Study on Potential Habitats in Giant Panda Nature Reserves

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Abstract

The loss of habitat is one of the main causes of the dramatic reduction in the population of giant pandas. It has become an urgent requirement to increase the habitat of giant panda rationally and effectively. We adopted the "3S" technique to systematically analyze the expansion of reserve under the situation of population growth, and established a predicting model for the expansion of isolated (Xiaohegou) reserve of giant pandas and a remote sensing information extraction model for giant panda nature reserve. The identification and prediction of potential habitat within Xiaohegou Nature Reserve in Pingwu County were completed, with the expansion scope well-defined and the predicting system for giant panda nature reserve established. This article gives a brief description of our current research progress on this topic.

Keywords: Giant panda nature reserves; Potential habitat; Prediction of expansion scope

Introduction

Giant panda, as a symbol of China, is an endangered and world-class protected species and thus getting a lot of attention from scientific research all over the world. Giant pandas' troops used to cover provinces of Yunnan, Hunan, Hubei, Shanxi, and Henan in history of more than 2,000 years ago. However, from around 1,000 years ago, habitat of giant panda began to reduce dramatically, and the decline has been more significantly during the recent 200 years. In the 19th century, there were still giant pandas living in northern Hubei, western Hunan and eastern Sichuan, but now the pandas in these areas have all been extinct [1] (Figure 1).
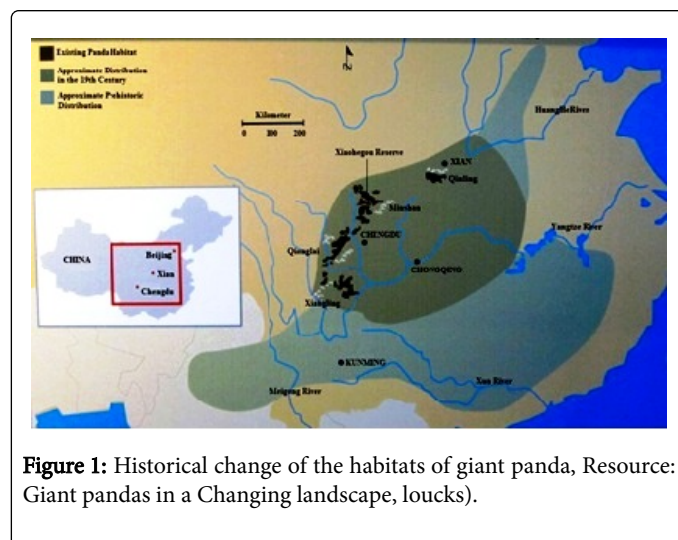

Figure 1: Historical change of the habitats of giant panda, Resource: Giant pandas in a Changing landscape, loucks).

The rapid loss of the habitat is mainly due to the encroachment by the rapid development of human society.

Currently, the population of giant pandas is only distributed among 6 mountain ranges, i.e., Da Xiangling, Xiao Xiangling, Qionglai, Liangshan, Minshan and Qinling [2], (Figure 2) in Sichuan, Gansu and Shaanxi provinces. The sharp reduction of habitat has led to the loss of living environment and the population decline of giant pandas (Figure 2).
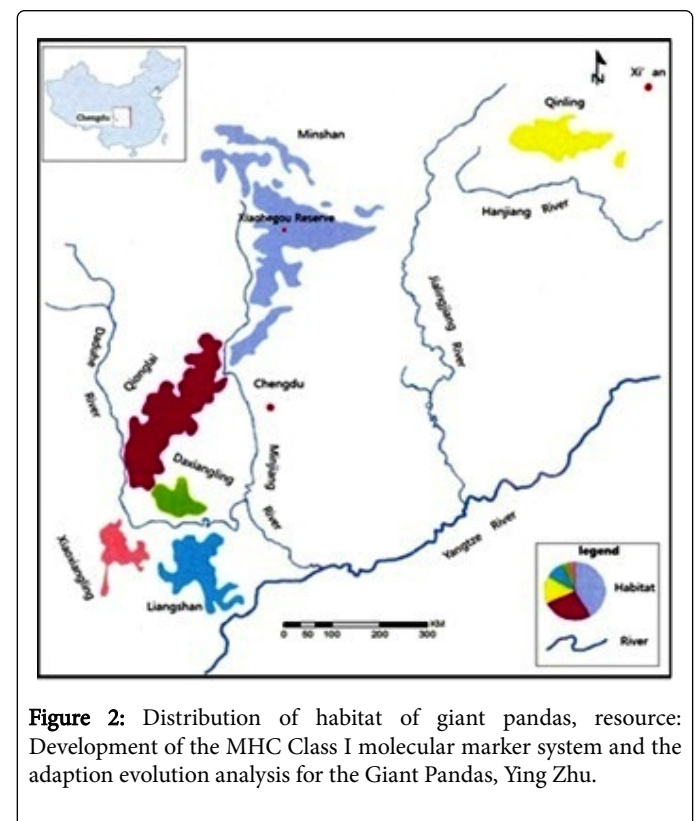

Figure 2: Distribution of habitat of giant pandas, resource: Development of the MHC Class I molecular marker system and the adaption evolution analysis for the Giant Pandas, Ying Zhu.

As stated above, loss of habitat is one of the main causes of the dramatic population decline of giant panda. And the loss of habitat is largely due to the human over-exploitation and use in those areas. Because of the unrestrained development, the habitat of giant panda has kept shrinking and degrading, and the remaining population is isolated into smaller groups with the fragmentation of the habitat. What's more, the habitat of giant panda is highly irreplaceable because of it specially contains a complicated system of various vegetation types including bamboos. When habitats are lost, giant pandas also lose the basis of survival and reproduction. With the loss of habitat, the population of giant panda is drastically reduced and thus the species has become endangered. In addition, in the recent 100-200 years, frequent geological activities, e.g. Earthquake happened in Wenchuan and Ya'an has beenanother main reason for the sharp reduction of distribution area and the population of giant panda. Therefore, to protect the habitat of giant pandas while increasing their population, it is necessary to expand the existing habitat, whose premise is to effectively explore the potential habitat of giant pandas.

Our research focused on the solutions for above problems and carried out rational and effective exploration of the potential habitat of giant pandas. The ultimate goal of our study is to provide a scientific basis for the future expansion of nature reserves and to form corresponding model systems for other types of expansion of nature reserves.

The core area selected for our study was the Xiaohegou Nature Reserve located in Pingwu County, Sichuan Province. The region possessed not only a representative biome but also a geographical location of great importance. This location also appears to be an important transition zone between panda species A and B. The area belongs to the Himalayan-Hengduan Mountains, one of the core global biodiversity areas. The reserve maintains typical natural ecological systems and this one in particular is the most intact ecosystem within its latitude region. It has representation and typicality that is outstanding on a global scale [3].

According to official published dataForestry Department of Sichuan Province [4] there are altogether 49 pandas in Xiaohegou Nature Reserve at present and the area of protection zone is 282 km^2. According to the understanding to the survival habitat of panda in previous research results, the single panda's territory area is about 7 km^2, considering that there are large stretches of bushwood and grassland, scree, sparse vegetation and other areas that are not suitable for the long-term survival of panda, it has caused the saturation and slight over capacity in Xiaohegou Nature Reserve only 4.77 km^2 for one to live. Therefore, the expansion of protection zone is brought to the schedule and the scientific problem how to reasonably and effectively expand the protection zone is put forward.

Based on the multidisciplinary knowledge, including ecology, geography and remote sensing spectroscopy, we adopted the "3S" technique to systematically analyze the expansion of reserve under the situation of population growth, and established a predicting model for the expansion of isolated (Xiaohegou) reserve of giant pandas and a remote sensing information extraction model for giant panda nature reserve. The identification and prediction of potential habitat within Xiaohegou Nature Reserve in Pingwu County were completed, with the expansion scope well-defined and the predicting system for giant panda nature reserve established.

So far, our study investigated the ecological dynamics of the Xiaohegou Nature Reserve from 1994 to 2014, carried out a detailed classification of vegetation in the core area, and calculated related indicators, including fractal dimension, shape index, diversity, dominance, and fragmentation. Using ecological niche modeling from remote sensing inversion and other approaches, we performed the inversion of related parameters e.g, temperature and coverage. What's more, ecological niche model of soil of the giant panda habitat in Pingwu County, ecological niche model of remote sensing inversion (master environment), ecological niche model of space and ecological niche model of heavy metal disturbance were established, and eventually, the scope of the expansion of the reserve was calculated. Part of the research results have been published in the author's doctoral thesis [5]. Based on the analysis of the spatiotemporal changes of Xiaohegou Nature Reserve in the period of 20 years, we performed further investigation on the potential distribution of giant pandas in Pingwu County and the characteristics of the giant pandas' biological living environment to establish a scoring system for expansion of isolated nature reserve of giant panda, offering a reference for later expansion of nature reserves of giant panda and their potential habitat under similar conditions.

Conclusion

In our study, we focused on the establishment of remote sensing information extraction model of giant panda nature reserve. In the past, when the "3S" technique was used to analyze the habitat, geographic information science (GIS) analysis was more favorable, while the research on the remote sensing inversion model of nature reserves were much rarer, which was mainly because that the previous research subjects were mostly large scale areas e.g., mountain ranges. The advantages of this approach include dan easy access to data for quantitative analysis, which can be obtained from a variety of public documents. However, our study was based on practical problems to explore the issue of Xiaohegou Nature Reserve expansion. Due to the small scale of the isolated nature reserve, the research data was difficult to be detailed and refined. In particular, the data of temperature, coverage, vegetation health and other major habitat environmental factors within small scale area were difficult to obtain, and the conventional measurement method could not be satisfactory. In such condition, however, the remote sensing (RS) inversion turned out to be effective and feasible [6]. Through the establishment of the ecological niche model from remote sensing inversion, we managed to obtain the refined suitability index for the potential area for giant panda habitat in small scale area, and thereby provided the scientific basis for the expansion of the reserve. From the aspect of sustainable research, since the replacement of remote sensing technology is very fast and satellite technology with higher resolution will be soon renewed and popularized, the corresponding well refined research on the area with smaller scale would thereby be developed. Therefore, our study offers a new way of thinking, and also provides a chance for the future formation of a mature system.

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