Study on the relationship between ecological environment and tourism industry development in Tai’an

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Abstract. As a special form of tourism, ecotourism is one of the important factors to realize the sustainable development of tourism. The relationship between ecological environment and tourism development is not very clear. Based on the development of forestry resources and using the methods of linear regression and correlation analysis, this study analyzed the development of tourism industry in Tai’an, such as forestry production, tourism reception volume, and the relationship between them. The results showed that: (1) the area of forestry resources in Tai’an was increasing at an annual rate of 37.4%; (2) during 2004-2009, the proportion of the tertiary industry in the GDP of Tai’an increased from 34.19% to 35.57%, and the tourist reception increased by 22.2% year on year; (3) there was a significant linear correlation between forestry resources and tourism development, and the functional relationship between them was \( y = 0.0383x - 2965.5 \), \( R^2 = 0.874 \). The results of this study can provide scientific reference for the sustainable development of ecotourism in Tai’an.

1. Introduction

It is only 40 years since ecotourism was put forward. Under the background of global environmental crisis and people’s "ecological awakening", ecotourism had a great impact on tourism. In the 1980s, with the rise of the global ecotourism boom, it entered China [1] and really received domestic attention in 1995. Since the concept of ecotourism was introduced into China, a number of domestic scientific research institutions have carried out researches and practice on it [2]. However, there are many domestic research institutions engaged in ecotourism, and the academic backgrounds of each research institution are quite different. Therefore, there are great differences in expounding the concept and connotation of ecotourism [3]. At the same time, due to the ambiguity and diversity of its connotation, ecotourism has become a universal label after entering the market, which is very confusing in practice [5-8].

The tourism industry attaches great importance to explore the broad and profound culture of Mount Tai, and the cultural taste and brand image of the main scenic spot of Mount Tai have been greatly improved in Tai’an [5]. However, the biggest pressure that Tai’an faces is the rapid increase in tourist flow, which exceeds the current allowable limit of ecotourism capacity [6]. Especially in the peak tourist season, scenic spots are often in crowded scenes, which not only cannot travel normally, but also cause damage to plants and buildings (i.e., the so-called "tourism public hazard"). Among them, garbage pollution is a relatively serious problem. There are serious commercialization and improper
development of scenic spots [7-8]. Therefore, it is necessary to coordinate the relationship between protection and development. The tourism industry of Tai'an is endowed with abundant resources. At the same time, Tai'an occupies a powerful geographical location, which is the only place to connect many railways, highways and other traffic arteries. As the leader of the tertiary industry, tourism industry is strongly supported by various policies of the government, which is the necessary condition for the development of tourism in Tai'an. With the rapid development of economy and the continuous improvement of consumption level, people begin to get tired of the fast-paced lifestyle. Returning to nature and cultivating sentiment have become the first choice for modern people to relax and entertain. However, due to the substantial increase in the number of tourists, on the one hand, it promotes the spread and development of local economy and culture, on the other hand, it also brings pressure to nature. In order to realize the harmonious development of tourism and ecological environment, the development of ecotourism has become the current mainstream. Therefore, through the analysis of the development of forestry resources in Tai'an from 2004 to 2009, this study analyzed the development of tourism industry such as forestry production and tourism reception in the ecological environment of Tai'an and the relationship between them by using linear regression and other analysis methods, and determined the development direction of ecotourism in Tai'an according to the relevant conclusions, which can provide a theoretical basis for the development of tourism in Tai'an.

2. Materials and methods

2.1. Geographical location
Tai'an is located in the middle of Shandong Province along the eastern coast of China. It has jurisdiction over 6 counties and districts: Mount Tai District, Daiyue District, Xintai City, Feicheng City, Ningyang County and Dongping County. It is a part of the mountainous area in the middle of Shandong Province. It is located between 116°20′-117°59′ E and 35°38′-36°28′ N. It belongs to a warm temperate continental semi humid climate zone with an annual average temperature of 10 ℃-20 ℃. The four seasons are distinct and the climate is pleasant. Tai'an has convenient transportation and superior regional location. Located at the south foot of Mount Tai, the city is connected with mountains and cities, with beautiful scenery and rich cultural deposits and it is a famous cultural tourism city.

2.2. Tourist resources
Tai'an is endowed with unique tourism resources. The advantage of tourism industry is to play a good brand of Mount Tai, radiate around Mount Tai, and drive the development of surrounding scenic spots. Typical ecotourism resources mainly include agricultural sightseeing, cultural relics, forest parks, hot spring vacation, homestay and rural areas. Tourism activities in Tai'an, such as "Mount Tai International Climbing Festival", are representative of typical ecotourism resources [4].

2.3. Research methods
This study mainly used multivariate statistical analysis, correlation analysis and linear regression analysis methods, and finally used the mapping function of Excel to complete the production of the map.

3. Results and analysis

3.1. Analysis on the development of ecological environment in Tai'an

3.1.1. Analysis of ecological environment and selection of indexes in Tai'an. Ecological environment refers to the general name of the quantity and quality of water resources, land resources, biological resources and climate resources that affect human survival and development. It is a complex
ecosystem related to the sustainable development of society and economy [9]. Ecotourism is developed on the basis of the ecological environment, which should not only meet the growing material and cultural needs of people, but also protect the ecological environment on which human beings live. In view of this, ecotourism as a generally accepted way of entertainment and leisure, its rapid and healthy development is extremely necessary.

Forestry production is an essential indicator to measure the ecological environment of a region. Afforestation is conducive to improving the forest vegetation coverage, thus purifying the local environment and effectively protecting the ecological environment [10]. Therefore, the protection intensity of the ecological environment can be obtained according to the annual forestry production of a province or city, to provide the necessary resource conditions for the development of ecotourism.

3.1.2. Analysis of the forestry production in Tai'an. In order to protect the ecological environment, Tai'an increased the investment in afforestation and greening, which made the forestry production increase year by year and further improved the ecological environment. This was consistent with Mount Tai and has great tourism development value [11-16]. In recent years, in order to develop ecotourism and promote the development of the tertiary industry, forestry production in Tai'an has increased year by year at an annual growth rate of 37.4% (Figure 1, Figure 2 and Figure 3). On the one hand, it shows that Tai'an takes the protection of the ecological environment as the focus of development; on the other hand, it provides conditions for the development of ecotourism.

![Figure 1. Annual changes of Tai'an forestry production](image1)

![Figure 2. Annual changes of Tai'an forestry production](image2)
In recent years, the afforestation area has increased by 6000 hectares. The seedling area has reached 3000 hectares, and the forest coverage rate has reached 31.3%. Mount Tai Forest Farm has a total area of 210000 mu, with a forest coverage rate of more than 90% and a vegetation coverage rate of 95%. In order to make up for the natural ecological environment destroyed by the construction of roads around the mountain and the development of cableways, the urban greening coverage rate has been increased to 40%. All these were ecological environment construction for the greening and beautification of the city [17].

The production situation of forestry resources in Tai'an showed an overall upward trend, but the afforestation area, tending of young stand area, reforestation area and low production forest improvement area decreased. This is mainly due to the restrictions of the total forest area and tending of young stand in Tai'an. Therefore, government departments and their relevant personnel should establish a corresponding forest protection policy system to maintain the development of ecotourism.

### 3.2. Analysis on the development of tourism in Tai'an

#### 3.2.1. General situation of ecotourism development in Tai'an

Tai'an is dominated by industry in the economic growth model, and the proportion of the added value of heavy industry in the industrial enterprises above designated remains high [19]. Taking tourism as a breakthrough, the transformation of industrial structure and growth mode has become a significant path for Tai'an to achieve transformation and structural adjustment [20]. The development of tourism is closely related to the development of the tertiary industry and GDP. The rapid development of tourism drove the development of the tertiary industry. The proportion of the tertiary industry in the city's GDP increased from 34.19% in 2004 to 35.57% in 2009.

In recent years, Tai'an has given full play to the advantages of tourism resources and vigorously developed the tourism economy, so that tourism accounts for an increasing proportion of Tai'an's GDP and has become a significant source of income for Tai'an. Tourism has preliminarily improved the situation of "hot mountain and cold city, hot day and cold night, hot summer and cold winter". The influence of "three-day tour" has been continuously enhanced, and the tourist satisfaction index remains at the forefront of the province [18]. The city received a total of 53.118 million tourists, with a total tourism revenue of 50.05 billion yuan. These two items increased by 10% and 13.3% respectively, and the number of visitors to Mount Tai exceeded 5 million for the first time.

#### 3.2.2. The changing trend of the number of tourists in Tai'an

From 2004 to 2009, the number of tourists in Tai'an showed an upward trend year by year (Figure 4), and the increase was huge, which greatly promoted the rapid development of Tai'an economy and created huge benefits. Up to now, Tai'an has received a total of 37.2784 million tourists from home and abroad, achieving total tourism revenue of 31.86 billion yuan, with year-on-year growth of 22.2% and 25.8% respectively [21].
Among them, 352600 inbound tourists were received and foreign exchange income was 219 million US dollars, with a year-on-year growth of 18.21% and 18.89% respectively, showing a good development momentum.

![Figure 4. The trend of total number of domestic and foreign tourists in Tai’an](image)

### 3.3. Linear analysis of ecological resources and tourism development trend

To sum up, there was significant linear relationship between forestry production, the number of tourists and the development of the tertiary industry in Tai’an [22].

![Figure 5. Correlation analysis of forestry area and tourist number](image)

The number of tourists was positively correlated with the increase of afforestation area (Figure 5). Except for a slight deviation in 2008, the number of tourists in other years tends to increase with the increase of afforestation area. Therefore, forestry production plays a great role in promoting the protection of ecological environment. It is the main factor that effects the total tourism income of the study region. However, the ecological resource is a long-term factor, which does not play a full role in the short term and can only appear in a long period of time [23]. While appropriately increasing the number of tourism enterprises to meet the needs of tourists, Tai’an should pay attention to improving the service quality of tourism enterprises and realizing standardized management [24].

### 4. Conclusions

Through the study, it can be concluded that the ecological environment indicators (e.g. forestry production, etc.), tourism reception and the relationship between them have the following conclusions:

1. The situation of forestry production in Tai’an is generally on the rise, with an increase rate of 37.4% per year. However, some forestry resources have not shown good development and are still declining.
The number of tourists received in Tai'an increased by 22.2% from 2004 to 2009, which led to the rapid development of the tertiary industry in Tai'an. In recent years, the proportion of the tertiary industry in the city's GDP increased from 34.19% to 35.57%.

There was a significant linear relationship between forestry production and the development of tourism in Tai'an, and there was a linear correlation between them. Through linear function analysis, the relationship can be expressed as \( y = 0.0383x - 2965.5 \), \( R^2 = 0.8774 \).

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