

Bio-Cultural Diversity and Development of Western China

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Abstract China is one of the countries possessing the richest biodiversity resources in the world. As a mega-diversity country within global biodiversity, China has varied ecosystems, vegetation, species and rich genetic diversity. China's plant life is enormously rich, some 30,000 plant species are native to China, among them 7,500 are indigenous species of trees and shrubs, and China's fauna is also enormously rich. Statistics show that there are 6,347 species of vertebrates (including 1,244 species of birds and 3,862 species of fishes) found in China. The endemic plant species are as many as 17,300; endemic vertebrates are 667 species; Western China consists of six provinces being Gansu, Guizhou, Shanxi, Sichuan, Qinghai, and Yunnan, and five Autonomous Regions being Guangxi Zhuang Autonomous Region, Inner-Mongolian Autonomous Region, Ningxia Hui Autonomous Region, Xinjiang Uigur Autonomous Region and Xizang Autonomous Region and Chongqing Municipality, covers a land area of 6.98 million km², comprising approximately 70% of China's total landmass and more than 75% of the plant and animal species. The population of the area is approximately 405 million, many of which are ethnic minorities. The multicultural status of human population and cultural diversity make Western China a unique area of bio-cultural diversity in China. On the other hand, Western China faces rural poverty, degradation of natural resources and environment, and the marginalization of ethnic minority people. This paper discusses bio-cultural diversity in Western China and its potential contribution to economic development and the urgent need for conservation of nature and culture in the area in order to sustain development and environment in the country.

Key words Western China, biodiversity, cultural diversity, economic development, conservation
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1 Introduction

Western China (WC) consists of six provinces being Gansu, Guizhou, Shanxi, Sichuan, Qinghai, and Yunnan; five Autonomous Regions being Guangxi Zhuang Autonomous Region, Inner Mongolian Autonomous Region, Ningxia Hui Autonomous Region, Xinjiang Uigur Autonomous Region and Xizang Autonomous Region; and Chongqing Municipality. The total land area of WC is about 6.98 million km² making up about 70 percent of the country's total landmass. The general topography of WC is higher in the west, including the Qing-Zang plateau in the west, Yunnan-Guizhou plateau in the southwest, Loess plateau in the northwest and Karam-Kunlun-Tianshan-Altain mountain ranges in the far west of the region. As a vast region WC has diverse landforms, ecosystems, vegetation and biological diversity. Many important river systems of Asia such as the Yangtze River, the Yellow River, the Yalung Tsangpo-Brahmaputra River, the

Mekong River, the Salween River and other smaller rivers originate from the region, known as the Water Tower of the world. Therefore, this region is considered as one of the most important regions in the world with regards to global climate change and biodiversity conservation. The population of WC is about 405 million of which 70% are distributed in the warm and relatively humid areas of southwest China (Sichuan, Chongqing, Guizhou, Guangxi and Yunnan). As the area is landlocked and mountainous, its transportation communication and infrastructure were largely underdeveloped until the 1980 s. Economic development in the region is generally based on subsistence agriculture, forestry and animal husbandry, with various forest products, cash crops, medicinal plants, and mineral products from different provinces of the region. Compared with Eastern China, WC is economically underdeveloped and relatively poor. The over-exploitation of natural resources, over-grazing, soil erosion, environmental pollution, and deforestation in particular have resulted in serious impacts on ecosystems and the environment. The loss of biodiversity in this region, which is of great importance globally, is a serious problem. With continuing population growth and economic development, the conflict between the use and conservation of biological resources has become more intense. This situation is serious as the region s ecosystems play an important role in maintaining the stability of climate and water balance within the region and beyond.

Within the context of development, and the economic and environmental factors China is now facing, it is important to clarify the position WC occupies and the potential contributions and issues to economic and sustainable development and conservation. This paper will focus its discussion on biodiversity and cultural diversity in WC and its economic potential for development and conservation issues.

2 Bio-cultural diversity in Western China

2.1 Biodiversity



Fig 1 Map of Western China

China is one of the countries possessing the richest biodiversity resources in the world. As a mega-biodiversity country in the global biodiversity^[1], China has varied ecosystems, vegetation, species and rich genetic diversity. China s plant life is enormously rich, some 30,000 plant species are native to China, representing nearly one-eighth of the earth s diversity, and among them 7,500 indigenous species of trees and shrubs. China s fauna is also enormously rich. Statistics show that there are 6,347 species of vertebrates (including 1,244 species of birds and 3,862 species of fish) found in China^[2]. China is the only country on earth where there are continuous connections of tropical, subtropical, temperate, and boreal forests. This continuity has resulted to the formation of rich plant associations rarely seen elsewhere in the world. China also has the most

diverse flora of any country in the North Temperate Zone. With regard to ecosystem diversity in China as many as 599 Formations of Terrestrial ecosystems have been identified, of which 212 are forest ecosystems.

Endemism of biota is very high with 17, 300 species of plants being endemic and 667 species of vertebrates being endemic^[2].

Western China is well known for its biodiversity resources. This area has the most diverse flora and fauna of any area in the country. Different types of ecosystems can be found in this region, from tropical Seasonal Rain Forest Ecosystem in the lowlands of Yunnan Province to Evergreen Broad-leaved Forest Ecosystem in Southwest China ; Evergreen Conifer Forest Ecosystems to Meadow Ecosystem and Steppe Ecosystems in the Chinese Himalayas, semi-arid grassland vegetation and Desert Ecosystems in this region are mainly distributed on the northern slopes of the Kunlun Range in Southern Xinjiang , Northern Xizang and Inner-Mongolian area. The species diversity of WC is enormously rich. There are at least 20,000 species of higher plants, as 75% of the total flora of China is distributed over the region. A list of species diversity of WC region is presented in Table 1.

Tab 1 Species diversity in CWP,

| province | No. of higher plants | No. of vertebrates | No. of useful plants |
|----------------------|----------------------|--------------------|-----------------------|
| Yunnan | 17 000 | 1 737 | 12 000 |
| Sichuan | 9 268 | 1 239 | 8 000 |
| (includes Chongqing) | | | |
| Guanxi | 6 000 | 878 | 1 430 |
| | | | (medicinal plants) |
| Xizang(Tibetan) | 5 476 | 798 | 1 106 |
| | | | (medicinal plants) |
| Shanxi | 3 700 | 704 | — |
| Xinjiang | 3 510 | 510 | 2 944 |
| Guizhou | 6 450 | 563 | 2 500 |
| | | | (medicinal plants) |
| Gansu | 3 000 | 922 | 1 270 |
| | | | (medicinal plants) |
| Qinghai | 2 500 | 420 | 1 100 |
| Inner mongolia | 2 167 | 596 | 1 900 |
| Ningxia | 1 500 | 415 | 917(medicinal plants) |

Source :Provincial floras lists of plant and animal of concerned provinces, 1980~1999.

Genetic diversity in this region is another dimension of biodiversity. It is suggested that a large number of cultivated plants , landraces and varieties of domesticated plants and its wild relatives are distributed in the region. At present, among the 666 species of domesticated plants recognized for their economic importance in the world , there are at least 136 species that originated in China^[3], of which about half of the species are found in the Chinese Himalayan region(Yunnan, Sichuan and Tibet). WC contains a wide variety of landscape vegetation types and microclimates in which biospecies have evolved and from which different gene types are found. Human protection, selection and domestication of both native and exotic plants and animals have also resulted in an enormous genetic diversity. For instance, some 5000 strains of rice(*Oryza* spp) are found in Yunnan^[4]. Tea(*Camellia sinensis* var. *assamica*)originated in this region and around 200 varieties of tea have been identified in Yunnan^[5].

Western China is considered as the home of many famous flowers in the world. with at least 2000 species of flowers with ornamental value. For example, the genus *Primula* has 242 species(c.500 in total), *Gentiana*(200/400), *Meconopsis* (ca 40/50), *Aconitum* (150/350), *Pedicularis* (250/500)are all concentrated in the region ; *Camellia* has 35 species in this region, and *Paeonia subfruticosa* commonly known as Peony is called the King of Flowers in China. All the woody *Paeonia* species are native to China and two or three species of this genus occur in the Chinese Himalayas^[6].

2.2 Cultural diversity

Being a multicultural country, China is consisted of 56 ethnic groups of which Han Chinese (Han-Zu) is the majority comprising 94% of total population. Much of Western China ,including Guangxi, Inner

Mogolia, Ningxia, Xinjiang, Xizang, Yunnan, Guizhou, Qinghai, Gansu and Sichuan, is inhabited by ethnic groups of a non-Han Chinese ethnic status and derivation. In China, 55 different ethnic groups are officially recognized as national minorities. Overall, these groups display considerable cultural and economic diversity, ranging from hill peoples who practice sifting-agriculture to grasslands and high plateau-dwelling groups whose primary mode of subsistence is animal husbandry.

There are 45 cultural groups or ethnic minorities living in Western China. Most are indigenous to the area, including Zhuang, Mongol, Tibetan, Uigur, Yi, Hui, Khazak., Bai, Hani, Miao, Dai, Tujia, Naxi, and other smaller groups with the total population more than 60 million, or 16% of the total population of WC. This multicultural status gives Western China distinctive cultural diversity in cultural beliefs, medical culture, food culture and folklore cultures, compared with that of Eastern China regarding socio-economic situation and natural resource management.

Traditionally, ethnic minorities of Western China have established a close relationship with nature and the bio-environment in which man and nature is in harmony and balance. This is because firstly, these ethnic groups were engaged in subsistence agriculture, forestry and animal husbandry and relatively isolated from outside world, and secondly, the traditional cultural beliefs of those ethnic groups played an important role in nature conservation and biodiversity protection. These traditions still exist among many ethnic minority communities today. For example, the Dai people's Holy Hills and temple-yard plants^[7]; the Hani's Rattan Forest,^[8] and Sacred Forest Nejawadu; and the Yi people's plant worship of 13 species of plants in the Chuxiong Area of Yunnan^[10].

Use of herbal medicine for health care has been a common practice among all traditional societies of all ethnic groups in the region. Being an important cultural tradition and indigenous knowledge system traditional medical knowledge has contributed to local health care and income generations for the rural poor through harvesting and cultivation of medicinal plants in their natural environment. The updated documentation on Chinese traditional medicine consists of 12,807 species of which 11,146 species are plants, 1,582 animals, and 81 minerals^[11], these include about 7,000~8,000 species of ethno-medicine derived from ethnic minorities in Western China, such as Tibetan Medicine, Mongolian Medicine, Uigur Medicine, Dai Medicine and Yi Medicine etc^[12].

Traditional practices of ethnic minorities, indigenous knowledge and technologies on forest management, maintaining agricultural crop diversity, agroforestry and rangeland management for animal husbandry, have been used in natural resource management and sustainable productions throughout history. For instance, various types of indigenous agroforestry systems in Yunnan and Sichuan, non-timber forest products management of swidden farming groups in Yunnan, fuel-wood plantation of the Dai people in Xishuangbanna, Yunnan, and management of medicinal plants in Sichuan are good examples of indigenous systems^[13~15].

The relationship between natural resources and people has been forged within moral, cultural, political economic and ecological boundaries. Respect for these boundaries by different communities and social groups were the result of historically accepted formal and informal rules and norms^[16].

The transition from centuries of isolation to intense interaction with the outside world since the founding of peoples Republic of China in 1949, and further the Opening Up policy launched by government in 1980s has been rapid and abrupt. This has led to the degradation of traditional and ancient natural resource management systems in the region. The modern market economy is affecting all cultural groups in their material and cultural life cycles. Indigenous knowledge and cultural traditions are disappearing. It is time now to realize that traditional knowledge and resource management systems are as important as the need to introduce modern innovative approaches to sustainable development of natural resource in this region.

3 Economic pottential of biodiversity and conservation of nature

As natural resource biodiversity has social, economic, ecological and ethical value. Understanding ecological functions of biodiversity, respecting ethics and social importance of biodiversity, appropriate exploitation and use of biodiversity are the global issues facing biodiversity today, and have particular significance to Western China at present.

The 21st century has brought Western China a new era for development. At same time, the discussions within the scientific community both at home and abroad on the uncertain consequences of development in nature, culture and the environment has been done among scientific society home and abroad. Thus, sustainable utilization of biodiversity resources and conservation of nature must focus for the new development of Western China in the new century.

3.1 Economiic potential of biodiversity

Economic potential of biodiversity in WC region has been studied and discussed by scientists in different ways. Research was carried out by the Chinese Academy of Sciences, in Southwest China Provinces in the 1980 s ; Qinghai-Xizang Plateau in 1960 ~ 1990 and Xinjiang in 1970 ~ 1980 s. These are important integrated studies on natural resources. WC is a vast region, varying widely in its landforms , plants animals, and its cultures with regard to biodiversity . The information we have on the topic of biodiversity in Western China is far from complete, thus, I will present some brief information for discussion.

(1)Biodiversity supporting diversification of agriculture

The large number of plant and animal species and gene types are the most important natural resources and gene banks for supporting agricultural development in this region. As traditional subsistence agriculture has been practiced for thousands years in the region, food crops are the main crops cultivated in different agricultural systems. The recent transfer from food crops production dominated agrofarming, to multi-crop systems agriculture is in demand with different varieties and new crops varying from cash crops, fodder plants, flowers, and plants for soil erosion control and protection. In this regard, the rich biodiversity of the region provides better support for diversification of agricultural development. For example, edible tuber crops such as taro, *Amorphophallus spp.*, *Dioscorea spp.* and *Lycopus lucidus* ; wild vegetables such as *Houttuynia cordata*, *Smilacina spp.*, *Eryngium foetidum* and *Parabaena sagitata* etc. There is potential for cultivating lesser known crops and potential wild plants.

(2)Biodiversity of grasslands supporting sustainable development of animal husbandry

The areas of grassland vegetation make up almost one-third of total China s territory and are mainly distributed in Western China. Diversity of grassland ecosystems and plant diversity in WC are the resources for animal husbandry development. For instance, in Inner-Mongolia, there are 900 species of natural fodder plants distributed over different types of grassland vegetation. Over-grazing and farming on grassland have resulted grassland degradation and led to desertification. Proper use of plant diversity in grassland and managing biodiversity as resources in grassland ecosystems are the only solutions to the sustainable development of animal husbandry in this area at present.

(3)Indigenous agroforestry as bio-productive systems

Local communities of Western China have developed a diversity of agroforestry systems for different products. For instance, Tea and *Alnus nepalensis* inter-cropping ; Tea and *Cinnamomum glanduliforum*/*Cassia siamea* and Indigo tree plantations in Yunnan ; Mulberry tree and annual crop system ; citrus fruit tree and annual crop inter-cropping system in Sichuan, etc. These indigenous agroforestry systems were developed on the basis of species diversity in local flora, and have both productive and ecological functions well adapted to mountainous and marginal lands. Therefore , agroforestry systems are highly recommended for

bio-productive system development in the mountainous and hilly areas of this region. In addition, various home-gardens could be developed based on local models. Home gardens are recognized as highly productive systems with the ecological functions of agroforestry system^[17].

(4) Cultivation of medicinal plants for marketing

Western China is well known for its medicinal plants. Among thousands of medicinal plants about 200 species are domesticated and cultivated at present. Considering the huge market needed for China's population as well as the increasing international market demand, there is a great potential for cultivating commonly used medicinal plants for traditional Chinese medicine and the pharmaceutical industry. Cultivation of medicinal plants by better planting, selection of planting materials and good management will lead to production of good quality botanical medicine, and is also an effective way to protect wild medicinal plant resource in the mountain forests, grasslands and desert ecosystems in the region.

(5) Biodiversity and industry development

Among thousands of bio-species in this region, hundreds of domesticated and wild species make valuable contributions to various industry products and international marketing. This ranges from food, beverages, timber, medicine and fiber to fabrics, silk, cosmetics and perfumes, oil and fats, gum and glue, dye and coloring, rubber and plastics, and many other materials for light industry, food industry, handicrafts and chemicals. Examples of traditional forest products from this region include tea, silk, fruits, bamboo, rattan, mushrooms, vegetable oil and fats, lac and wax. Many of these products are identified today as Non-Timber-Forest Products (NTFPs). Appropriate collection and harvesting of these products do not disturb the forest. Environmental strategies need to be developed for better planting and management of NTFPs in this region, and thus the huge economic potential of NTFPs in CWP can be developed without environmental cost to the local forest ecosystems. For instance, development of one hectare of rattan in natural forest can bring economic benefits of \$US 1,000 per year from the cane and stem-shoots for vegetables, without damaging mountain forest in the tropics^[8].

(6) Biocultural diversity as resource for tourism development

Global concern for sustainable development and environment protection has brought the tourism industry into a new era. The public are more concerned than ever to travel without damaging the environment and being sensitive to indigenous people and culture. Eco-tourism as a suitable mode of environmental friendly development for the tourism industry is being promoted in China. As healthy and diverse environmental resources, the diversity of natural ecosystems, landscapes, and human cultures which forms the fundamental elements of tourism resources are great potentials for tourism with particular for community-based tourism development. At present, more than 500 nature reserves and forest parks have been established of which several have been included in the world Cultural Heritage List, such as Jiuzhaigou, Emei Mountain in Sichuan province. In recent years, some ethnic minority cultural villages have been established in Yunnan Province as tourist attractions while maintaining local cultural traditions. Traditional festivals and cultural sites associated with plants, animals and flowers are increasingly becoming tourist attractions today, such as Tea, Bamboo, Camellia Flower, Rhododendron Flower, Fire-torch festivals etc. However these biocultural diversity based tourist development must be developed with local community participation and benefit to local people, and without damaging the local environment including nature and culture.

(7) Biodiversity contributes to environmental construction and landscaping in Urban area

Western China is well known for its rich flowers and ornamental plants. Many species of wild plants from this region are planted in botanical gardens and urban areas for landscaping in Europe, North America and Asian countries since the eighteenth century. For instance, *Camellia*, *Rhododendron*, *Magnolia*, *Ligustrum*, *Metasigua* and *Osmanthus* etc.. The diversity of plant species in WC is also an important plant bank of environmental construction plants, suitable for landscaping, soil erosion control, bio-remedy uses,

treating polluted land, for example, Seabackthorn (*Hippophae rhamnoides*) in arid and desert area, *Alnus ferdinandii* and *A. cremas-togyne* for mountain areas, and *Eulaliopsis binata* in tropical mountain areas of Western China.

3.2 Conservation of nature

However, Western China is not only important for its economic potential but also a critical area in the context of global biodiversity and climate change. The new development opportunities will undoubtedly bring about economic growth in the region. At the same time, conservation of nature must be put in the strategic position as well. This is because, geologically this region is very sensitive to any change by human activities; biologically, ecosystems of the region are very fragile to any disturbances, and; socio-economically this region is multicultural with a strong influence from traditional and local resources management patterns, which are important in terms of socio-political stability.

Recent reform policy of Chinese government has already reflected the strong concern for ecological and environmental conditions in the development process of Western China. Decisions have been made to restore forests and grasses that are currently unsuitable farming lands on mountain slopes; to stop all commercial logging operations and conserve natural forest; to further implement reforestation in the upper reaches of the Yangtze, by the Mekong and the Lu River systems in Western China. These important decisions made by the Chinese government illustrate the high regard for ecological conditions in Western China and support for environmental protection in the region. It is not limited to policy to support eco-development in the region but also a financial commitment made by the government to support the areas. This is particularly important for this region, as rural poverty, environmental degradation and marginal status of some cultural groups are major constraints facing the region. Without policy and financial support it is extremely difficult for local people to change the present situation.

In order to sustain development and the environment in western China, there is an urgent need to conserve nature and human cultures. The relationship between nature and culture has already been mentioned in this paper. The conservation of ethnic minority cultures in this region, such as the Dai, Hani, Yi, Bai, Naxi and Tibetan have been discussed in many papers^[7, 10, 18, 19]. The ethnic minority cultures with their management strategies for productive purposes of natural resource use succeeded in maintaining the ecosystem of this region at a high percentage of forest coverage and in managing biodiversity in their environment very effectively over a long time. These factors can be seen as an example of the positive impacts of interaction of human cultures with the environment and the conservation of biodiversity that existed in many earlier societies in this region.

Human culture is built upon and developed on the basis of the physical world, and are interdependent. Cultural diversity, hence, largely depends on biological diversity, which provides a huge variety of tangible materials for humans to establish societies and lifestyles. Thus the co-existence of biological diversity and cultural diversity has resulted in distinctive physical phenomena in the landscape of ethnic minority areas in this region, for instance, various Sacred Forest, Sacred Trees, different Home Gardens and many other human culture has modified landscaping systems in this region.

It has been suggested that conservation of cultural diversity should be integrated into conservation of biological diversity in the process of economic development. Priorities should be placed on ethno-culturally diverse and biodiversity rich areas to protect traditional medical knowledge, medicinal plants, and traditional useful bio-species associated with human cultures; to protect all sacred sites and sacred plants and animals, which are part of human cultures and contribute to nature conservation; to protecting indigenous knowledge in the use and managing of biodiversity, and; incorporate indigenous knowledge along with indigenous strategies into community development schemes and projects. Hence, local people's participation in

conservation projects and development activities is seen as the key to successful project implementation, and mechanisms for participatory approach of conservation and development at the community level, should be examined according to local conditions varying from case to case. The principle is that people contribute to conservation, and conservation benefit return to the people in the concerned area.

4 Conclusion

The potential for economic development in connection with biodiversity resources in Western China is enormous, the challenge of environmental degradation and loss of biodiversity along with rural poverty and poor infrastructures are the main constraints to sustainable development today. Furthermore, cultural diversity can be used as a resource for development and conservation. The conservation of biological diversity and cultural diversity should be considered as integral needs in the process of development today. It is hoped that with current government policy's guide and support, the future of Western China will be much brighter than ever in Chinese history, the economy will continue to grow and ecological conditions will be improved in the years ahead.

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生物文化多样性与西部大开发

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摘 要 中国是世界上生物多样性资源丰富的国家之一。作为全球性生物 巨多样性 "国家, 中国具有多种多样的生态系统、植被类型、物种和遗传多样性。中国的植物尤其丰富, 30, 000 种高等植物产于中国, 其中乔、灌木 7, 500 种 ;中国的动物区系同样丰富。据统计已发现有 6, 347 种脊椎动物(包括 1, 244 种鸟类和 3, 862 种鱼类), 特有植物物种多达 17, 300 种 ;特有脊椎动物 667 种 ;中国西部 12 个省、市、自治区, 包括甘肃、贵州、陕西、四川、青海、云南 6 省, 广西壮族自治区、内蒙古自治区、宁夏回族自治区、新疆维吾尔自治区和西藏自治区等 5 个自治区以及重庆市。土地面积 6. 98 万 km², 约占国土总面积的 70% ;有全国 75 %的植物物种数和动物物种数。中国西部省区人口总数为 4. 05 亿, 其中少数民族人口占相当比重。多民族文化状态造就了中国西部省区成为独特的生物-文化多样性地区 ;另一方面, 中国西部省区面临农村贫困、自然资源与环境的退化和少数民族依然处于边缘状态的现实。本文讨论了中国西部省区的生物与文化多样性及其在经济发展方面的潜力。急需保护该地区的自然和文化, 以达到可持续发展的目的。

关键词 中国西部, 生物多样性, 文化多样性, 经济发展, 保护