

Ecological impacts of geography and traditional culture on the Tibetan plateau

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Abstract. There are diverse factors influencing the ecology of the Qinghai-Tibet Plateau, and this article primarily discusses them from two perspectives. These include the impact of natural geographical conditions and the influence of cultural traditions. Natural geographical conditions primarily consider the plateau's unique geographical location and altitude, while cultural traditions mainly involve local religious beliefs and customs affecting the ecology. The article primarily demonstrates a comprehensive understanding of the current ecological state of the Qinghai-Tibet Plateau from multiple angles and discusses how these factors can be utilized to protect and improve the ecological situation.

Keywords: Tibetan Plateau, traditional culture, Tibetan Buddhism, natural geography, environmental protection, sky burial, Tibetan medicine

1. Introduction

Known as the "Roof of the World" and the "Third Pole of the Earth", the Tibetan Plateau, with its majestic topography and cold climate, is the highest region on Earth. Covering 2.9 million square kilometers, this region has an average altitude of 4,500 meters, with the highest point being 8,848 meters. Due to its high altitude and special geographic conditions, the region is relatively fragile and has a weak capacity to recover from ecological damage. The terrain of the Tibetan Plateau is characterized by encircling mountains, deep canyons, and interlocking massive mountain ranges, which form the basic framework of the region's topography. Scattered among these mountains are deserts, basins, grasslands and river valleys, forming a diverse natural environment. Under these special physical and geographic conditions, the Tibetan Plateau has given rise to different traditional human environments, including religions and customs.

2. Geographic overview and ecological situation of the Tibetan Plateau

2.1. Climate change on the Tibetan Plateau

Since the beginning of the recent modern climatic period, when human meteorological observations have been recorded, the overall change in the Earth's climate has been mainly characterized by global warming. This trend is gradually changing the Tibetan Plateau. As shown in Fig. [1], the temperature in the Tibetan Plateau region has been increasing at a rate of 0.47 K per decade during the period 1982-2015, with all increases stronger than the global average. In terms of precipitation, the trend of precipitation change in the Tibetan Plateau is not significant as observed in the figure.

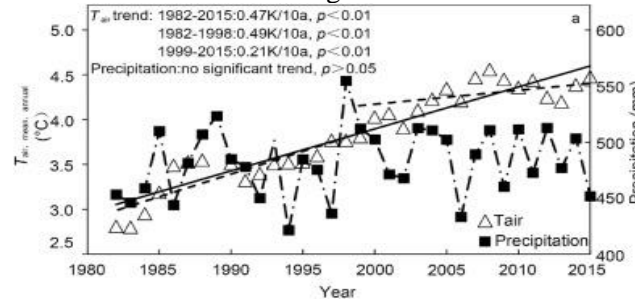


Figure 1. Trends in temperature and precipitation on the Tibetan Plateau, 1982-2015

Note: This figure and the related data mentioned above are from the literature [1] respectively

Zhou Siru and Xin Zhongbao collected the spatial and temporal data of precipitation on the Tibetan Plateau over the past 40 years, and examined eight different precipitation datasets and the data from Chinese meteorological stations using the Mann-Kendall method^[2], and found that about 80% of the meteorological stations showed an increasing trend in the annual precipitation, which accounted for more than 66% of the whole Tibetan Plateau, and that the areas with a significant decreasing trend in the precipitation were generally less than 10%. percent. The dataset shows that precipitation variations are not significant in most areas, but there is obvious spatial variability. Thus, precipitation on the Tibetan Plateau shows only a weak upward trend in general.

2.1.1. Impact of climate change on glaciers and lakes. Warming of the Tibetan Plateau has intensified the melting of glacial snow. This has also exposed land previously covered by snow and ice, and solar radiation has been absorbed more by the earth, exacerbating regional warming. In recent years, glacier reserves on the Tibetan Plateau are only 80% of what they were 50 years ago, and the area covered has been reduced by about one-fifth. In the long term, with the continued loss of glaciers, solid water reserves are gradually decreasing, and the replenishment of glacial lakes is bound to become increasingly insufficient, exacerbating the potential risk of water shortages.

From a short-term perspective, the large-scale melting of glaciers mostly occurs in spring and summer, on the one hand, the melting snow water in a short period of time into the rivers and lakes to increase the surface water area, exacerbating the evaporation of the lakes, and the evaporation of the water vapor generated by the water vapor directly involved in the atmospheric cycle, which at this point in time is also the season of precipitation concentration, resulting in frequent occurrence of extreme weather, and induced under the complex topographical conditions of ice avalanches, glacial lake outburst, glacier mudslides and other disasters. In 2018, in October, two ice avalanches occurred in Sedongpu Gorge near Gala Village in the middle and lower reaches of the Yarlung Zangbo River, forming an ice avalanche weir [4]. The processes of accelerated glacier degradation, significant overall expansion of lakes, and increased glacier runoff have led to an increasing risk of water resources and water disasters around the Tibetan Plateau.

2.1.2. Climate extremes are important drivers of ecological and environmental change on the Tibetan Plateau. The Tibetan Plateau has unique geographic conditions such as low temperature, low pressure,

and strong radiation, which make the frequency and scale of extreme weather events, such as strong winds and snowstorms, higher than those in general areas. Sun Mai, Li Peng and others have carried out relevant studies on the Tibetan Plateau [5], and verified the effects of extreme temperature and precipitation events of different intensities on the spring and fall phenology of vegetation on the Tibetan Plateau. The results showed that the spring phenology on the Tibetan Plateau was significantly advanced by 3.6 hours each year. For different vegetation types, extreme high and low temperatures caused different degrees of advance and delay of spring and fall phenology, and extreme precipitation events also had corresponding effects on phenology.

It can be seen that changes in vegetation and climate will directly affect the living conditions of animals in the region, some creatures with migratory habits will be affected by climate change: if the animals migrate to the destination, the plants they rely on for food have not yet blossomed and fruited, they will lose their original food sources and forced to look for new food; if the animals adapted to the change in climate and migrate early, then in the original area of the predators feeding on the animal will be due to a lack of food and survival problems. If the animals adapt to the change in climate and migrate early, the predators in the original area that feed on such animals will have difficulties in survival due to the lack of food, and the organisms that originally served as food for the migrating animals will be able to reproduce because of the lack of natural enemies. Climatic changes will disturb the ecological rules of each region within a certain range, resulting in an imbalance in the food web, which will affect the ecology of the entire Tibetan Plateau in the long run.

3. Ecological situation in Tibetan areas under human activities

3.1. Tibetan traditional culture and religious concept

In order to survive and reproduce in a complex ecosystem, human beings have developed an ecological culture. This culture is a series of adaptive cultural systems formed by ethnic groups in the process of adapting to the environment, utilizing resources and changing their surroundings, and encompasses religious beliefs, production activities, living habits and social customs. For the Tibetans in particular, because of the fragility of their living environment and the irreplaceability of their natural resources, they emphasize harmonious coexistence with nature in their concepts and behaviours, and in their spiritual and material cultures, and regard the cherishing of all life as the core value of their ecological culture.

Looking at the ecological culture of the Tibetan people from the perspective of their religious beliefs, we can see that the Tibetans, in coping with the changing and demanding natural environment of the Tibetan Plateau, have relied heavily on the religion they worship to seek spiritual solace. Through an in-depth understanding of the traditional religious concepts of the Tibetan people, in the traditional religion of the Tibetan people's "view of the mountains and waters as a place to send souls" and the "theory of the spirit of all things", we can understand that, as the inhabitants of this piece of land, the Tibetans regard the environment they live in as a holy place, and therefore call it the "Sacred Snowy Plateau". "Sacred Snowy Plateau".

In Tibetan tradition, the lofty mountains of the Tibetan plateau are regarded as sacred mountains, its lakes as sacred lakes, and the sky as ruled by the gods of heaven. This plateau blends natural and cultural landscapes into a complete system of harmonious coexistence. In their mythological stories, the ancestors of the Tibetans recounted how the five grains were obtained from the cracks in Mount Sumeru, and these stories emphasized a central idea: that humans are not rulers of nature, but must live in harmony with the natural world. This idea is not only rooted in Tibetan culture, but is also in line with the Confucian concept of "unity of heaven and mankind" in traditional Chinese culture. It is also compatible with the contemporary goal of sustainable development of resources and the environment.

3.2. Ecological impact of traditional Tibetan culture and religion

3.2.1. Ecological impact of Tibetan medicine culture. The Origin of Tibetan Medicine. As early as in ancient times, the inhabitants of the Tibetan Plateau recognized the therapeutic effects of some plants through continuous exploration and attempts, and in the process of hunting, decomposition of corpses and cooking, they gradually recognized the pharmacological effects of some animals. Legend has it that in the third century B.C., there was the saying that "if it is poisonous, there is medicine", which coincides with the idea of Chinese medicine that "medicine is three times poisonous". In 641 AD, Princess Wencheng entered Tibet, bringing new theories and prescriptions to Tibetan medicine. In the following thousands of years, Indian, Daxi, Nepalese and Chinese medicines were continuously introduced into Tibet, which made Tibetan medicine continuously develop and improve. Therefore, Tibetan medicine is a unique system of medicine formed through long-term practice on the basis of extensive absorption and fusion of the theories of Chinese medicine.

Current status of Tibetan medicines

An important factor that distinguishes Tibetan medicine from other ethnic remedies is the herbs, and the unique ecological environment of the Tibetan Plateau provides Tibetans with many rich herbs that are different from those grown on the plains. For a long time local residents have chosen to harvest wild Tibetan medicines instead of planting them. After so many years of exploitation wild Tibetan medicine resources have become endangered and many traditional remedies have had to choose alternatives. After searching and testing by various organizations, there are currently 25 endangered Tibetan medicinal herbs of the first grade; 22 endangered herbs of the second grade; and 22 endangered herbs of the third grade. These herbs used to be the core medicines in Tibetan medicine [10].

3.2.2. Changes in Tibetan burial culture and ecological impacts. 1. Unique Tibetan Sky Burial.

Sky burial is a typical and unique funeral ceremony of the Tibetans, in which the body of the deceased is placed on a funeral pyre and fed to scavenging birds after the sky mourner finishes the ceremony. The reason why sky burial is accepted by the Tibetans is closely related to their religious culture, mythological origin and other national cultures. Under the influence of Benzoism, Tibetans believe that everything has a spirit, and that the soul of a loved one will be separated from the body after the ceremony, and the soul of the loved one will go to the Elysium [13]. The influence of Buddhism, on the other hand, has led Tibetans to believe that the feeding of vultures with the bodies of the deceased, as well as the various rituals prepared for the deceased during the sky burial ceremony, are for the purpose of cultivating blessings in the afterlife of the deceased.

2. Relationship between sky burials and the ecological environment

The Tibetan Plateau, with its special geographical conditions, does not have the material conditions for the universal practice of burial and cremation. The animal species are also very different from those in the plains and hills, and it is this unique natural environment and sparsely populated human conditions that have contributed to the development and evolution of sky burials.

Sky burial can save land resources and forest resources, first of all, sky burial does not need to excavate the soil and establish burial mounds, which greatly saves people's physical strength, secondly, cremation needs to burn a large amount of firewood, but the temperature of the Tibetan Plateau is much lower than the plains, and the species of trees are relatively rare. And the form of sky burial is relatively simple, affected by the local climate is small [14], at the same time, sky burial by the Tibetan religious and cultural influence is very profound, in the hearts of the local residents have extraordinary, far-reaching cultural significance and environmental significance.

3.3. Ecological impacts of human development

3.3.1. Degradation of grasslands due to human activities. About 60% of the Tibetan Plateau is covered by grasslands [6], which provide a source of food for livestock. As the primary industry, animal husbandry is the main source of local income. In recent years, the gross domestic product (GDP)

generated by animal husbandry has grown rapidly in the Tibetan Plateau region. The built-up area of Tibet and Qinghai provinces increased from 170 square kilometers at the end of the 20th century to 250 square kilometers at the beginning of the 21st century, and the railroad history of the Qinghai-Tibetan region increased rapidly from zero to 3000 kilometers between 1965 and 2008 [7]. However, the rapidly growing livestock population and urban expansion will inevitably squeeze the wildlife habitat. Based on the ground (A) of Tibetan grassland carrying capacity drawn by Zhang Yangjian's predecessor [8] and the ground (B) of actual livestock numbers (standard sheep units) in each Tibetan county, we can find that the grassland livestock carrying capacity of the Tibetan Plateau has great spatial differences. Although the carrying capacity and the actual number of livestock show a similar pattern, decreasing from the east to the west of the Tibetan grassland, there are still many areas where the actual carrying capacity exceeds the theoretical carrying capacity Fig. (C), and the degradation of grassland caused by this result is very significant [9].

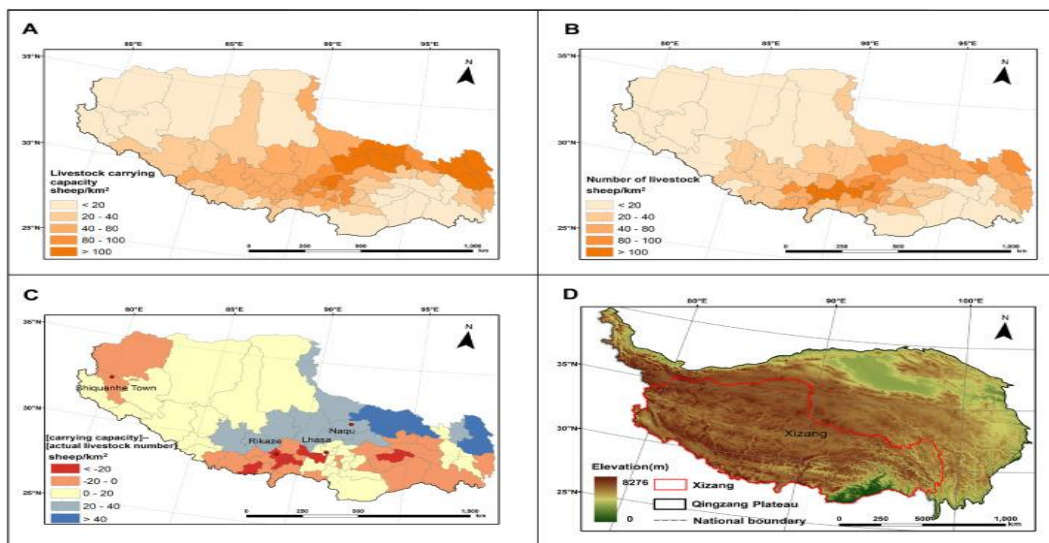


Figure 4. [9]Vegetation carrying capacity (A), livestock density (B) wildlife carrying capacity and(C) TAR boundary (D)

3.3.2. Impacts of human activities on wildlife. Since ancient times, due to its special geographic conditions, the Tibetan Plateau's agricultural and livestock production has been unstable, so hunting has become an important part of the local population's livelihood.

Among other things, the concept of location taboos is deeply rooted in Tibetan folk beliefs. This custom and also has a long history. During the Chinggan period of the Tang Dynasty, the ecological environment of the Xichuan region was damaged as never before. Faced with this situation, Songtsen Gampo then issued a decree dividing the unappropriated mountains and forests into two types: sacred mountains and public forests. The sacred mountains were regarded as the territory of the Buddha and were placed under the supervision of temples, where any kind of infringement was forbidden and violators would be severely punished. The public forests, on the other hand, were jointly managed by local tribes and villages. These measures have effectively prevented further environmental destruction and provided a solid guarantee for the protection of the forests and their wildlife.

In addition to the location taboos resulting from the worship of sacred mountains, there are also many species that are forbidden to be hunted or captured in Tibetan religious customs, known as species taboos. For example, Tibetans believe that snakes are the incarnation of the land god. Another example is the sky burial mentioned above, where vultures are used to eat the carcasses, so there is a custom of not catching vultures. These traditions indirectly protect species diversity.

4. Improvement of ecological protection measures

Strengthening glaciers, snow-capped mountains, rivers, lakes and wetlands, forests and grasslands and protecting biodiversity, especially balancing the distribution of habitats between livestock and wildlife and rationally solving the problem of man-made grassland degradation caused by overgrazing, are the main elements of ecological protection in the Tibetan Plateau region.

4.1. Promoting Tibetan culture and spreading the idea of environmental protection

In the teachings of Tibetan Buddhism, an interdependent relationship that emphasizes the equality of all living things, the protection of life and compassion is emphasized. Taboos based on religious beliefs play a key role in protecting the natural environment. Tibetan culture believes that the products of nature should be left to nature and opposes personal possession and control of natural resources. These traditional beliefs help to prevent the overexploitation of natural resources, thereby effectively protecting the ecological environment.

Tibetan communities also practice diverse religious rituals that deepen their respect for nature's gods. Some of these rituals also aim to alleviate ecological pressures, such as the Tibetan herders' tradition of adopting livestock for worship. Through these religious activities, they express their respect for the gods, mountains, and lakes, and at the same time, by sacrificing large numbers of cattle and sheep, they achieve the dual goals of controlling the number of livestock and reducing the pressure on the grasslands, thus preserving the resources of the pastures.

4.2. Protect Tibetan medicine resources and strengthen ecological protection

The lack of core medicinal species has made it impossible to use many of the prescriptions of Tibetan medicine, and the protection of wild Tibetan medicine and the restoration of local ecology have become urgent. At the same time set up a protected area, planting Tibetan medicine in the protected area, in the protection of Tibetan medicine, at the same time, for the local animals and plants to provide a place to survive and reproduce. At the same time, the government should increase publicity, set up appropriate laws and regulations, in the hearts of the people to establish the protection of the ecological environment is to protect the consciousness of human beings themselves, and open the relevant positions on the Tibetan medicine ecological reserve for inspection and supervision. These policies in the protection of Tibetan medicine, protection of the ecological environment at the same time also provides a certain number of jobs for local residents, so that local residents in the protection of the ecology at the same time poverty alleviation and enrichment.

4.3. Enhance wildlife conservation and maintain the balance of the biological chain

Much of the Tibetan Plateau is still overgrazed, and these areas have been overgrazed for a long time, and wildlife species and populations have become scarce, especially large predators. Some species at the bottom of the food chain, such as rats and rabbits, are growing exponentially because their natural predators are not able to recover at a rate commensurate with their needs. The authorities concerned can adopt certain means to attract the original large beasts to return to the area and balance the ecology of the place.

In carrying out ecological work, fences or isolation zones are sometimes constructed according to the needs. However, this approach will result in the fragmentation and fragmentation of animal habitats, causing unnecessary harm to wild animals. The authorities should adopt a more ecological approach when formulating measures, such as using gentle materials to build fences, removing fences in high-frequency areas where animals are found or planting special demarcation lines with obvious shrubbery and forested areas for animals to pass through.

4.4. Maintaining the dynamic balance between human beings and nature

The current nature reserves are no longer adequate for the long-term reproduction and development of wildlife in the future. There are also many areas on the Tibetan Plateau with relatively productive

vegetation that are geographically uninhabitable and where new nature reserves could be established to accommodate the growth of wildlife populations.

At the same time, however, modern transportation and ever-deepening road networks will take us to more untouched and pristine areas. In addition, the number of tourists is growing rapidly, and more and more tourists are choosing to visit remote areas that they do not often visit, which will inevitably cause disturbance to wildlife. Therefore, the authorities concerned should improve the relevant policies and regulations to leave the remaining pristine space for wildlife.

4.5. *Improving the modernization of ecological and environmental governance on the Tibetan Plateau.*

On October 14, 2022, the Ministry of Ecology and Environment issued a notice on the issuance of the Medium- and Long-Term Development Plan for Ecological Environment Satellites (2021-2035), which for the first time proposed the establishment of a "five-base" synergistic monitoring system integrating space-based satellites, air-based remote sensing, aerial drones, mobile monitoring vehicles, and ground observation. A three-dimensional remote sensing monitoring system for the ecological environment was proposed for the first time. On July 11 of the following year, the Ministry of Natural Resources announced that China had for the first time fully completed the delineation of the red line of ecological protection, and that more than 50% of the land area of the entire Tibet region had been included in the scope of the red line of ecological protection.

The combination of the ecological red line and the five bases system can improve the accuracy and scope of monitoring, shorten the monitoring cycle, and significantly improve the efficiency of ecological protection work on the Tibetan Plateau. It is hoped that the relevant departments can promote the five-base system as soon as possible, and through the ecological environment big data platform, the establishment of a natural resources database and other technical measures to realize the full coverage of the ecological protection of the Qinghai-Tibet Plateau.

5. Conclusion

This study analyzes the geographical environment and culture of the Qinghai-Tibet Plateau, exploring the influence of local geography and culture on the local ecology. The results show that the ecosystem of the Qinghai-Tibet Plateau is influenced by multiple factors of culture and geography. It elaborates on how to restore the local ecology without compromising local economic development. The findings of this study provide important references and guidance for the restoration of the ecosystem of the Qinghai-Tibet Plateau, offering new ideas and solutions for relevant regulations and practices.

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