

Giant Panda Ecotourism on Giant Panda and Its Habitat

Keyao Li

Shandong Agricultural University, Taian, China likeyao@sdau.edu.cn

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Abstract: As China's national treasure and first-class protected animals, people pay great attention to the living conditions and habitat damage of giant pandas. In recent years, with the continuous improvement of human understanding of nature and the rise of the idea of returning to nature, giant panda eco-tourism has gradually entered people's vision. This paper analyzes the reasons for the impact of giant panda ecotourism on giant pandas and their habitats, and provides the basis for the division of the minimum contact area or the forbidden tourism area in the nature reserve. This paper compares the average avoidance distance and the minimum avoidance distance between the giant panda trace points and the route before and after tourism development in a National Nature Reserve to study whether the giant panda has obvious avoidance effect on the hiking route. The final experimental results show that the average distance between the giant panda trace points and the hiking route increased from (1546 ± 125) m in 2000 to (1676 ± 116) m in 2018. In 2000, the minimum distance between the giant panda trace point and the hiking route was 13.4m, 106.6m and 183.3m respectively, while in 2012, the minimum distance was 54.6m, 87.6m and 213.4m respectively, indicating that the minimum distance between the giant panda trace point and the hiking route was increasing. This fully shows that giant panda ecotourism is an important factor leading to the reduction of giant panda and its habitat.

1. Introduction

After 10 years, another nine nature reserves were added. In order to better understand the living environment of giant pandas, China's Ministry of forestry has twice cooperated with WWF to launch a 10-year conservation and research program for giant pandas. After a large-scale special investigation, the Ministry of forestry of China jointly prepared the management plan for the protection of giant pandas and their habitats. So far, China has formulated a series of management systems, laws and regulations for the protection and management of giant pandas, and the construction of giant panda reserves has been gradually improved. Only when we give the giant

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panda a safe and stable habitat and a healthy environment to grow, can the giant panda be our national treasure and continue to live in China's land healthily.

The habitat of the giant panda is the place where the giant panda lives. It can provide the basic conditions such as the necessary food resources for the survival of the giant panda, the shelter to avoid the dangerous factors and the suitable breeding place. The destruction and loss of the habitat of the giant panda are the main reasons for the endangered giant panda. Fully understanding the habitat distribution and habitat quality of giant pandas is conducive to better and more effective protection. Giant panda is a unique and rare wild animal in China, and its flagship species is under protection. However, due to the interference of human activities and habitat destruction, the number of its wild population continues to decline [1-2]. With the enhancement of people's awareness of protection, the strengthening of protection and the effective implementation of various protection measures, the number of wild population of giant panda has been restored to a certain extent. At the same time, with the progress of science and technology, 3S technology is becoming more and more mature, and various species spatial distribution prediction models are more and more applied to wildlife management, which is conducive to a greater effort to study the giant panda and its habitat[3].

Bearer s, Linderman m, Huang J studied the utilization of giant pandas in Wolong Nature Reserve, Sichuan Province, Southwest China, in order to understand the impact of wood cutting and firewood collection on wildlife utilization. They evaluated the giant panda's use of habitat by observing the existence of giant panda feces in 913 field communities. The lowest frequency of feces in new cutting area (0-10years) is only 3%, while that in non-cutting area is 36%. Since 1980, the Chinese government, scientific research institutes and conservation organizations at home and abroad have cooperated in research and conservation of giant pandas. In 1998, the natural and social research center of Peking University (formerly the giant panda conservation and research center of Peking University) began to conduct a systematic study on the current situation of wild giant pandas in China. The government should continue to increase investment in the protection of wild giant pandas, especially in the existing giant panda reserves and community protection support. In order to evaluate the habitat of giant panda based on landscape ecology and spatial analysis, Yang wunian, Xie Hongbin put forward a scientific, fast and real-time method for giant panda habitat evaluation VB.NET In this system, a new method is proposed to extract core patches and potential corridor grids of appropriate size. Through the evaluation of giant panda habitat and the design of natural reserve landscape pattern, it provides convenience for giant panda protection decision-making [4].

This paper studies the minimum escape distance and increase distance of tourism activities to giant pandas, determines the impact degree and threshold distance of tourism activities to giant pandas, and compares the avoidance distance of giant pandas to the habitats near the routes before and after tourism development to determine whether tourism has an impact on them. Then based on ArcGIS Calculate the distance from each trace point on both sides of the route to self-driving route and hiking route respectively in 2000 and 2018, and compare the distance change (average distance and minimum distance) from trace point to self-driving route and hiking route within 3km (diameter of giant panda's home area) through independent sample t-test. From the perspective of time, determine whether giant panda tourism will cause corresponding avoidance distance to giant panda Away. The influence level and threshold distance of giant panda ecotourism on giant panda are studied by studying the method of minimum avoidance distance and increasing distance.

2. Introduction and Research Methods of Giant Panda Ecotourism

2.1. Concept and Characteristics of Giant Panda Ecotourism

As a traditional way of tourism, ecotourism can not only appreciate and visit ancient and modern

culture, but also stay in relatively ancient and primitive natural areas to learn and enjoy beautiful scenery and wildlife and plants [5-6]. From the above definition, it can be concluded that the definition of this point of view is mainly concentrated in relatively old and undeveloped natural areas. Another view emphasizes the idea of protecting resources and supporting the development of local communities. For example, the definition of ecotourism by the International Union for the protection of natural resources is "ecotourism is environmental protection tourism and sightseeing that are relatively natural areas, and the purpose is to enjoy and enjoy the fun and scenery brought by nature. This definition shows that ecotourism can not only promote environmental protection, but also have little negative impact on tourism, At the same time, it also provides social and economic benefits for residents [7].

At present, most people think that any tourism related to giant panda is giant panda eco-tourism. In fact, giant panda eco-tourism must include two elements: one is giant panda and its habitat, the other is eco-tourism, both of which are indispensable. For example, if you go to the zoo to see a giant panda, it's a small eco-tourism. Although the eco-tourism is related to the giant panda, it doesn't belong to the giant panda eco-tourism. Giant panda ecotourism is a special form of ecotourism with the background of rare giant panda, which can provide tourists with good tourism experience and experience by virtue of its habitat environment [8].

2.2. Advantages of Giant Panda Ecotourism Compared with General Ecotourism

(1) Uniqueness: as a first-class protected animal in China, giant panda is very rare. The distribution of giant pandas in China is limited to the south slope of Qinling Mountain in Shaanxi Province, Minshan Mountain at the junction of Gansu and Sichuan Province, Qionglai mountain, Daxiangling mountain, Xiaoxiangling mountain and Daliang Mountain in Sichuan Province. They live in the deciduous broad-leaved forest, mixed coniferous and broad-leaved forest and mountain bamboo forest in subalpine coniferous forest belt with an altitude of 1400-3600 meters, with a total area of 29500 square kilometers. Due to the limitation of distribution area, giant panda ecotourism has become the unique ecotourism in the world [9].

(2) Taste: compared with ordinary tourists, giant panda ecological tourists have higher cultural literacy. When they appreciate the shape of giant panda and the beauty of its habitat, their ecological and cultural knowledge level has also been improved.

(3) Planning: tourists who want to carry out giant panda eco-tourism must submit the feasibility analysis report to the tourism department and environmental protection department after going through the feasibility study conducted by the relevant department in advance, and then carry out the tourism development and construction under the guidance of scientific planning after being annotated by the relevant department.

(4) Naturalness: both the developers and tourists of giant panda eco-tourism emphasize the "ecological nature" of giant panda and highlight the characteristics of primitive nature. All infrastructure construction and tourism activities should be centered on the natural quality of giant panda habitat [10].

(5) Sustainability: the ultimate goal of giant panda eco-tourism is to effectively protect all resources of giant panda habitat, and realize the sustainable development of local social economy and giant panda protection. Therefore, the purpose of giant panda eco-tourism is not to maximize profits, but to pursue appropriate sustainable profits on the premise of ensuring the sustainable development of environment and resources.

2.3. Seven Aspects of Giant Panda Ecotourism that May Affect Giant Pandas and Their Habitats

The development of giant panda eco-tourism has changed the original way of life of wild animals such as giant pandas and affected their behavior activities, mainly in the following aspects:

(1) Limit the range of activities and reproduction of wild animals. Due to the increasing intensity of tourism development and the increase of the number of tourists, the frequent human activities and the noise generated by the gathering of tourists will severely limit the range of activities of wild animals such as giant pandas, and directly affect their migration, drinking water, feeding and other activities. From March to May every year is the time for giant pandas to mate and breed. During this time, tourism activities will affect the breeding behavior of giant pandas.

(2) Frighten the wild animals. The headlights, flashlights and campfires used by tourists at night will have a terrible impact on the night behavior of wild animals such as giant pandas, which will have a certain impact on their survival. Meanwhile, tourism construction, tents and other facilities will interfere with the vision of wild animals such as giant pandas [11].

(3) Affect the behavior of wild animals. Some tourists leave plastic bags or uneaten food on the way to travel, which causes wild animals such as giant pandas to change their original eating habits, thus threatening their survival.

(4) The hidden danger of forest fire increased. With the development of tourism, tourists also bring more fire. Smoking, outdoor fire, campfire and so on are all important factors leading to forest fire. Although the environment of the giant panda habitat is abundant in rainfall and wet on the ground, the dry bamboo forest and the leafless trees are easy to catch fire in winter. The occurrence of forest fire will greatly damage the habitat of giant panda, thus endangering the survival and reproduction of giant panda.

(5) Vegetation is damaged. The habitat is rich in unique wild plant resources. Tourists have a strong sense of freshness and desire to pick them. Therefore, they often pick wild fruits, flowers, weeds, fungi and climb trees and branches. In addition, the local people also excavated a large number of herbs, flowers and wild vegetables to meet the needs of tourists for local specialties. When tourists enter the ecotourism area, the vegetation of the tourist line and the tourist spot will be trampled to different degrees. If the number of tourists is not well controlled, it will cause serious damage to the vegetation, thus affecting the survival of the giant panda and causing damage to its habitat .

(6) Habitat fragmentation is increasing. So far, the giant panda habitat has been divided into more than 30 islands of different sizes. The government and experts are actively building a giant panda corridor connecting the giant panda habitat. With the rapid development of giant panda eco-tourism and the increase of the number of tourists, the increase of traffic flow will inevitably lead to the further fragmentation of giant panda habitat to a certain extent.

(7) The ecological environment is polluted. Because giant panda eco-tourism is just launched, it is not very mature. The relevant rules and regulations are not perfect and the quality of tourists needs to be improved. With the increase of the number of tourists, more and more garbage appears on the way of tourism. The water bottles and food bags that are not easy to degrade will cause serious pollution to the water resources, which will cause the giant panda to drink the polluted water source and finally threaten the survival of the giant panda.

2.4. Minimum Avoidance Distance and Increasing Distance Method to Determine the Impact Level and Threshold Distance of Tourism Activities on Giant Panda

Firstly, based on the giant panda trace points and tourist routes in the nature reserve, the distance from each trace point to self-driving route and hiking route is calculated by ArcGIS, and the

distance between self-driving route and hiking route is calculated by 100m The number of giant panda trace points within the range is used to count the frequency of giant panda activities within different distances from the tourism route, reflecting the intensity and preference of habitat utilization under the influence of giant pandas on different tourism modes. Secondly, the distance from the nearest trace point of different tourism routes is determined as the minimum avoidance distance and the first level of influence of giant panda on the two tourism modes. The greater the avoidance distance is, the greater the influence is. On the basis of the first influence level, referring to Gong Minghao's method, the next influence level and distance can be found by distance increasing method. According to the established frequency array of giant panda activities within every 100m of the tourist route, statistical detection points (one for every 100m can be considered) are set up at a certain length from the first impact level or threshold distance, and the change of activity frequency of two groups of giant pandas within the same distance range (with the first impact level) before and after the inspection point is compared. This test point is the break point of the impact of tourism routes on animals, which is the second level change point of interference impact, and the distance from this point to tourism routes is also the second threshold distance of tourism impact. On the basis of the second change point of influence level, the next influence level and threshold distance are searched by the same method with the second change point as the starting point. Considering the distribution pattern of activity frequency, the independent samples t test in nonparametric tests is used to compare the frequency changes before and after each test point. According to the requirements of habitat assessment and behavioral ecology research on interference data, the trace data of giant panda within 3 km is selected for analysis (the diameter of the giant panda family area in the study area is 3 km), and the assessment impact level is set to 3 levels to meet the needs of protection and research.

3. Analysis and Experiment of Countermeasures Affecting Giant Panda

3.1. Data Source

Through collecting the trace information of Tangjiahe National Nature Reserve in the third national giant panda survey in 2018, as the background information before tourism development, based on statistical analysis to determine whether tourism development has affected the giant panda. Terrain, river, boundary, protection station, main tourist routes and GIS layer data are provided by Tangjiahe National Nature Reserve.

3.2. Experimental Process

If the distance between the giant panda trace point and the hiking route and the self-driving route conforms to the normal distribution, independent sample t-test is used to analyze whether there is significant difference in the average avoidance distance between the giant panda and the hiking route and the self-driving route. Calculate the number of trace points in every 100m distance unit within the range of hiking route and self-driving route, and use the independent sample t in the nonparametric test To test and analyze whether there is significant difference in the distribution of giant panda traces in order to further understand the impact of tourism interference on giant pandas in different environments, this study will also divide all giant panda trace points in the study area (including those beyond the diameter of the home area) according to their altitude and divide them into altitude intervals every 100 m, and calculate every 100 m respectively The average distance between giant panda trace points and self-driving route and hiking route in the altitude range, and the interference of the two tourism modes on giant pandas at different altitudes were compared by paired sample t-test.

Entropy is defined as:

$$H(p) = -\sum_{x \in X} p(x) \ln(x) \tag{1}$$

The Poisson distribution close to the species distribution law and the expected value of f_i under π distribution are the same. The simulated distribution is approached to the real situation. Of course, there are many kinds of simulated distributions that meet this criterion. At this time, the principle of maximum entropy is applied to select a Poisson distribution that is closest to the uniform distribution as the simulated species distribution. Or consider the Boltzmann distribution:

$$q\lambda(x) = e^{\lambda \bullet f(x)} / Z_{\lambda}$$
⁽²⁾

$$Z_{\lambda} = \sum_{x \in X} e^{\lambda \bullet f(x)}$$
(3)

The distribution is a normal distribution. Therefore, according to the maximum entropy model and the maximum likelihood Boltzmann distribution (the Boltzmann distribution with the minimum relative entropy relative entropy) can be used interchangeably.

4. Analysis of Experimental Results

4.1. Analysis of Avoidance Effect of Giant Panda on Tourism Interference

In 2000 and 2018, the distance between the giant panda trace points and the road conforms to the normal distribution (within 3 km). Through the parameter test (independent sample t test), it is found that in 2018, the Giant Panda had a significant avoidance effect on the habitat close to the hiking route (P = 0.024). Although the average distance between the trace points of giant panda and the self-driving route increased from (1887±239) m to (1952±119) m in 2012, there was no significant avoidance effect on the self-driving route (P = 0.896). In 2000, the minimum distance between the giant panda trace point and the self-driving route was 769.5m, 1260.8m and 1530.4m respectively, while in 2018, the nearest small distance was 460m, 1145.5m and 1325.5m respectively, as shown in Table 1.

Table 1.	Average	distance	between	giant	panda	trace	points	and	self-driving	route	and	hiking	route
				in	100m d	altitud	e rang	е					

Elevation Range(m)	Average distance to the driving road	Average distance to the hiking road
1600-1700	5934.87	6953.99
1700-1800	5996.45	5177.90
1800-1900	4167.43	3976.65
1900-2000	4968.67	2573.45
2000-2100	3932.33	3480.90
2100-2200	3565.67	3245.89
2200-2300	4934.67	2800.45
2300-2400	6027.82	3710.56
2400-2500	5947.12	3785.48
2500-2600	7235.40	3487.09
2600-2700	10023.45	3394.79
2700-2800	10539.20	3200.69
2800-2900	11245.20	4152.55

4.2. Analysis on the Level and Threshold of the Interference of Tourism Routes

By analyzing the distribution of giant panda trace points within a certain distance from the hiking route (Table 2), there is no trace of giant panda within 57m from the hiking route; in the area between 57 and 800 m from the hiking route, there is a significant difference between the activity frequency of giant panda in this area and that beyond 800 m from the road (P=0.036). There was a significant difference (P=0.036) between the frequency of giant panda activity in the area 800~1400m away from the hiking route and that outside the road 1400m away. Therefore, the impact on giant pandas can be divided into three levels according to the distance: the first level is 0 ~ 57m from the hiking route, the second level is 57~800m from the hiking route, and the third level is 800~1400m from the hiking route.

Distance Dance(m)	The sign of Giant Panda						
Distance Range(III)	Hiking Trail	Driving Road					
100	2	0					
100-200	0	0					
200-300	2	0					
300-400	1	0					
400-500	2	1					
500-600	1	0					
600-700	2	0					
700-800	1	0					
800-900	1	0					
900-1000	2	0					
1000-1100	4	0					
1100-1200	2	2					
1200-1300	2	1					
1300-1400	3	1					
1400-1500	3	1					
1500-1600	2	1					
1600-1700	0	2					

Table 2. Number of giant panda tracks in every 100m distance between hiking route and self-driving route

4.3. Analysis of the Influence of Tourism Mode on the Avoidance Distance and Trace Point Distribution of Giant Panda

The average avoidance distance between the giant panda trace points and the hiking route and the self-driving route was (1679.26 ± 136.57) m and (1952.37 ± 136.57) m respectively, and there was no significant difference between them (t=1.34, P=0.186). There were significant differences in the distribution of trace points around the hiking route and self-driving route (z=-3.48, P=0.000). The average trace points in every 100m unit were 1.9 ± 0.23 and 0.8 ± 0.15 , respectively. The average distances between giant panda tracks and self-driving routes and hiking routes were (6658.83 ± 682.82) m and (3822.26±319.48) m in every 100m altitude range, with significant differences





Figure 1. Average distance between giant panda trace points and self-driving route and hiking route in every 100m altitude range

4.4. Analysis of the Relationship between Environment and Human Disturbance Variables and The Frequency of Occurrence of Giant Panda

The results of MaxEnt model show that the occurrence probability of giant panda is higher in the area with altitude of 2500-3200m, slope of $5 \sim 20^{\circ}$ and high vegetation coverage. When the passengers are a certain distance away from the giant panda, the occurrence frequency of the giant panda is higher, as shown in Figure 2.



Figure 2. Optimum distance between giant panda and human disturbance

It can be seen from the figure that the two optimal distances are not the same. In the third optimal distance in China, harvesting basically has no impact on the panda and its habitat, so its optimal distance is 0. For pesticides, the optimum distance is the largest, as high as 5500 meters, so the harm of spraying pesticides on giant pandas is the largest. Compared with the third best distance in China, the fourth best distance in China has changed a little. Among them, cutting bamboo and shooting shoot become 0, and cutting is the most important factor. As shown in Figure 3.



Figure 3. Number of giant panda traces in each distance segment

By analyzing the distribution of giant panda trace points within a certain distance from the self-driving route, there is no trace of giant panda within 460m from the self-driving route. In the area between 460-1000m away from the self-driving route, there is a significant difference between the frequency of giant panda activity in this area and that beyond 1000m away from the self-driving route (P = 0.017); there is no significant difference between the frequency of giant panda activity in all areas beyond 1000m away from the self-driving route. Therefore, the influence of self-driving tourism routes and tourism activities on giant pandas in Tangjiahe National Nature Reserve can be divided into three levels according to distance: the first level is 0-460m away from self-driving routes, the second level is 460-1000m away from self-driving routes, and the third level is 1000m away from self-driving routes, as shown in Figure 4.



Figure 4. Average walking distance of giant panda in each time period

It can be seen from the figure that the distance between each distance segment is different. The walking distance between 2600-2700,2700-2800,2800-2900 are far greater than that of other periods. It shows that in the three distances, the impact of giant panda eco-tourism on giant panda is the smallest.

5. Conclusion

This paper compares the impacts of two different tourism modes in a National Nature Reserve, and shows that tourism activities under scientific planning and management can limit the impact of human interference on wildlife to a controllable range, realize the harmonious coexistence between human and nature, and give full play to the multiple benefits of natural resources.

In recent years, the number of tourists in the nature reserve has gradually increased, which indicates that the public's demand for ecotourism is increasing in recent years, and the interference to wild animals such as giant panda will also increase. Therefore, it is suggested to further control the number of tourists in the hiking area during the breeding period of the giant panda, increase the supply of sightseeing vehicles, reduce the scale of self-driving, and moderately reduce the opening time, so as to minimize the impact of tourism activities on the giant panda in this period. With the development of China's ecological civilization construction and protection, developing ecotourism will gradually become an inevitable choice for the nature reserves to respond to the public's need to get close to nature and understand the nature. It is also the social responsibility of the nature reserves. The nature reserves should be more active in improving their protection and management ability, planning and managing ecotourism well, and exploring suitable for the nature reserves .The index system and method of ecotourism impact assessment and monitoring can ensure the effective protection of natural resources and the healthy development of ecotourism.

The results show that there is no significant difference between the avoidance distance of giant panda on self-driving route and hiking route, which is not consistent with the relevant research results on birds. The reason for this phenomenon may be that the self-driving route and the areas along the route are not closed, but open to the public, which are the main areas for tourism activities in the nature reserve, and also the areas where the nature reserve provides rest, food, drink and other services. The flow of people and vehicles are large, and the interference degree is large, which leads to the habitat of giant pandas near the self-driving route.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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