

## SUSTAINABLE MOUNTAIN DEVELOPMENT IN CHINA

### Yaxin Zheng

Commission for Integrated Survey of Natural Resources(CISNAR), Chinese Academy of Sciences(CAS), China

**Keywords:** Technology transfer, poverty alleviation, economic reconstruction, infrastructure development, market economy, governmental roles, Qinghai-Tibet Plateau, Taihangshan Mountain, Dabieshan Mountain, Spark Project, benign cycle, Shanjianghu pattern, poverty alleviation, Changbaishan Mountain, Gongcheng Karst Mountain, farming bio-gas livestock industry, population resources environment development (PRED), Third Pole of the earth, Himalayan, heterogeneity of the mountainous topography, agroforestry, green food projects, post-industrial society.

### Contents

1. Mountain Conditions in China
  2. Mountain development program
  3. Case studies
  4. Problems and Pressure
  5. Counter-measures
- Bibliography  
Biographical Sketch

### 1. Mountain Conditions in China

1. Physical conditions, definition of mountain, geological formation and spatial distribution, geophysical environment, regime of vertical zones
2. Social conditions: ethnic people of minority nationalities, economic activities, infrastructure, transportation and communication, education and culture.

### 2. Mountain Development Program

In geography, areas with relative elevation difference equal to or larger than 500 m, are, by definition, mountainous areas. In a broad sense, mountainous area includes hills and dissected plateau. Sustainable mountain development is an important component of global sustainable development. In mountain areas, there are many steep slopes but few flat areas suitable for farming, so that agricultural production is limited and inefficient. Mountain areas are usually inaccessible as regards both transportation and information; educational development usually lags far behind. It is difficult for local inhabitants to receive high-quality education, and this often disqualifies them from employment opportunities. Production remains at a primitive level and people are trapped in poverty.

Mountain areas are usually water source areas, providing the upper reaches of big rivers. The Qinghai-Tibet Plateau, known as the Chinese water tower, is really also the South Asia sub-continent water tower. Scientific and rational exploitation and protection of mountain resources, and sustainable social-economic development can provide a

reliable ecological shield for the middle and lower reaches of the drainage basin. On the other hand, irrational exploitation leads to deforestation, destruction of vegetation and degradation of the eco-environment. When intensive or ultra-intensive precipitation occurs, the mountains fail to retard the runoff and massive erosion follows. This was the main cause of the Yangtze flood in 1998, when a vast area of fertile farmland in the middle and lower reaches was engulfed and a million people lost their livelihood.

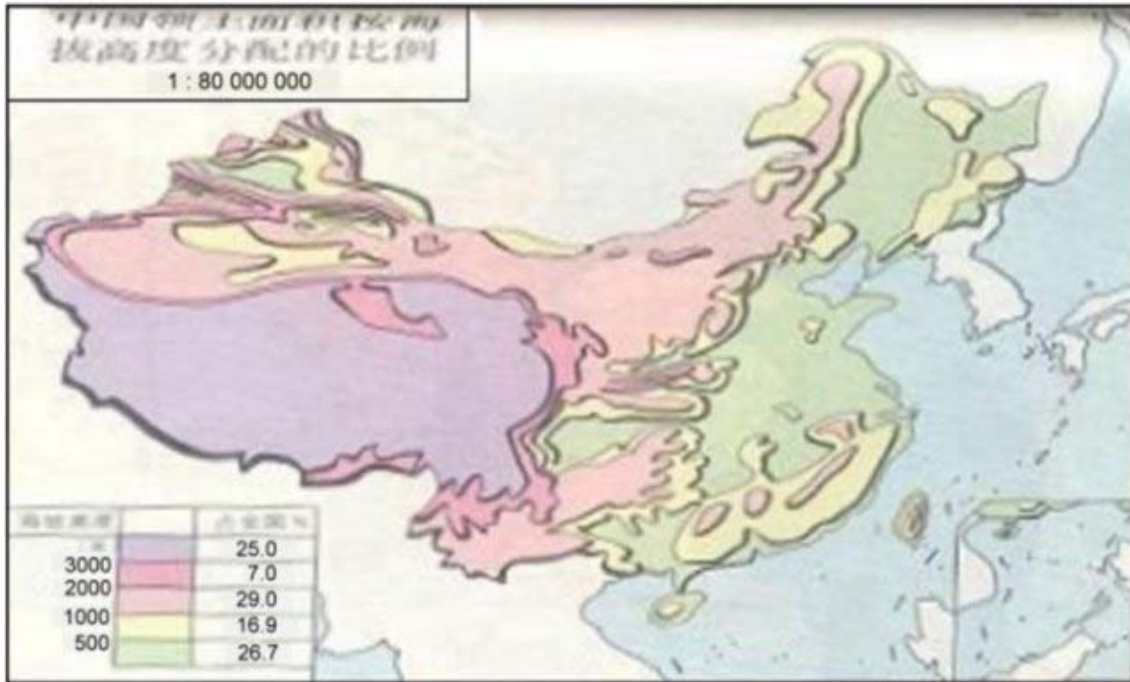


Figure 1. China's territorial distribution in elevation

China is a mountainous developing country. In fact mountainous areas accounts for 69% of the total area. There are 1 564 mountainous counties in the whole country; the population in mountain areas comprises two thirds of China's total rural population. In the western provinces and autonomous regions of China, the mountain area occupies an even higher percentage, e.g. mountains and plateaus account for 94% of the total area of Yunnan province, and 92.5% of the total area of Guizhou province. Sustainable development in mountain areas is fundamental to national sustainable development. Most of China's ethnic minority nationalities live in mountain areas; they have their own unique lifestyles and colorful cultural traditions. Sustainable development of mountain areas is an therefore an important prerequisite of preserving the cultural tradition of ethnic minorities and human cultural diversity. It is also an indispensable prerequisite for China's prosperity in the twenty-first century.

Prosperous mountains depend on the science and technology and the "Taihangshan Mountain Pattern" provides a nice example. The exploitation of the Taihangshan Mountain area, which began in 1979, is a banner of mountain area exploitation. It takes science and technology as its bedrock and uses the resources of the local population. It uses enhancement of labor skill as its base and the integration of intelligence, technology and capital as its tool. With the aim of enhancing the integration of science, technology and economy, it promotes the exploitation transforming from individual

technology development to supportive successive technology exploitation, from resource exploitation and technology demonstration to supportive industry and small watershed integrated exploitation and from conventional natural economy to scale unified trade-industry-agriculture economies. Its major features are as follows:

First, it is necessary to have a rational arrangement and to carry out the mountain area exploitation strategy in a planned and organized way. The steps of the strategy are: firstly, according to the characteristics of different types of ecological environment, it is necessary to build up various types of test model sites, to carry out integrated demonstration sites of different types of management, and to carry out key science and technology projects based on Research and Development (R & D). It is necessary to set up integrated demonstration models of different types around test sites, to compose several techniques into a complete set, while making them popularized and tested in practice. It is then necessary to disseminate successful experience from the test sites radiating out into broader and larger areas.

Second, it is necessary to insist on close integration of science, technology and economy, to increase the conversion ratio of scientific research results. The strategy steps involve firstly focusing on the combination of production-study-research, setting up a technique development system based on universities and colleges and R & D institutions. This system takes scientific research personnel from cities and counties and brings them together with rural technicians and demonstration models. It is necessary to emphasize the combination of agriculture, science and education, to integrate professional education and agricultural technology, to popularize activities of science and technology and different forms of technical training for local peasants.

Third it is necessary to have breakthrough in operation mechanism of mountain area development, to set up perfect operation mechanism in running mountain area technology applicable in a market economy. It is necessary to have breakthrough in technological support in developing a set of supportive technologies with high contents of technology and high added value, in management means it is necessary to make a breakthrough in incentive mechanism.

Fourth, it is necessary to set up diversified patterns of mountain area exploitation. During recent 20 years, Taihangshan Mountain region in Hebei Province, based on principles with local realities, management in each individual region, integrated exploitation and coordinating development have been carried out in 57 counties, there are 35 model counties and 500 model basic sites. Due to special attention paid by the Party and government leaders at all levels of Hebei Province, great efforts made by scientific and technical staff as well as local people everywhere, Taihangshan Mountain region is undergoing great changes, some engineering technology patterns, i.e. representative ecological economy gully in earth and stone mountain area, representative “enclosing mountains for cultivation” in Yenshan gneiss mountain area, representative “retained and terraced fields in loess hills in Northwestern Hebei Province, and representative dry farming agriculture in arid mountain areas.

Taihangshan Mountain pattern has proved that science & technology are the first productive force, raised in the scientific theory. It is a successful case in combination of

science & technology and economy, as well as transforming the way of economical growth, and it is also an effective way of getting off of poverty and becoming prosperous, from “transfusion”(merely depended on budget and total red deficit) to “blood producing”(profit-producing and paying added tax ).

Dabieshan Mountain, located in bordering area among Hubei, Henan, and Anhui provinces, is the water divided ridge between the Yangtze River and Huai River, there are 37 counties(cities) with 25 million population and an area of 7 450 km<sup>2</sup> , Dabieshan Mountain is one of China’s poverty-stricken & connected areas, in 1985, per capita income of rural peasants of the region is only 288 Yuan(RMB), almost 40% of its population live below poverty line, population growth is fast, ecological destruction is serious, natural disasters happen frequently, closed and narrow mindedness, poverty and backward become major characteristics of Dabieshan Mountain. In recent decade, Dabieshan Mountain has opened a way of development pattern in mountain area, depending upon science & technology and developing regional supportive industries. Its main features are: guided by science and technology, based on local resources, taking a little investment, quick return and widespread benefited farming, breeding and deep processing projects of agricultural products and by-products as major target of investing. Regional supportive industries are energetically developed by selecting those having local resource advantages and high attendance of local peasant participation, with concentrated and concerted efforts of science & technology staff; simultaneously, it is necessary to make efforts in optimizing structure of traditional industries, improving quality and enhance grade of products, cultivating leading enterprises and new economic growth points of mountain areas; therefore a group of supportive industries and leading enterprises with certain scale and comparatively high technical contents in poverty-stricken areas are gradually formed.

Some detailed methods are described as the following: First, it is necessary to carry out analyses on regional conditions, to work out “Comprehensive development strategy study on Dabieshan Mountain area”, and then it is possible to provide a scientific way of development of economy, science & technology and society of Dabieshan Mountain area in the phase of from poverty-stricken state to the stage of having sufficient food and clothing, and to help poor counties to work out their own development plans of economy, science & technology and society, as well as plans of getting rid of poverty. Second, it is necessary to carry out industrial policy inclined to the focal point, to support mainstream industries and supportive industries with famous quality products, as well as special and new products, as leading enterprises in capital, technology, material, information, management, service and preferential policies, providing overall complement support. And the science & technology input is taken as a key measure to be emphasized. Various kinds of science and technology plan projects, such as tackling key science and technology problems, poverty alleviation model projects, popularization of R&D results, the Spark Project and the Torch Project etc. are supportively carried out in a complete set, therefore the characteristics of “tackling the technology around support, starting the project around the technology, producing benefits around exploitation” are formed. Third, it is necessary to carry out family planning project and put population growth under strict control, making efforts in improving qualification of local people. Many poverty-stricken counties bring forward the slogan of “have fewer children and plant more trees”, having poverty alleviation and

family planning combined, carrying out the project of fewer, healthier and better educated children, as well as becoming wealthier faster. For example, in Jinzhai county, located in Dabieshan Mountain of west Anhui province, 100 thousand birth population are reduced in ten years, 9 million ha of cash trees have been planted. Fourth, it is necessary to emphasize eco-environmental protection and management, and reverse current deteriorating trend of environment, entering the state of benign cycle. It is necessary to insist on the principle of combination of resource exploitation and utilization with environmental protection and management, to pay attention to capacity of proliferation and regeneration of renewable resources for sustainable utilization.

Jiangxi Shanjianghu pattern of insisting on “first river management, then lake management; first mountain management, then river management; first poverty reduction then mountain management”

Shanjianghu project in Jiangxi province started in 1983. This well-known project both at home and abroad is a sustainable development project of a large drainage. The project is based on close connections between hills, rivers and lakes within the Shanjianghu drainage, i.e. the characteristics are that “the mountain is the source, the river is the flow and the lake is the reservoir”, in their strategy, the river management is the pre-requirement of the lake management, the mountain management is the pre-requirement of the river management, and poverty reduction and education are the pre-requirement of the mountain management, their policy is “footed on ecology, emphasis on economy, systematical exploitation and integrated management”, large scale development and management have been carried out.

The main feature of Shanjianghu pattern lies in combination of mountain management with poverty alleviation. Its significance is not only lying in the ecological, economical and social benefits generated by the project itself, but also lying in the fact that it has provided a valuable sustainable development pattern of whole drainage type for implementing scientific strategy of regional sustainable development strategy. It also provides a precedent example for people to understand the exploitation of mountain resources in broad senses.

“Changbaishan Mountain pattern”, carrying out industrialization of agricultural resources in mountain areas

Changbaishan Mountain, located in Jilin province, bordering with North Korea, Russia and close to Japan, with an area of 774 000 km<sup>2</sup>, an elevation of 750 m to 1 100 m a.s.l.(above sea level) and 5.1 million population has forest ecological system as the main body, this area is characterized in having plenty of mountains, plenty of trees, plenty of water and lacking of farmland. Changbaishan is one of China’s important timber production base, called as forest sea, being natural shield of Northeast China Plain. It is abundant in wild animal and plant resources, there are large reserve of high-quality Chinese herb medicine and abundant mineral resources in Changbaishan Mountain. However in past decades, resource advantages of the mountain area have not turned into advantages in economy, despite comparatively high forest coverage percentage, most parts of the forest are secondary growth with low value, and felling quantities are more than contribution quantities, it is difficult to realize “green

mountains forever and sustainable utilization”, state-owned forest enterprises are facing both resource crises and economic difficulties. In recent years, Changbaishan Mountain area, based on “two advantages” both in resources and locations, oriented to “two markets” both home and abroad has opened up its own unique superiority’s industrialization pattern, by making efforts in key guiding industries, setting up enterprise group with special characteristics and combination of resource exploitation and protection.

Firstly, it is going to carry out survey and investigation on resources of various areas, making species, classification, area, reserve, economical values, present state of exploitation and utilization and production potentials clear, then a computer dynamic management system is set up, having classified guidance in industrialization development, making key projects stressed, preventing blindness projects and low-level repeated construction. Secondly, it is needed to put greater emphases on ten major industries, i.e. forestry, Chinese medical herbs, hybridized apple pear, wild vegetables, tobacco, beef cattle, forest fog, etc..

Forestry is characterized by intensified management and preserve project of natural forests, optimized structure of standing forest and upgraded forest quality, the traditional ecological forestry is transformed into ecological economy type. Simultaneously, bases of deep-processing timber products and precision work, as well as serious timber products are going to be set up. Chinese medical herbs are mainly ginseng and pilose antler, some big enterprise groups, i.e. Dongbao, Aodong, Huakang etc. have been set up, responsible for providing chain service of raw material production, deep-processing, marketing and R&D of Chinese medical herbs, as well as necessary technical support.

Apple pear is being out together produced in Yanbian, Daheishan Mt., industrial groups are being set up for systems of production, processing, package and store. Wild vegetables include brake, fungus, round mushroom, fungus-glossy ganoderma, etc., being used for development of wild fruit beverage, healthy food, gradually developed to green food series.

Thirdly, it is necessary to comply with laws of ecological economy, the relationship between industrialized resource exploitation and protection of resources and environment in Changbaishan Mountain must be well dealt. Fourthly, it is necessary to have economical interests in chain links of production well managed, the operation mechanism of shared risks, benefits and opportunities of development has to be set up. The leading enterprises are responsible to provide local peasants advantages by offering means of production, purchasing at protective prices and selling means of production in credit, etc. profits in processing and marketing are distributed with a certain ratio back to local peasants, therefore, interests of local peasants are well protected.

Gongcheng Karst Mountain area development pattern, carrying out “farming –bio-gas -livestock industry” three-in-one

In south China’s mountain areas, especially in southwestern Karst mountain areas, rural energy is really a big problem, in high-altitude mountains, where ethnic minority nationalities are gathering, due to backward mode of energy consumption, people

consume great quantities of forest resources to meet their demands of daily life and production, due to their simple and crude houses with poor insulation, in winter, people are used to sit around fire pan around the clock, in average each household consumed one m<sup>3</sup> wood one year, this energy consumption pattern, along with population growth, has become one of important reasons in causing forest coverage rate decreased sharply, deterioration of eco-environment and occurrence of large area of stone desert in karst mountain area. Gongcheng karst mountain area's development pattern has put farming – bio- gas –livestock industry three-in one, set a good example in well dealt relationship between population –resources –environment –development (PRED).

Integrated development scheme of ethnic minority nationality economy and eco-environment on Qinghai-Tibet Plateau

Qinghai-Tibet Plateau is the area where minority nationalities with Tibetans as its main body are concentrated, also the Third Pole of the earth, commonly belonged to the mankind. Qinghai-Tibet Plateau possesses unique advantages in natural resources, however, severe conditions of physical geography and historical reasons remained made backward and low level of economical development on Qinghai-Tibet Plateau, industrial scale is small, productive force is still at comparatively low level; backward management in enterprises makes comparatively serious phenomena of resource waste and environmental pollution in resource exploitation.

Therefore in China's Agenda 21, i.e. China's White Book of Population, Environment and Development in twenty-first Century, the scheme of integrated development of ethnic minority nationality economy and eco-environment on Qinghai-Tibet Plateau has been put into implementation, simplified as 9525 project, the project implementation is not only helpful for fundamental solution of environmental protection and sustainable development on Qinghai-Tibet Plateau, but also providing development experiences for other ethnic minority nationality areas, then sustainable development of the whole ethnic minority nationality region would be pushed forward.

Implementation scope of the scheme of integrated development of ethnic minority nationality economy and eco-environment on Qinghai-Tibet Plateau includes the whole area of Tibet Autonomous Region, Haixi, Yushu, Guoluo and Huangnan autonomous prefectures in Qinghai province, Ganzi and Aba autonomous prefectures in west Sichuan province, and Diqing Tibetan autonomous prefecture in Yunnan province, total area is approximate 2 million km<sup>2</sup>.

Implementation period is from 1995 to 2020, abundant sunshine advantages on Qinghai-Tibet Plateau are fully utilized, cooperation projects with advanced countries in developing solar energy technology, i.e. Japan, U.S., Germany are to be carried out, measures of solar energy utilization are popularized into hinterland on Qinghai-Tibet Plateau ceaselessly, simultaneously connected with the most advanced solar energy technology, enable resource advantages on Qinghai-Tibet Plateau turned into advantages in sustainable development.

At the same time, overgrazing on grassland of animal husbandry on Qinghai-Tibet Plateau has to be changed, traditional management in animal husbandry has to be

transformed, input-output efficiency of animal husbandry has to be enhanced, grassland degrading trend has to be reversed, grassland eco-system has to be entered into benign cycle. After incessant efforts in decades, local industrial system and religious tourist sites with characteristics of Qinghai-Tibet Plateau will be gradually set up, world -class bases of plateau scientific research will also be set up.

-  
-  
-

TO ACCESS ALL THE 15 PAGES OF THIS CHAPTER,  
Visit: <http://www.eolss.net/Eolss-sampleAllChapter.aspx>

### **Bibliography**

China's Atlas of Physical Geography, 1984. Edited by Geography Department of North-west Normal College and Publication House of Maps. Published by Map Press.

Chinese Society of Agricultural Engineering, 1998. Proceedings of 1998 International Symposium on Resource Development and Protection of Mountain Areas. Science and Technology Commission of Hebei Province, China Rural Technology Development Center. Shijiazhuang, China

### **Biographical Sketch**

**Yaxin Zheng** is an associate professor in the Commission for Integrated Survey of Natural Resources (CISNAR), Chinese Academy of Sciences (CAS). His research interests include geochemistry and sustainable development. His research experience is as follows:

1. Geothermal Survey in Hengduan Mountains, eastern extension of Qinghai-Xizang (Tibet) plateau, south-west China, i.e. west Yunnan Province and Sichuan Province, 1983-1985
2. Project of Resources Development expedition to Southwest of China, in charge of energy planning sub-project, 1986-1988
3. Project of Tibet "One River and Two Tributaries (middle reach of Yarlung Zangbo river and middle and lower reaches of Lhasa river and Nyangqu river)", 1989-1990
4. Project on sustainable development overall planning of Wuyishan Biosphere Reserve, 1991- 1992
5. Project of Sven Hedin's natural heritage in Tibet, preparatory stage of collecting materials in the National Museum of Ethnography, Stockholm, August-October 1993
6. World Bank poverty alleviation project in South-west China 1994-1995
7. Project of Sino-Swedish cooperation project on Sven Hedin's natural heritage in Tibet, field work stage, September-October 1995
8. Project of Sino-Swedish cooperation project on Sven-Hedin's natural heritage in Tibet, indoor work stage 1996; Sino-Swedish seminar on groundwater protection and sustainable utilization, October-November 1996.