



## News &amp; Views

## Nature protection and human development in the Selincuo region: conflict resolution

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Tibet serves as an important ecological security barrier for China. It has the largest national nature reserves in China, spanning 372,000 km<sup>2</sup> and accounting for 30.94% of the land. Although the national nature reserve has provided ecological benefits, it has also resulted in serious conflicts between nature conservation and human development. Especially in the modernization period since the 21st century, Tibet has played an unprecedented important role in balancing protection and development. In this study, Selincuo, a key region explored during the Second Tibetan Plateau Scientific Expedition, was selected as a case study for discussion.

The Selincuo region is located on the southern margin of the Changtang Plateau Desert Ecological Barrier in Tibet and covers six administrative divisions—Xainza County, Nagchu City, Ando County, Bangor County, Nyima County, and Shuanghu County. It has an average elevation of more than 4,500 m and five lakes with individual surface areas >200 km<sup>2</sup>, making it the region with the densest distribution of lakes in the Qinghai-Tibet Plateau. In 2003, the Selincuo National Black-necked Crane Nature Reserve (hereinafter referred to as the Selincuo Nature Reserve), which covers an area of 18,900 km<sup>2</sup>, was established for protecting the black-necked crane (a rare and endangered bird species) and the wetland ecosystem where they reside and breed [1]. During the functional zoning [2], in consideration of the fact that the core and buffer zones in Selincuo Nature Reserve can get more eco-compensation, the proportion of areas in the core and buffer zones was increased to 81.49%, substantially higher than that of most other nature reserves in China. Currently, the core and buffer zones are 7,100 and 8,200 km<sup>2</sup> respectively, of which certain areas are subject to frequent human activity, including the seat of government for Maiba, Bazha, and Tarma, traditional rangelands uninhabited by black-necked cranes, and 34 residential areas (Fig. 1).

The population of the Selincuo Nature Reserve has grown continuously in recent years, which has resulted in greater population pressure being exerted on nature conservation and regional development. From 2003 to 2016, the population within the reserve increased by 68,000. The population growth rate is essentially

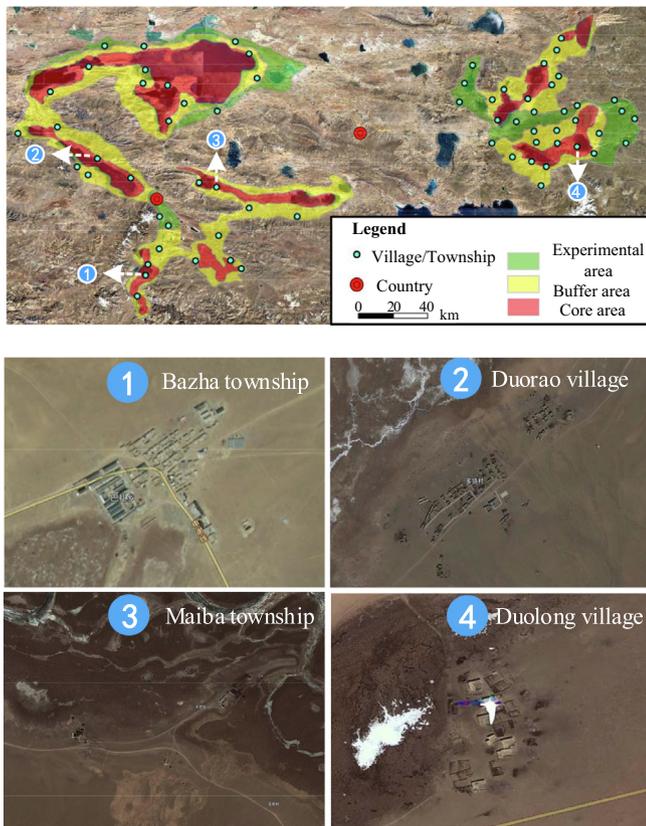
the same as that of the rest of Tibet. At present, the population of the core and buffer zones accounts for 50.29% of the total population in Selincuo. In accordance with regulations on the management of national nature reserves, core zones are natural ecosystems undisturbed by human activity or having the potential for primitive habitat restoration. Therefore, all human activities are prohibited in core zones, and the buffer zones is strictly limited to scientific research and observation activities. Owing to the restrictions imposed by these management regulations, rangeland improvement cannot be implemented in the core and buffer zones [3]; consequently, production conditions for animal husbandry and living conditions for herdsman cannot be improved. Therefore, in this area, the average income growth rate for farmers and herdsman is about 30% lower than that of the annual rate for Tibet, and the incidence of poverty was 16.89%. In addition, because asphalt roads cannot be constructed in the nature reserve, all types of vehicles drive on the grassland, which destroys the ecology of the alpine grassland and could startle and even lead to the death of protected animals.

As the rangelands of Changtang are mainly distributed in the Selincuo Region, the economic development of the region is largely dependent on livestock husbandry [4], with the herder population accounting for more than 90% of the total population. Therefore, an increase in population has, in turn, led to an increase in livestock production. In 2017, the livestock inventory per capita was as high as 28.7 per head. Excessive herding has resulted in alpine grassland degradation [5], which in turn has led to a demand for increased rangeland areas. The rangeland boundary has shifted northwards from that in 1950 by approximately 100 km. However, with the establishment of nature reserves, wild animals have also been protected, thereby leading to a rapid increase in wildlife populations. Over the past two decades, the population of the black-necked crane in Changtang has increased by more than 30% [6], while the number of Tibetan antelopes has risen by more than 100,000. In 2017, the distribution of wild yaks reached 3.29 per 100 km<sup>2</sup>. The marsh wetlands inhabited by these herbivores are usually rangelands with high grass production, which leads to competition for space and food between wild and domesticated animals; therefore, the problem of overloading livestock on grasslands is exacerbated [7]. To ensure that domesticated livestock receive a relatively adequate amount of grazing, herders have built

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**Fig. 1.** Conflict between functional zone and residential area in Selincuo Nature Reserve.

extensive fencing, which has greatly reduced the foraging and living spaces of wild animals and resulted in problems such as habitat fragmentation and injuries or deaths of Tibetan antelopes due to tangling. In addition, the populations of local carnivores such as the snow leopard have experienced significant growth, with the distribution of snow leopards reaching 3.04 per 100 km<sup>2</sup> in 2017. Consequently, there have been frequent occurrences of attacks on herders and preying of domesticated animals by these carnivores, causing a steady increase in the loss of human life and property over the years.

The expansion of Selincuo lake has become a threat to the natural ecosystem and herders' production and living activities. The Selincuo Lake is the largest lake in this region and presently the largest saltwater lake in the whole of Tibet. From 1976 to 2017, the level of the lake increased by 0.8 m every year on average, and area of the lake increased approximately 43%, from 1,667 to 2,389 km<sup>2</sup> [8]. Lake expansion towards the east and the north has been more significant, with submergence resulting in the relocation of approximately 300 herders. Owing to submergence of grasslands coupled with the lack of other job opportunities, herder relocation has inevitably aggravated the human-land conflict in the rangeland areas.

The natural alpine desert landscape of the Selincuo region is characteristic and representative of the Qinghai-Tibetan Plateau. It is home to various rare and endangered animal species, including the black-necked crane, Tibetan antelope, snow leopard, wild yak, brown bear, and kiang, and encompasses traits of the Changtang nomadic culture, such as the Zhangzhung culture and Bon religion [9]. Therefore, in view of the region's resource endowment, Selincuo is an ideal location for the establishment of a national park. National parks are specific areas for the scientific protection and

rational utilization of natural resources with the main purpose of protecting large areas of representative national natural ecosystems [10], and simultaneously to provide comprehensive functions such as scientific research, education, and recreation [11]. Through the construction of national parks, recreation activities could be developed to increase the asset value of the ecological landscape and improve the income and employment of herders. Therefore, the establishment of a national park in the Selincuo region is a reasonable means to balance the conflict between nature conservation and human development. During the establishment of the Selincuo National Park, particular emphasis should be placed on the following aspects:

- (1) The nature reserve should be redesignated to coordinate the needs of biodiversity conservation, effective management of nature conservation and sustainable development of communities. The ecological protection and human development of Selincuo National Park are coordinated in land use by functional zoning and strict protection. It is convenient for strict protection of natural ecology and rational utilization of ecological landscape resources.
- (2) According to the interactive relationship between soil and water resources, ecological resource elements and human activity space, the resource environmental bearing capacity of the Selincuo National Park is determined. Then, the upper limit of population capacity and the number of wild animals is put forward as rigid constraint parameter to strictly and effectively control the number of tourists and the range of activities, and the number of wild animals and the range of activities, so as to achieve the balance of carrying capacity of human and animal resources and environment.
- (3) Based on the characteristics of community economic activities and its ecological impact assessment, and according to the principle of "promoting protection in large areas through development in small areas", the green industry and green town development model of Selincuo National Park should be established. These include the establishment of visitor reception centres in key towns, expansion of employment channels, and creation of channels for the integration of agricultural and husbandry development and tourism industry chains, which could facilitate the emancipation of herders from a survival and development route that relies solely on competition for grassland resources, and increase herder income through full-time or part-time participation in the establishment of the national park.
- (4) The routes to realize the maintenance and appreciation of grassland ecological assets in national parks, as well as the ecological compensation system, shall be established. The grassland within the scope of national parks shall be purchased or invested by means of unified management. The subsidy measures shift from grassland area to labor employment workload and ecological asset improvement, and benefit from the development of national parks to make up for the loss of grassland ecological function and wild animals hunting livestock.
- (5) An integrated monitoring network that combines satellite, aerial, and ground imagery should be established to observe the change of ecological environment, the spatial distribution, range of activities and the state of living environment of large animals, important birds and rare and endangered species in the wild. Meanwhile, it also monitors the activities of tourists in real time and provides high-quality information services to prevent and avoid wildlife injury and other incidents, to serve the national park public management system.

## Conflict of interest

The authors declare that they have no conflict of interest.

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