Chapter 8

Protecting and Constructing the Ecological Environment on the Tibetan Plateau

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Introduction

The ecological environment in Tibet is varied and marked by distinctive characteristics and functions. Such diversity plays an extremely important role in maintaining the world's environmental balance. The local authorities in Tibet attach great importance to protecting and constructing the ecological environment, and these efforts have proved to be effective. However, adverse effects such as global warming make the local environment more vulnerable, threatening its ecological security. Therefore efforts must be made to promote the protection of the Tibetan environment and ecology.

Tibet makes up the main body of the Qinghai-Tibet plateau, which is distinguished by a unique geographical and natural environment with rich wildlife and plant diversity, water, and mineral resources. Its environmental quality ranks among the best in the world. It has been known as 'the spine of the world' and 'the third pole of the earth'. It not only serves as 'the headwaters' region' and 'ecological source' of China, South Asia, and Southeast Asia, but also as 'the climate generator and regulator' of China and the eastern hemisphere. In short, it is of strategic global significance in ecological and environmental terms.

The ecological environment in Tibet

Types of ecological environment in Tibet

Tibet autonomous region occupies a vast area of 1,200,000 sq. km. made up of various landforms and complicated topographical features. The climate has distinctive differences at different altitudes, giving rise to a great variety of ecosystems. According to differences in landform and land types, the ecological environment in Tibet falls into the following categories – i) mountain, ii) lake basin, and iii) river valley. The mountain ecological environment can be subdivided into cold desert and lowland

hills .The lake basin ecological environment consists of deserts and swamps; the river valley ecological environment, plains and canyons. Because of the great diversity in ecological conditions, Tibet has all the 15 types of vegetation recorded for the whole of China. Most of this vegetation cover remains in natural condition, which is indicative of the pristine nature of the local environment. According to the classification of vegetation cover, the land area of Tibet can be divided into i) forests, ii) shrubs, iii) grasslands, iv) wetlands, v) deserts, vi) mountain ice barriers, and vii) artificial environments. It can be said that Tibet contains all types of terrestrial ecosystems, except for the oceanic. Among all the ecosystems, grassland, forest, and wetland occupy most of the land in Tibet.

Grassland ecosystem

The grassland ecosystem, especially the high-cold grassland ecosystem, is most distinctive. The area of natural grassland is 82.07 million hectares, which makes up 21% of the natural grasslands of China and 68.11% of the total area of Tibet. The applicable area accounts for 64% of the total. The first nationwide survey of grassland resources in China indicated that Tibet has 17 of the 18 types of grassland identified in the country as a whole. As one of the top five pastoral areas in China, grassland, especially the high-cold grassland ecosystem, is of utmost importance in protecting the ecological environment of Tibet and promoting animal husbandry. Success in maintaining the ecological health of grasslands is the key link in the orderly and intact ecological chain in Tibet.

Forest ecosystem

The forest ecosystem of Tibet is characterised by high productivity and a rich diversity of living things. The area of forest in Tibet is 7,170,000 hectares, with the volume of standing trees at 2.09 million m^3. The forests found in Tibet represent the largest areas of virgin forest in China and range from tropical mountain rain forest to seasonal rain forest at the highest altitude in the northern hemisphere to spruce forest along the Yalongzangbu River Valley. Its forest reserve ranks first in China. Assuming that one cubic metre of forest produces 350 kg of carbon, the total capacity of forest reserve in Tibet stands at a staggering 757,525 million kg. Therefore, it plays a crucial role in easing global warming.

Wetland ecosystem

The Tibet Autonomous Region (TAR) has a total wetland area of 60,000 sq.km., accounting for 4.9% of the total land area. Of this, lakes occupy 2,500 sq.km., the highest lake cover area in China, and, moreover, they represent some of the highest mountain wetlands in the world. The wetland ecosystem is distributed along lakeshores and in broad valleys and is characterised by very lush meadow vegetation covers. These meadows are the major resources for developing plateau animal husbandry. The wetland in Tibet plays a key role in holding flood waters in the rainy season and in accommodating water from melted ice and snow. The lakes serve as the natural habitats for a multitude of wild animals and aquatic lives. Marked by plateau characteristics and a network of lakes, the wetland ecosystem of Tibet is instrumental in maintaining regional ecological balance by regulating the local climate and improving the ecological environment.

The service function of the ecosystem in Tibet

The unique geographical environment and various types of ecosystem give rise to specific and diversified service functions. These services include biological production, water source maintenance, soil conservation, protection of biological diversity, outdoor recreation, prevention of natural disasters, and climate regulation. Among all the service functions, water source maintenance and protection of biological diversity are the most important ones.

Water resource maintenance

Tibet is known as the headwater area of the rivers in China, South Asia, and Southeast Asia. Some of the largest rivers, such as the Brahmaputra, the Lancang, the Lu, the Jitaiqu, the Jiazhafangge, the Shiquan, the Pengqu, and the Xibaxiaqu, originate from Tibet and flow across the Chinese border into neighbouring countries. Among the rivers originating from Tibet, more than 20 have river basin areas of above 10,000 sq.km. The water from melted glaciers is estimated to be 32,500 million m^3, accounting for 85% of the total for China.

Tibet is also rich in underground water resources and therefore has been called the 'water tower of Asia'. All types of ecosystems, especially forest, grassland, and wetland, in Tibet possess the function of conserving water resources for the rivers. Based on observations on the maximum water-holding capacity of the soil with a thickness of 50 cm, in virgin as well as secondary spruce and fir forests located at Hengduan mountain, it is estimated that the maximum capacity of soil water reservation in the Tibetan forest ecosystem can reach 25,100 million m^3, which is equal to the planned flood control capacity of the Three Gorges' project. This suggests that the forest ecosystem in Tibet plays a pivotal role in conserving water resources and hydrographic adjustment. Generally the maximum

water-holding capacity of the soil in the ecosystem, with Yunnan pine as the dominant species, is around 2000 m^3/hm^3, while the maximum water-holding capacity of the soil in virgin sub-alpine coniferous forest is 3000 m^3/hm^3.

Protecting biological diversity

As a distinctive environmental regional unit, Tibet is home to a unique biotic community, which is made up of many rare and valuable wild animals and plants. It is a major location from which emergence and differentiation of world mountain biotic species have taken place. As a result, it has one of the most diversified ranges of biotic species in the world and is recognised globally as one of the top 25 areas in terms of biotic diversity. It has been listed as the resource pool of various biotic species and a protective zone of biotic diversity. Recently, more than 9600 wild plants have been listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Thirty-nine wild plants are listed as rare and endangered plants and placed under special protection status. In addition, Tibet possesses 6,400 advanced plants, 300 of which have special medicinal values. Its faunal diversity includes 798 types of wild vertebrates, 142 wild mammals, 56 reptiles, 45 amphibians, 68 fish, 488 birds, and around 4,000 insects of which 125 have been placed under special national protection, accounting for one-third of those in China as a whole. More than 600 advanced plants and 200 terrestrial vertebrates cannot be found elsewhere except in Tibet. Therefore, protection of the biodiversity in Tibet is of great significance for scientific research and economic development.

Characteristics of the ecosystem in Tibet

In addition to its diversity in types and functions, the Tibetan ecosystem is characterised by distinctive local features, namely, virginity, variety, peculiarity, regional diversity, and harmony between nature and humanity. These features distinguish Tibet from the rest of the world and make Tibet a unique region. However, the ecosystem in Tibet is also affected by its vulnerability, dryness, and instability which limit the development of commercial enterprises such as animal husbandry.

The advantageous characteristics of the Tibetan ecosystem

- High altitude and geological peculiarity: Covering the major part of the Qinghai and Tibet plateau, Tibet is marked by the shortest geological history and highest average altitude. This results in unique ecological environment combinations with highly adaptive ecological resources.

- Virginity: Tibet occupies a vast area, and its population density is low. Human activities have had little impact on its ecological environment. There are still many areas remaining untreated by human beings, thus maintaining their pristine status.
- Variety: The terrain and landform in Tibet indicates an obvious diversity. There are great regional differences in natural conditions, and this explains the diversity of the ecological environment.
- Harmony between nature and humans: The Tibetans have lived in harmony with nature according to the ethos of Buddhism. The combination of mysterious culture and the beautiful landscape and monuments makes Tibet a unique tourist attraction.
- Regional diversity: Complex landform and distinctive geographical differentiation have caused obvious regional diversity in land use. The fertile river valley areas in the southeast are used for cropping, while the expansive grasslands in the north and northwest are used for raising livestock. Forests dominate the east and southeast. Besides the temperature, the efficiency of accumulated temperature and solar radiation are more intense than in other parts of China at the same latitude and altitude. As a result, the biological productivity is higher. The yield of crops can reach 15,000 kg per ha and the average growth of forest is 4.46m^3 per ha. Such productivity can seldom be found elsewhere.

Disadvantages of the Tibetan ecological environment

- Instability: The geological history of Tibet is still relatively short, and hence the formative activity is very intense. Over the past two million years since the fourth season, the Tibetan plateau has risen by 3,500 to 4,000m, and an intense upward thrust of the plateau is taking place. In the mountain areas, especially high mountainous areas and valleys, where the mountain slopes are steep and the soil layers are unstable, loose debris is prone to soil erosion and landslides.
- Vulnerability: The vulnerability of the ecological environment finds expression in a short growth period and a narrow ecological security threshold value of vegetation cover growing in a high-cold environment. Changes in the environment have a serious impact on the growth of vegetation cover. In addition, if the vegetation cover on a slope is damaged, the soil erosion rate on the slope is much more rapid than the rate of soil formation. To re-establish and restore the ecosystem is very difficult. What is worse, the heavy rainfall, strong wind, intense sunlight, and quick evaporation result in poor water retention in the soil surface. Then, if indigenous plants with deep root systems are damaged, restoration of vegetation cover becomes difficult.

- High-cold dryness: Due to the cold climate, frozen land and glaciers cover a large area where frequent freezing and melting of the soil occurs. The high-cold dry climate causes strong physical weathering of surface materials, while soil formation is inefficient. Hence the surface soil is extremely coarse, thin, and barren. Soils with such poor properties are widespread and are unfavourable for vegetation growth.

The adverse ecological environment in Tibet suggests that to realise sustainable development of the Tibetan economy and ecological environment is rather difficult. At the expense of the ecological environment, exploration of natural resources and economic development have resulted in environmental deterioration and destruction.

Achievements in protecting the ecological environment and construction of Tibet

The local authorities of the TAR have attached great importance to protecting the environment and its restoration. Taking sustainable development as a guideline, environmental protection has been recognised as an integral part of the state strategy in planning, implementation, and economic development of urban and rural areas. Efficient protection has been carried out for forests, rivers, lakes, grassland, wetland, glaciers, snow-covered mountains, and wild animals and plants.

Protecting the ecological environment

In Tibet, a succession of 40 natural protected zones of various types has been established, of which seven are at state level, eight at the level of the autonomous region (equal to provincial level), and 25 at the municipal level. The total area of protected zone is 407,300 sq.km., accounting for 33.9% of the total area of Tibet. Except for marine and coastal ecosystems, a network of protected zones representing the various types of ecological distribution has been established. Among them are Mount Qomolangma State Natural Protected Region, with a total area of 298,000 sq.km.; the Yalonzangbu Great Canyon State Natural Protected Region with a total area of 9168 sq.km. (the largest and deepest canyon); and the Lalu Wetland Natural Protected Region with a total area of 6.2 sq.km. In these protected regions, measures have been taken to protect 125 wild animals and 39 wild plants requiring special national protected status and the breeding places and habitats of rare and endangered species–including wetlands for migratory birds, natural scenery, and geological and biological relics of research value.

In order to maintain the flow level and quality of water in the rivers and to promote sustainable development of the local economy, favourable conditions are being created to protect the headwaters of the rivers in Tibet. The local authorities of the TAR have demarcated an area of 2.6 million hectares around the fountainhead of the Brahmaputra River to establish an ecological protection area. For the purpose of improving the ecological environment of the grasslands and promoting the use rate of natural resources, an amount of 29.6 million RMB has been invested to construct a grassland ecological demonstration area at state level in middle Naqu. Simultaneously, the Yigong National Geological Park, the Riduo Hot Spring Geological Park, and state forest parks at Basongcu and Seji have been established successfully.

Constructing the ecological environment in Tibet

Several projects aimed at protecting the fragile environment of the region have been launched. These include natural forest protection projects in three counties in the upper reaches of the Yangtze River, reclaiming forest and grassland from farming land and sand control projects in the middle reaches of the Brahmaputra River. The first, second, and third phases of the Sand Control Project at Alishiquan River have been completed. Since the 90s, reforestation has been widely promoted. The annual reforested area has now reached 13,600 hectares. Other activities, such as determining the stocking rate by grass growth, rotating grazing within defined areas, fencing and controlling the livestock population, planting grass, improving degenerated grassland, irrigation and rodent and pest control, and combating poisonous grasses, have been undertaken since the 70s. Projects aimed at grassland construction, such as anti-crisis reserves and livestock feeding research and demonstration stations, have been launched in the major pastoral areas. During the Fifth Nine-Year Plan, 62,000 hectares of grassland were fenced and another 1.67 million hectares were cleared of the three adverse effects of rats, insects, and poisonous grasses.

In the middle river basins encompassed by the Yangtze, Yellow, and inland rivers, 1,200 million RMB have been invested to implement a comprehensive agricultural exploration project which focuses on environmental protection and ecological construction. Through applying necessary biological and engineering methods, the use rate of local land and coverage of artificial vegetation have witnessed remarkable increases, and land desertification and erosion are under effective control. From the upper reaches to Rikaze and Zedan, artificial forests extend for hundreds of kilometres, and this is conducive to conservation of soil and water along the Brahmaputra River. As a result, the comprehensive quality index

of the regional ecological environment has been upgraded. With support from the central government, Ecological Environment Construction Planning has been formulated and implemented for the TAR. More than 22,000 million RMB will be invested to undertake 160 more ecological environment protection and construction projects, and this will result in the continuous improvement of the ecological environment of Tibet.

Methods of protection and construction of the Tibetan ecological environment

Over the past few years, the ecological environments in some regions have been improved. However, because of high altitude and cold climate, the natural ecological environment of Tibet is vulnerable, unstable, and sensitive. Under the influence of global warming in its unique geological environment and improper exploitation of ecological functions, the ecological environment in Tibet is generally undergoing light and moderate degeneration. In the more densely-populated areas, degeneration is gaining momentum as a result of human activities. In uninhabited mountainous areas, the ecological environment is suffering from light degeneration. Consequently, protecting and constructing the ecological environment in Tibet should be subject to the overall goals of checking ecological deterioration, maintaining ecological functions, safeguarding ecological security, preserving biotic diversity, and improving the living environment. A pilot demonstration site for comprehensive environmental protection is to be established to promote conservation technologies throughout the whole region.

Promoting scientific research and sustainable conservation measures

Firstly, studies on Tibet's ecological security strategies should be carried out and a relevant strategic framework formulated. Priority should be given to dynamic changes, vulnerability of the ecological environment, ecological security, and industry. In addition, studies on restoring and re-establishing the degenerated ecological environment in hypersensitive areas should be given extra attention.

Secondly, through better understanding of the problems, proper goals for ecological protection should be determined and relevant measures taken.

Thirdly, research on practical techniques of ecological protection, for instance restoring vegetation cover, should be carried out to provide necessary technological back-up.

Based on the research findings, an overall plan for protection of the ecological environment of the Tibet Autonomous Region should be formulated as soon as possible. Therefore, all work protecting the ecological environment in Tibet will be consistent and carried out in an orderly and well-organised manner. A monitoring system should be established to track the dynamic changes in the local ecological environment and provide evidence for decision-making. Efforts should be made to promote the enactment of laws for the protection of the ecological environment.

Implementing strategies of environmental protection

Firstly, protection measures should be carried out according to key ecological functions. Various ecological function protection zones should be established in the following areas: i) around headwaters of rivers for water resource conservation; ii) in flood regulating and water reserves; iii) in wind combating and sand-consolidating areas: and iv) in areas of water earmarked for fishing. The degenerated ecological environment in ecologically sensitive areas should be restored. Under the aegis of the Tibet Headwater Areas' Protection Action Plan, rescue efforts should be undertaken to protect the headwaters of the Brahmaputra, the Lancang, the Lu, the Jinsha, and the Shiquan rivers. In addition, protection of wetlands around major cities and towns should be strengthened. With efficient protection measures, wetlands will be able to improve our living environment and attract tourists: their ecological and economic benefits will be fully realised.

Secondly, compulsory protection measures should be implemented in major resource exploration areas. Resource exploration associated with grassland husbandry, forestry, water conservation, tourism, energy industry, transportation, and mineral production should be under close environmental monitoring .The first priority is to protect the environment in mining areas and tourist destinations. Based on the successful regulation of production at gold mines, all the mineral resource exploration in the TAR should be fully regulated and rectified.

Thirdly, areas with a good ecological environment and rich species should be protected. Within the framework of a national ecological park, special protection status should be given to crucial and unique natural ecological environments. The four major approaches to environmental protection, i.e., protection of the natural ecosystem; protection of ecological function; demonstration of ecological protection measures; and beautification of small towns, should be adopted. Concerted efforts must be made to complete the implementation of large environmental protection projects,

including reverting farmland to forest and restoring artificial pastures to natural grasslands.

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Chapter 9

Regional Disparities and the Rural Urban Gap in the Tibet Autonomous Region (TAR)

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Introduction

Tibet Autonomous Region (TAR) is one of the five provincial level, minority autonomous regions and is an economically backwards and marginal area in China. It has special physical conditions which are rather different from the other minority autonomous regions. Table 1 shows the socioeconomic changes that the TAR has undergone over the last few decades.

Table 1. Aggregate socioeconomic indicators for selected years

Indicator	1952	1965	1978	1990	2002
GDP (100 million RMB)	1.32	3.27	6.65	27.70	161.42
Per capita GDP (RMB)	115	241	375	1276	6093
Agri. output (100 million RMB)	-	2.64	3.92	19.50	55.85
Sec. Industry (100 million RMB)	-	0.22	1.84	3.57	32.92
Ter. Industry (100 million RMB)	-	0.73	1.44	10.03	88.81
Revenue (100 million RMB)	-	0.22	-0.16	0.18	8.73
Expenditure (100 million RMB)	-	1.13	4.57	12.92	139.89
Urban income per capita (Yuan)	-	-	565	1613	7762
Rural income per capita (Yuan)	-	-	175	582	1521
Population (10,000)	115.00	137.1	178.8	221.47	266.88
Urban pop. (10,000)	-	-	20.21	36.32	52.85
Hi. Education (No)	-	2251	2081	2025	8438
Spe. School (No.)	-	455	4640	4175	6437
Mid. School (No.)	-	1059	17679	21303	90469
Pri. School (No.)	-	66800	262600	157400	320000
Hosp. Beds (No.)	-	1570	4198	5015	5694
Me. Personnel (No.)	-	2424	5780	7498	7117

Source: 2002 Tibet Statistical Yearbook, China Statistics Press, Beijing; 2003 Tibet Statistical Yearbook, China Statistics Press, Beijing