increasing the farmers' income, the project area represents a new type of agriculture which contributes to the development of the countryside. Finally, the social demand for green agricultural products exist. There are huge challenges facing China's food quality and safety.

Table 1: Functional zoning of the project area.

Serial number	Functional zoning	Components
Z1	Eco-harvesting zone	More than twenty types of fruits are cultivated, which can provide recreational harvesting activities backyard poultry, high-quality poultry and egg products
Z2	Leisure village	Providing ecological farmhouse enjoyment, an opportunity to taste local farm food; providing the product trading venues, supermarkets, and organic gift shops.
Z3	Fun farm zone	Providing fun farm, with seasonal vegetables grown in open field.
Z4	Facility agricultural zone	Constructing standard greenhouses; producing vegetables, flowers, fruits and edible mushrooms establishing operation sites and cold storages.
Z5	Technology demonstration zone	The promotion and demonstration of new agricultural varieties, new technologies, and new materials.
Z6	Recreational zone	Carrying out agricultural theme recreational activities such as camping and farmhouse enjoyment.
Z7	Qi River original ecological experience zone	Experiencing the original ecological riverside environment of Qi River; healthy cycling
Z8	Agribusiness incubator zone	Providing the incubator platform for ecological agribusiness
Z9	Development reserve zone	Land set aside for the long-term development of the project area

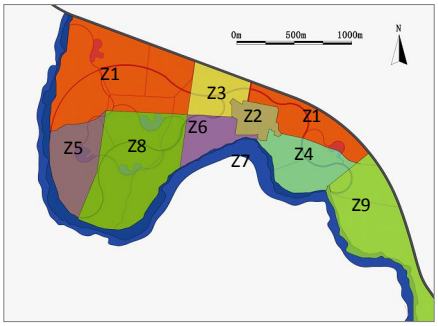

Fig. 6: Functional zoning map.

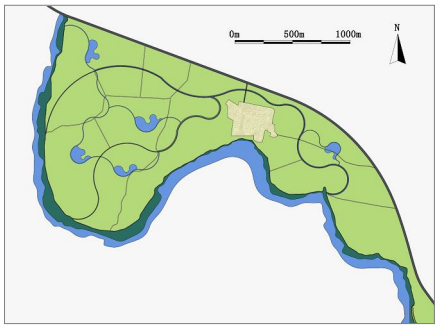

Fig. 7: Sketch map of master plan.

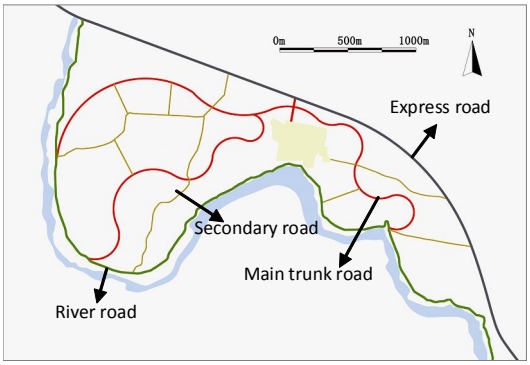

Fig. 9: Sketch map of road system planning.

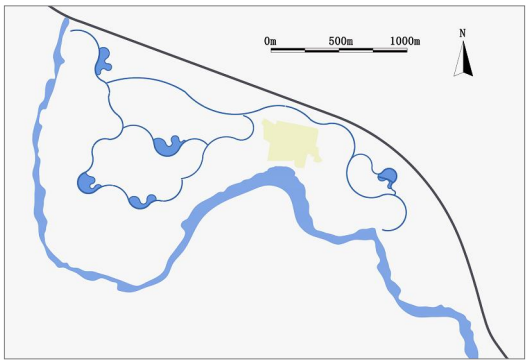

Fig. 9: Sketch map of water system planning.

Environmental pollution and the irrational use of fertilizers, pesticides and hormones seriously affect the quality of agricultural products (Gang Dong 2013, Chenhao Jia 2013). The public has great demand for pollution-free, safe and quality agricultural products, and products from the project area can exactly meet this demand.

Development Positioning

Development positioning refers to the reasonable positioning of the park's development on the basis of the comprehensive consideration of various factors, and the reasonableness of this positioning is directly related to the sustainable development of the park. Moreover, development posi-

tioning will have a direct impact on the layout and spatial structure of the park. Because of the large size of the project area, compound functions can help improve the utilization of space and reduce market risks. Efficient use of resources and coordinated development of the society, ecology and economy can be achieved by compound functions. The project area has the functions of efficient production, rural landscape, recreation, modern agricultural business incubator, agricultural logistics, recycling economy, science and technology demonstration and promotion, as well as science education.

Functional Zoning

Functional zoning is to partition and arrange various material elements of the project area based on functional requirements to form an interconnected, well distributed organic whole. The functional zoning can create favourable environment and conditions for various activities in the agricultural park. To ensure the normal park activities, we must arrange the locations of various functional zones properly, maintaining the interconnectedness without mutual interference. Nine functional areas are ultimately formed under the current plan in accordance with the basic principles of functional similarity and industrial association, considering the geographic location and land use conditions (Figs. 6, 7, Table 1).

Road System Planning

The project area currently only has field roads for production purpose, and they do not form an organic system. Road system has the dual functions of transportation organization and sightseeing. Road system in the project area has a layered structure (Fig. 8), in which the express roads are the main channels of products and tourists transportation; riverside road is the main route for experiencing the original ecological landscape of Qi River; the smooth linearity of the main trunk road is conducive to production and leisure; and secondary roads can link various functional zones together.

Water System Planning

Adjacent to Qi River, the project area enjoys excellent water source conditions. By channelling water into the project area to reorganize the park's water system (Fig. 9), it meets the dual needs of production and landscaping. This method can be used as the source for drip and sprinkler irrigation in the park. The beautiful waterscape can upgrade the attractiveness of the park.

Infrastructure Planning

Infrastructure in the agriculture park, including municipal infrastructure and tourism infrastructure, are essential for the park's production and leisure activities. Municipal infrastructure include water supply and drainage facilities, electrical facilities, communications facilities, sanitation facilities, etc.; tourism infrastructures include management facilities, landscape facilities, leisure facilities, reception facilities and signage. Together with functional zoning, road transportation, and water system planning, the infrastructure planning forms a complete system with the planning in these aspects.

CONCLUSIONS

The planning of ecological agriculture park must be based on careful analysis. SWOT analysis, ecological suitability analysis and market demand analysis are the basic guarantees for the sustainable development. Reasonable analysis can help the park construction to meet the needs in the aspects of ecology, economy, society and tourism.

Special planning for eco-agriculture parks is key to their sustainable development. Development positioning and functional zoning determine the planning of road system, water system, ecological infrastructure and other special programs. Special planning should be coordinated to enhance the overall effectiveness.

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