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# Study on the Influence of Environment Vulnerability in the Northwest Yunnan

Zhaorong OU<sup>1,2</sup>, Qingke ZHU<sup>2</sup>, Guangjing BAO<sup>3\*</sup>, Xiaoyun YANG

1. School of Ecotourism, Southwest Forestry University, Kunming 650224, China; 2. School of Water and Soil Conservation, Beijing Forestry University, Beijing 100083, China; 3. School of Urban and Environment, Yunnan University of Finance and Economics, Kunming 650221, China

**Abstract** With the deterioration of the global ecology, the eco-environment fragility has been an important topic of the ecological environment research. The Northwest Yunnan is a typical area of abundant biological resources and vulnerable ecological environment. The ecological environment vulnerability is more initiated by the human disturbances except its special natural basic factors such as the geological structure, the terrain, the geomorphology, the climate and hydrology conditions and so on. The paper analyses the human disturbances factors which impress the ecological environment vulnerability of the region from the negative interferences and positive interferences in order to enhance the research of the ecological environment to protect the ecological environment better in this area.

**Key words** Human disturbance, the Northwest Yunnan, Ecological environment, The vulnerability

## 1 Introduction

Northwest Yunnan is sitting in the bordering of Yunnan, Tibet and Sichuan Province in China, including Lijiang City, Zang Autonomous Prefecture of Diqing, Lisu Autonomous Prefecture of Nujiang, and twelve counties and cities, nine of which are poverty-stricken counties of state level. The total area is about 59 800 km<sup>2</sup> and the total population is 2.14 million. There are 26 nationalities living in Northwest Yunnan, such as Han, Zang, Naxi, Lisu and Nu. The minorities account for more than 75% of the general population in this region. Influenced by special topography and climate, most places in Northwest Yunnan have very vulnerable ecological surroundings. What's more, there are many minorities there and its economic and social growth are relatively low. Along with economic development, human beings are exerting an increasingly important role in Northwest Yunnan, which makes the regional ecological environment more vulnerable.

## 2 Characteristics of ecological surroundings in Plateaus in Northwest Yunnan

Since there are many north-south mountains and valleys in Northwest Yunnan, its geological movement is very active and the earth crust rises drastically. The varying height forms a kind of special landscape. Considering the influence of global warming and regional climate changes, glaciers in Northwest Yunnan have been degrading at different degrees since the 1980s, and the snowline tends to rise markedly. Glaciers in Mingyong are receding at a speed of around 50 m each year. Since the second half of 1999, the frontier of glaciers in Mingyong has narrowed about 200 m from an elevation of 2 660 m, and the density has reduced to 150 m from 300 m<sup>[2]</sup>. The melting glacier and rising snowline affect the

benign circle of water and soil conservancy, vegetation protection and ecological system in most places<sup>[3]</sup>.

The particular climate and topography in Northwest Yunnan produce a variety of vegetations, including all kinds of ecosystems except for those which grow on deserts and in the oceans, some of which are national or provincial – level rare and endangered species of flora and fauna<sup>[4]</sup>. Because of steep mountains, unproductive soil and cold climate, the biological groups in Northwest Yunnan recover and replace extremely slowly. The spaces for many kinds of species to grow are extremely limited, and it would be very difficult for those places to recover once they are affected by natural disasters or destroyed by human beings. At the moment, the habitats for many rare species are shattering<sup>[5]</sup>.

Earthquakes, debris flow and landslide occur frequently in Northwest Yunnan. According to uncompleted statistics, there are 668 places having debris flow or landslide<sup>[6]</sup>. Most rocks there are granites, crystallized limestone, sandstone, and shale. Water and soil losses in Northwest Yunnan have been accelerated by the frequent geological disaster, shattered rocks and its special geological environment<sup>[7]</sup>.

## 3 Human influences and vulnerability of ecological environment in Northwest Yunnan

It is believed that the ecological environment in Northwest Yunnan is affected both by the nature and human beings, and some of these human being influences are negative disturbance and positive disturbance. However, the influences of negative disturbance outweigh its positive influences, which triggers potential factors of ecological surroundings of original vulnerability, speeds up changes of ecological environment and makes the ecological environment more vulnerable.

### 3.1 Main negative human influences

#### 3.1.1 Industrial development by human beings.

(1) Traditional agricultural cultivation method As there is

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\* Corresponding author. E-mail: kmocr@126.com

little suitable arable land in Northwest Yunnan, and the contradiction between more people and less arable land is outstanding, traditional arable land is applied. The water and fertilizer conserve poorly<sup>[8]</sup>. Because of shortage of reasonable rotating cultivation and fertilizer, soil structure of most arable land is destructed, and soil's resistance of erosion reduces. Influenced by regional topography, most minorities are accustomed to cultivate in steep slope. The arable land in places where gradient of non-irrigated farmland in Lijiang County, Ninglang County, and Fugong County is larger than 25°, accounted for more than 50% of general land area, and most of those arable lands still plant crops<sup>[9]</sup>. The disadvantage of slope gradient is soil erosion. After cultivation, the output is very low and the arable land reduces into wasteland or deserted land.

(2) Over-grazing. Grasslands can be found in Lijiang, Zhongdian and Deqing where domesticated animals are local production tool, and source of meat and edible oil<sup>[10]</sup>. The enduring over-grazing results in soil erosion and desertification. The biological groups of grassland changed. The percentage of edible grassland decreased<sup>[11]</sup>. The abnormal increase of domesticated animals leads to reduction of habitats to rare species and environment capacity.

(3) Development of wetland. Driven by increasing population and economic development, the wetland in Northwest Yunnan is cultivated to different degrees and the ecological functions of wetland change dramatically. Compared with wetland in other places, the eco-environment in Northwest Yunnan is more evident with the intense solar radiation, low annual mean temperature, less precipitation, relatively small wetland, harsh water supply, and weak recovery capacity of ecological system<sup>[12]</sup>. Taking Napahai wetland in Shangri-la as an example, its sight view changed a lot and destructed most sceneries. Most wetlands have been adapted into arable land or farmland<sup>[13]</sup>. In 40 years, the general lake area in Napahai reduced by nine tenths, and the soil nutrition reduced and the wetland degraded seriously<sup>[14]</sup>.

(4) Use of wild biological resources. Northwest Yunnan boasts abundant rare species, especially valuable medical plants, animals and wild fungus. As the price of wild animals and plants increases in recent years, driven by economic benefits, an increasing number of animals are killed or hunted randomly, so that many wild animals and plants are under the threat of extinction, which poses great impact on ecological environment. Taking cordyceps as an example, what's behind cordyceps is huge ecological crisis. For digging out one cordyceps, at least 30 cm<sup>2</sup> of grassland would be destroyed, let alone the treaded or ground land. Besides of being destroyed plants, the hollowed holes left by thousands of millions of people accelerated the soil erosion during the rainfall period.

(5) Forest exploitation. Northwest Yunnan is rich in forestry resources in Yunnan Province as the forest stocking volume there accounts for one third of the entire province. The plateau, rivers and lakes, as well as vegetations can conserve water resources and preserve soil. In the 1990s, the stocking volume of primitive forest

there was pretty high. Since the 1970s, forest in Northwest Yunnan has been developed for wood production or building construction. Various deteriorated lands have reached 1.844 9 million hectares, accounting for 43.45% of the general forestry land<sup>[15]</sup>. Forest serves as a kind of ecological protective screen, and the failing function of forest leads to water and soil loss, weakening land production and fragile ecological environment<sup>[16]</sup>.

(6) Mining. Northwest Yunnan boasts a variety of mines and it is one of the many essential heavy metal mining places in west China. Mining has become a local pillar industry, thus the contradiction of local ecological environment and mining is getting serious. Mining destroys forest and damages the stability of land. The waste water and waste residue produced during mining process contains large amount of heavy metal and poisonous matter, leading to serious pollution in the underground water, surface water and soil<sup>[17]</sup>. What's more serious is the exploiting mining process and mining method, which not only waste high-end mining resources, but also destroy ecological environment.

### 3.1.2 Infrastructure construction.

(1) Road construction. The national economy in Northwest Yunnan develops rapidly, especially the mining, logging industry and tourism, which promotes the thriving road construction. Most roads are built around the mountains or riversides, which would cause landslide or land collapse<sup>[18]</sup>. Lots of wasted soils are thrown into riversides or put on both sides of the road, resulting into different degrees of water and soil loss<sup>[19]</sup>.

(2) Urban construction. Since the 1980s, the increasing population and rapid economic development suggested that Northwest Yunnan began to enter into booming period. The expanding city changed the use style of land surrounding cities. The constructed land in Shangri-la alone expands at a speed of 209.3 hm<sup>2</sup> each year<sup>[20]</sup>. Urban expansion takes account of large amount of refined cultivated land and the increasing population burdened local ecology. The construction of infrastructure consumes lots of resources, which intensifies the destruction of ecology in mountains.

3.1.3 Tourism. Northwest Yunnan is famous for its special plateau, mountains, lakes and peculiar minority nationalities' customs. The ratio of tourism income in local GDP in Northwest Yunnan rose to 40% in 2008. Although tourism in Northwest Yunnan has created abundant economic income and lots of work opportunity, it has brought many problems on ecological environment.

(1) Tourism consumption. Tourism exerts an increasing pressure on local environment. The overwhelming large amount of tourists is more than what local environment can digest. According to the monitoring result about water quality, water quality in different stations is influenced by pollution at various degrees, some of which can be categorized as serious pollution, and some places are moderate pollution.

(2) Tourism itself. Tourists would inevitably pose influences on local ecological environment. Taking Shangri-la as an example. Boom season in Shangri-la lasts from May to October when a

large number of tourists would tramp on the grasslands and mountains which would deteriorate grassland. The structures of biological species have changed<sup>[21]</sup>. Tourists would throw away wastes, polluting waters and mountains<sup>[22–23]</sup>.

**3.1.4 Destruction of biological resources and alien species.** Because of forest fire and human consumption of animals, the rare species in Northwest Yunnan are disappearing at a speed that has never been seen before, which affects the biological diversity there. In order to obtain certain economic benefit, people introduce alien species, which would intensify the vulnerability of local environment. Alien species lack of natural enemies so that they have the advantage of getting more nutrition, moisture and living spaces. The intrusion of alien species has threatened aboriginal species, groups, structure and function of ecological system as well as local economy<sup>[24]</sup>.

**3.1.5 Human activities.** At present, there are still some people living in places with high elevation, little water, scattering village and bad traffic. Although there are many people and less land, the contradiction of human being and local environment is extremely outstanding. Under the influence of ideology of traditional energy consumption, living habit and local economy, local energy comes from wood and lightening. In the energy consumption structure in Lijiang in 2002, fireworks account for 96.9%<sup>[25]</sup>. Such kind of energy consumption method has low use efficiency, consumes lots of forests and damages surrounding.

## 3.2 Major artificial influences

**3.2.1 Ethnic minorities' traditional ways of environment protection.** Each nationality has their own living habits and customs in its long history. Those lifestyles indicate the thinking, ecological ethnics and ecological environment protection, and has its peculiar ecological environment protection method. Traditional methods of environment protection by ethnic minorities play an important role in nowadays environment protection in Northwest Yunnan. Naxi and Yi ethnic minorities have invented a series of terracing agricultural system, which can effectively conserve water and soil. So far, some minorities still use traditional method to cultivate. In places such as Dulongjiang, forest coverage rate is still high. People realize that growing trees can recover ecology. In some ethnics, god mountains and ancestors tombs are sacred, so are some forests for water conservation or land protection, which would no doubt play positive role in environment protection<sup>[26]</sup>.

**3.2.2 Industrial renewal and use of alternative energy.** With the advancement of local science and technology, it has become a new trend to update industry by dint of scientific research. Traditional natural collection has been gradually channeled to artificial cultivation, and wild flowers and vegetables, as well as demonstrated parks have been set up to gradually realize deep processing of biological products. Although it is unlikely for farmers not to use wood to make fire, some farmers begin to use biogas and solar energy to replace. Along with economic development, farmers are aware of environment protection and are gradually changing their life quality and living habit, which suggests a promising future.

**3.2.3 Artificial forest and converting farmland to forest.** Gaoshan forest in Northwest Yunnan conserves water and soil in the upper reach of Yangtze River. In order to protect ecological safety of Yangtze River, Northwest Yunnan began to carry out environment protection project since 1998 and stopped to cut down natural forest. It not only adjusts agricultural industry, which strengthen the awareness and enthusiasm of environment protection<sup>[27]</sup>.

**3.2.4 Establishment of biological diversity protection network.** For now, Northwest Yunnan has established a network to protect biological diversity by mainly focusing on natural reserve and supplementing by natural heritage, famous places, forest park and national park, *etc.* There are 27 natural reserves in Northwest Yunnan, which accounts for 12.5% of the national land. The establishment of biological diversity plays positive role in protecting local environment.

**3.2.5 The publication of laws and regulations and establishment of ecological compensation mechanism and monitoring mechanism.** In order to better protect environment, and to motivation people to protect local environment, more than 40 laws and regulations about environment protection have been enacted in Yunnan Province. Schools and media act to publicize knowledge about environment protection. Ecological compensation and monitoring mechanism have been established and various measures have been adopted to provide fund for the recovery, protection and construction of ecological environment. Departments work together to monitor ecological environment and evaluate local situation scientifically.

## 4 Conclusions

Considering the special territory, landscape and ecology of natural environment in Northwest Yunnan, the ecological system and natural ecological environment there are poor. With the frequent human activity and artificial disturbance, influences of regional ecological environment are getting more distinct. Enough attention should be paid on environment protection.

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increase primary productivity of the sea area and provide new habitat for organisms. Besides, after reef placement, the undersea physical environment, flow field change effect, bait composition effect, acoustic change effect, and reef shadow effect will attract gathering of nekton in varying degrees, and bring about obvious fish gathering effect. Artificial reef technology is a way of transforming habitat of marine ranching environment, but its ecological and economic benefits need a long term. This study shows that artificial reef has manifested its remarkable fish gathering and ecological environment improvement effect. Thus, reef placement is an effective measure for restoring fishery resources and improving marine ecological environment. It should be energetically popularized and developed in coastal suitable regions, to strengthen sea area management system and lay a solid foundation for marine ranching development.

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