

# Study on the path selection of sustainable development in the mountainous area of Beijing

Malin Chen<sup>1</sup>, Zhujun Zhou<sup>2</sup>, Huizhi Zhang<sup>1</sup>, Ci Chen<sup>1</sup>, Junhong Chen<sup>1</sup> and Zhongren Zhou<sup>1,3</sup>

<sup>1</sup>Institute of Agricultural Information and Economics, Beijing Academy of Agriculture and Forestry Sciences, Beijing 100097, China;

<sup>2</sup>China Grain Research and Training Center, Beijing, China 100801, China.

<sup>3</sup>zhongrenzh@163.com

**Abstract.** The mountainous area of Beijing is the broad region with weak economic features, ecologically fragile and special ecological functions. The ecological conditions, sustainability and regional economic development are intercorrelated in the region. It is arduous to enhance the regional competitive advantage and improve the economic development level through the environmental protection and ecological conservation. This study elaborates the relationship between ecology and economic development from the perspectives of ecology, productivity and life style in mountainous areas of Beijing. Then this paper discusses how to increase sustainable development of mountain areas from several aspects, including key regional developments, industrial development, and ecological compensation mechanism, considering the strategic goals of accelerating economic transformation, coordinating urban and rural development, and promoting new-type urbanization.

## 1. Introduction

Beijing mountainous areas, accounting for about 62% of the total area of the city, are important ecological barriers and water conservation [1]. The unique geographical locations, ecological fragility and other constraints are restricting its economic development. In addition, lack of industrial development support, the economy in the mountains area is relatively weak. The rapid development of urbanization puts forward new development requirements and challenges to mountainous areas [2-4]. In 2008, Beijing proposed the integration of urban and rural development goals, requiring a significant increase in rural economic strength and significant improvement of ecological services in 2020. In order to promote the urbanization and new rural construction, as well as to implement the “Green Beijing” development strategy, three projects named “warm up, light up, cycle up” were carried out in Beijing from 2006 to 2012. In 2013, three new projects’ “land transfer, asset management, and organized farming” were initiated. It effectively promoted the rural ecological environment construction as well as economic and social development[5,6]. Under the dual tasks of protection and development, with the background of overall urban and rural development and overall regional development, it is significant for sustainable development to realize the coordination development of ecology, economy and society[7-9].



## 2. Sustainable development characteristics and evaluation of mountainous areas in Beijing

This paper evaluates the sustainable development of mountainous areas in Beijing from three perspectives: ecological system, production system, and living system.

### 2.1. Ecosystems

*2.1.1. Good ecological environment rich in biological diversity.* With the strategic goal “Green Beijing”, mountainous areas become the region with best ecological environment (table 1), important species habitat and natural ecosystem reserve, by implementing a series of policies, such as forest conservation, restoring farmlands to forest, ecological restoration, industrial development adjustment. In 2015, 19 of 20 nature reserves built in Beijing locate in mountainous areas and protect over 90% of national and local key wildlife and habitat. The forest area in mountainous area accounts 51.9% of total area, which is higher by 10.3% compared to city average level.

*2.1.2. Significant ecological management and ecological restoration effects.* Beijing mountainous areas are mostly rocky with steep slopes, which lead to serious soil erosion. All mountainous areas have become "national demonstration country for soil and water conservation and ecological construction", and 21 small watersheds were named "national soil and water conservation ecological construction demonstration watershed" through the implementation of ecological cleaning, with small watershed management. In regard to atmospheric pollution prevention and control, chemical, coke, printing, dyeing and steel industries have been shut down and relocated one after another in response to the adjustment of production capacity. Additionally the mountainous areas optimized energy structure projects including the “warm up, light up, cycle up” projects as well as coal reduction and change projects. As a result, poor-quality fuel such as coal and straw are effectively reduced. At present, the ecological environment of the mountainous areas is superior to that of the plain and urban areas of Beijing.

**Table 1.** Ecological environment indexes of Beijing in 2015.

Beijing Districts		Ecological environment index
Mountainous area	Mentougou District	70.7
	Fangshan District	62.7
	Changping District	62.4
	Pinggu District	69.6
	Huairou District	73.2
	Miyun District	70.9
	Yanqing District	70.7
Plain area	Daxing District	51.1
	Tongzhou District	53.4
	Shunyi District	54.4

Data sources: Beijing Environmental Bulletin 2015

*2.1.3. Ecological compensation has effectively promoted the environmental construction in mountainous areas.* As export region of ecological service value, mountainous ecosystem contributes a lot to the whole region. Government has the responsibility to compensate ecological development when implementing ecological environment construction and accelerate environment capital accumulation. Moreover, ecological compensation promotes the coordination development between ecology and economy, urban and mountainous area, which is essential for the sustainable development in mountainous area. There are two types of ecological compensation: one for development and job opportunity loss, such as compensation for public forest and water resources, and the other for compensation for encouraging environmental protection, such as job positions for rangers and

subsidies for energy structure adjustment. These policies can promote effectively the construction of ecological environment in mountainous areas.

## 2.2. Production systems

**2.2.1. Mountain farmers' income is lower than that in plain area.** In 2014, per capita net income of rural residents in Beijing is shown in Figure 1. The wage income, property income and transfer income of residents in plain townships are higher than those of mountainous areas. The difference of household income is mainly caused by the development of tourism. The number of tourists, the number of employees and the total income of mountain villages and towns are all nearly tenfold higher than those of plain towns. Mountainous areas are the areas where low-income farmers are concentrated. The non-agricultural labor productivity of low-income households is 9955 yuan, which is only 1/15 of the non-agricultural labor productivity of Beijing (158613 yuan). The income structure of low-income households is mainly wage income (59.85%).

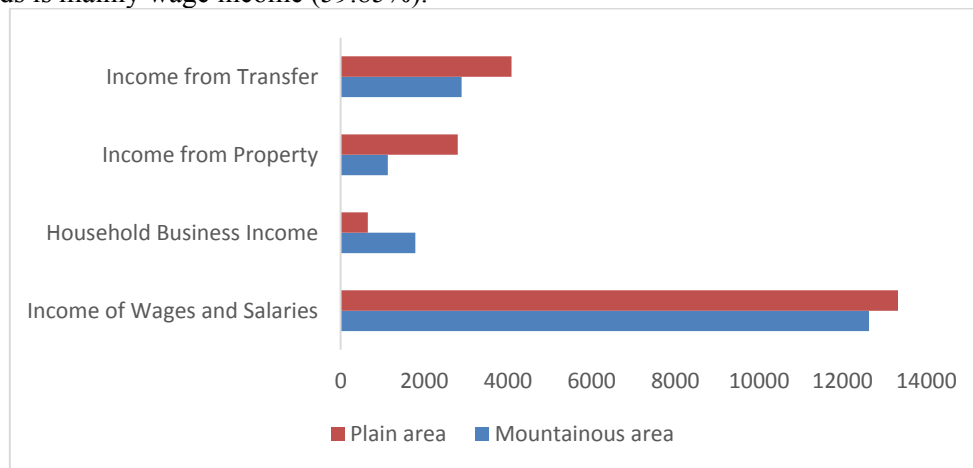


Figure1. Per capita net income of Beijing rural households in 2014(Unit:yuan)

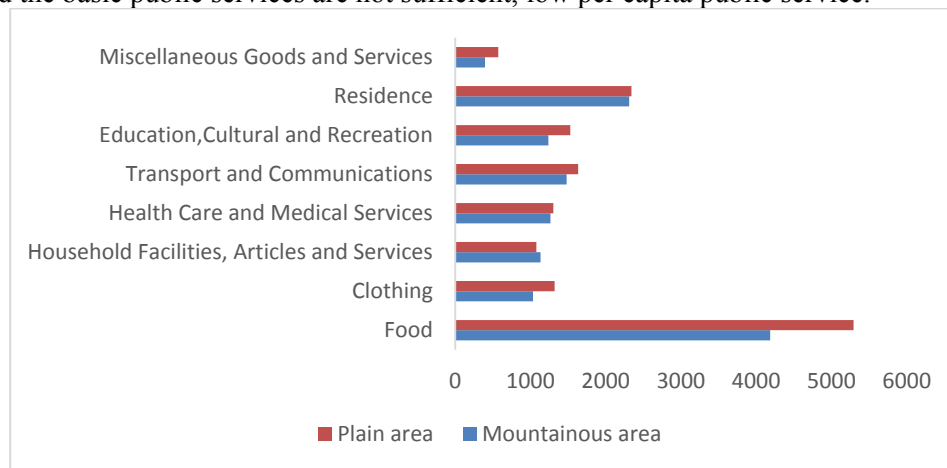
**2.2.2. Industrial upgrading task in mountainous areas is still arduous.** Urbanization affects greatly the regional system development and industrial structure of the mountainous areas undergoes continuous changes. At present, the proportion of agricultural employment is still high in mountainous areas, about 30%, compared to less 10% in plain area. The development of non-agricultural industries leads to the continuous declining share of agriculture in the total economic output. The industrial structure in Changping district and Yanqing district is “the tertiary industry, the secondary industry and primary industry”, while the other several mountain counties is “the secondary industry, the tertiary industry and primary industry” pattern, which means that the secondary industry is the highest proportion. In terms of enterprise development, the number of enterprises in mountainous areas is less than 15% of that in plain areas. The total income and profit of enterprises are also less than 10% of that in plain areas[10]. Rich in personality characteristics of regional culture, beautiful landscape and rich characteristics of agricultural products and other resources open up a vast space for rural leisure tourism industry. But the development of leisure tourism industry is still extensive on the whole expansion. Therefore, some aspects, like the level of service and brand effect, have to be settled urgently.

Industrial upgrade and integration in mountain confront twofold constraints. On the one hand, key development industries are those ecological friendly and beneficial to employment and income. On the other hand, the lack of industrialization funds is a major factor restricting rural economic development. The industrial structure optimization, which is under the ecological restraint, is an effective way to prevent and control the environmental pollution, and it is also an important means to promote the

sustainable development of mountain economy. Industrial restructuring includes encouraging industry and limiting industry. The limited industry is mainly target at those with large pollution, such as aquaculture, mining and so on. The encouraged industry is lack of the sustainable and effective guidance and support. The new competitive industries have not yet established. In this case, the economic development easily gets into a stagnant state. As the increasing population of Beijing, the fragile ecological environment will further push the industrial structure optimization and adjustment.

### 2.3. Life system

**2.3.1. The current characteristics.** Consumer spending in mountainous areas in clothing, food, housing, transportation and entertainment is lower than that in the plains, which is shown in Figure 2. The consumer spending is not only related to income level but also the consumption environment which is caused by the low spatial concentration of population and industry. Infrastructure needs to be improved and the basic public services are not sufficient, low per capita public service.



**Figure 2.** Per capita consumption expenditure of Beijing rural households in 2014 (Unit: yuan)

In 2013, according to the survey data of weak rural areas in Beijing in 2013, local farmers housing are mainly brick and concrete houses, still around 5% adobes. In terms of safe drinking water, 6% of the villages drink well water or shallow water. Some villages in the distant mountainous areas have the difficulty of seasonal water availability and lack funds for water supply, transportation and maintenance. In the aspect of energy use, 34.4% of the low-income households depend on firewood and the consumption of clean energy is relatively low. High income households prefer to use more commoditized, cleaner and effective energy, and have similar consumption pattern. And 53% of the villages need to solve the problems of environmental infrastructure including garbage disposal and sewage treatment.

**2.3.2. The construction effectiveness.** In recent years, living environment remediation in Beijing mountainous areas mainly includes two aspects, the sewage and garbage disposal, and ecological relocation. At present, treatment rate of the garbage in seven mountainous counties has reached 90%, but the environment and health remediation still need to be strengthened. First, the distribution of relatively scattered villages restricts some infrastructure construction and also affects the operation effect of some eco-environmental projects. Second, with the rapid development of leisure tourism and ecotourism, there are some blind expansions of the similar projects like agritainment. As the result, garbage disposal problem still exists, and garbage harmless treatment facilities, sewage collection pipe network and treatment facilities are obviously insufficient. Third, the huge demand for ecological construction funds has become the crucial factor that restricts the improvement of ecological environment. Many villages have almost no income, which leads to the absence of operation and

maintenance. People pay much attention to the construction but ignore maintenance, which affects the overall efficiency of public infrastructure. However, ecological relocation makes great achievement. Since 2004, the relocation project has been carried out in Beijing mountainous areas. By 2015, the three round relocation projects had relocated 84,000 people of seven mountain counties. The relocation project not only effectively improved the living conditions of mountain residents, but also broadened the employment channels for farmers, and promoted the integration of the primary industry, the secondary industry and the tertiary industry.

### **3. The sustainable development path selection in Beijing mountainous area**

It is normal in the initial stage of urbanization in the world that development in mountainous areas lagged behind that in the plains and urban suburbs. Economic development is the guarantee of sustainable development of mountain ecology according to the experience of the development in mountainous area at home and abroad. The mountain's contribution plays an important role in realizing "Green Beijing" and the world city with Chinese characteristics, especially when the ecological security has become the strategic task and the ecological civilization has been paid much attention to. Therefore, consolidating this advantage is duty-bound. The innate advantage of Beijing mountainous area determines that the development of resource-saving and environment-friendly industry is its optimal choice. In the process of achieving sustainable development, ecological security should be the first place, strengthen the bottom line thinking.

#### *3.1. Mountain construction focus*

*3.1.1. Local urbanization.* The urbanization in Beijing mainly includes the expansion of urban centers and suburban urbanization. Urbanization in mountainous areas is not characterized by taking the lead in realizing economic and population agglomeration, but through the infiltration of basic public service measures such as new rural construction, infrastructure construction and improvement of environmental sanitation, so as to change the traditional mountainous landscape gradually, and let mountainous area residents benefit the achievement.

To speed up the process of urbanization, Beijing promotes new rural community construction in the mountains. The new rural community construction strengthens industrial support, enlarges employment, and improves population concentration through the construction of a number of eco-tourism, folk culture and other characteristics of cities and towns. At present, Beijing has identified 42 key small towns, of which 29 towns are in the mountainous area. The focus of urbanization construction has gradually moved from the district to the town, from suburb to the outskirts of the city circle in the mountainous area, which offers the favorable conditions for the local urbanization and new rural communities. Therefore, in the process of urbanization and the construction of new rural communities, it is necessary to pay attention to ecological construction and environmental protection, and to make full use of rural culture and history and culture of mountainous areas so as to build beautiful villages.

*3.1.2. The ditch-area economy.* The economic function of agriculture is weakened gradually in the development of urbanization, which turns to highlight its social and ecological functions. Combined with the fact of the mountainous area, Beijing government focused on supporting a number of distinctive characteristics of the economic development of the valley with high standards to promote the economic construction of the ditch. It also created a ditch domain cluster. All of them have effectively promoted the mountainous area economic development and ecological environment construction. The ditch-area economy is the typical pattern of the integration of primary industry, the secondary industry and the tertiary industry. There are two major types of construction, one is the service driven by tourism, which promotes the development of economy and through tourism and folk culture, such as Mutianyu Great Wall Scenic Area, Yanqing District tofu feast. The other is the urban-based-modern-agriculture-driven construction, such as Yanqing Four Seasons flowers' ocean, which

upgrades the advantages of agricultural industry, developing the advanced and characteristic ecological industry, changing the traditional single production structure.

### 3.2. *The selection of leading industry*

3.2.1. *Modern agriculture.* The mountainous areas should attach importance to improving the quality and efficiency of agriculture, responding to changes in external demand and developing the eco-economic forest fruit industry, planting characteristics, green aquaculture and other modern urban agriculture so as to highlight its advantages. Animal husbandry gradually withdraws from the ecological conservation area, especially the tourist attractions and water sources in order to innovate the green aquaculture development model and optimize the animal husbandry structure. It is necessary to make most use of the advantages of the fruit industry and the flower industry, to strengthen the reserve of forestry resources and to develop the ecological and economic forestry so as to gradually expand the scale of the flower industry with both material and cultural values which is guided by market demand.

3.2.2. *Modern service industry.* Industrial convergence is the trend of development in mountainous areas. It is important to focus on the ditch-area economy and pay attention to ecological sustainable development and rural construction in mountainous areas. Based on its own environmental advantages, historical and cultural conditions, through fostering the scientific and technological innovation and cultural creativity, the core competitiveness of mountainous areas can be created. Moreover, it also needs to actively develop secondary and tertiary industries, and combine with the product development of organic agriculture, the original ecological characteristics of leisure, vacation resort, the cultivation of the healthy tourism industry so as to improve the industrial association, and improve the product culture connotation and added value. Replace traditional service industries with high-level service industries, such as cultural and creative industries, exhibition industry, promote leisure agriculture and rural tourism, and guide farmers to the new rural communities to achieve the integration of mountain ecological and economic development.

### 3.3. *Improvement of the ecological compensation policy*

From the government point of view, a series of public service projects of ecological environment for the mountain region will continue to promote as a whole, such as consolidating the results of ecological environment construction, increasing the city's financial transfer of mountain water sources, establishing water environmental monitoring linkage mechanism, enhancing the emergency response capacity of water pollution accidents. It is the long-term policy concerns that the implementation of restrictive measures on water and soil resources and environmental capacity in overload areas.

On the other hand, the improvement the ecological efficiency of mountainous areas can not only depend on "input" of the administrative policy. It is necessary for multi-subjects to participate and encourage local residents to participate in ecological protection and construction, which can achieve a multiple effect. Therefore, ecological compensation is an indispensable auxiliary form. On the basis of the existing policy of ecological compensation, the ecological compensation growth mechanism should be established. On the basis of the general compensation, additional incentive subsidy should be given to realize the differential compensation. It is necessary to play a wide coverage of the "basic security" role to ensure that the beneficiaries of the fairness and breadth. It is also necessary to achieve "benefit promotion" role to highlight the central role of ecological compensation from two aspects.

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## References

- [1] CHEN Jun-hong et al. 2013 Study on the economy development of Beijing's mountain valley areas: theory, practice and policy *China economic publishing house*
- [2] LI Zhi-wei 2007 The suburb and rural area construction path of internationalized Metropolis-A case study in Shanghai. *Tongji University*
- [3] LI Hong 2004 Sustainable development Evaluation in Beijing Mountainous area *China Agriculture University*
- [4] SONG Jin-ping, et al 2005 Modes of Sustainable Development in Mountainous Areas in China-A case in Beijing mountainous areas. *Journal of Beijing Normal University (Social Science)*. **192** 131-136
- [5] TONG Rui-ping, et al. Sep. 2008 Promoting way and effects of "three-up" projects in Beijing City. *Journal of Beijing Agricultural Vocation College*. **22(5)** 7-10
- [6] ZHOU Zhong-ren, et al 2010 Development status, problems and countermeasures of biomass energy industry in Beijing suburb *Renewable Energy Resources* **28(1)** 146-149
- [7] MU Song-lin Jul. 2016 Regional Selection and Developing Model in Beijing Mountain Areas: From the Perspective of Valley *Ecological Economy* **32(7)** 116-120
- [8] DUAN Wei, et al. 2017 Effect of forestry ecological projects on poverty alleviation in Wuling mountainous areas: a structural equation model analysis *Journal of Arid Land Resources and Environment* **31(12)** 8-12
- [9] WANG Na, et al. 2017 Sustainable Livelihood of Ecological Migrants in Qinling-Daba Mountains of Southern Shaanxi *Agricultural Science & Technology* **18 (8)** 1563-1566
- [10] *Beijing Regional Statistical Yearbook* 2015

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