Characteristic of rocky desertification and comprehensive improving model in karst peak-cluster depression in Guohua, Guangxi, China

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Abstract

Karst rocky desertification is a geo-ecological problem in Southwest China. Preventing and controlling rocky desertification has become critical. So, the Longhe, Pingguo, Guangxi Province in southwestern China, a typical serious rocky desertification area, were selected as the study area. After investigation and researches to the environments and regional economics in detail, the stereo eco-agriculture in different geomorphologic position of the peak-cluster depression has been built and was considered as an available model for the comprehensive improvement to rocky desertification. For about four years, the comprehensive improvement of rocky desertification in the experimental area has achieved good results. The vegetation is gradually restored, the annual mean income of the local people has increased by about 20%, and the new local ecological industry is formed.

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Keywords: Rocky desertification, rocky desertification control, comprehensive improving model, Longhe China.

Introduction

Karst rocky desertification is a process in which soil is eroded seriously or even thoroughly, so that bedrock is exposed widespread, carrying capacity of land declines seriously, and at last, landscape appears similar to desert under violent human impacts on the vulnerable eco-geoenvironment (Yuan 1993). Desertification has never occurred in the eastern part of North America and the middle and southern parts of Europe. East Asia karst region, as the largest one of the three karst regions, is a typical fragile ecological zone, and has the most intensive karstification. Southwest China is distributed in a karst plateau area in the central part of East Asia karst region (Lan et al, 2003), where karst rocky desertification is one of the most serious environment problems. The karst mountain region of the Southwest China is one of the largest karst
geomorphology distributing areas in the world (Yuan 1993). in 2006, the total karst rocky desertification area of Guizhou and Guangxi provinces in Southwest China has reached 50,000 km² and 47,000 km², respectively. And it is spreading at a rapid rate of 2,500 km²/yr (Huang et al., 2006).

Karst rocky desertification is a geo-ecological problem in Southwest China. At the same time, rocky desertification area is usually a poverty region, which is overpopulated and the social economy is lagged. So people have to over-exploit land for subsistence, so as to lead to serious land degradation in the form of karst rocky desertification. The karst landscape degeneration caused by the human activity proposes restoration challenges and opportunity to study stability and resistively of limestone ecosystem (Gillieson et al. 1996), therefore, more attention is now being given by both the government and the public (Wang et al. 2004), including the definition (Wang et al., 2004), distribution, causes, ecological-environmental effects and preventive strategies. Some researches on karst conducted in those areas mainly focused on hydrology and karst evolution.

Karst rocky desertification is one of the most serious environment problems. The sustainable development in this area has been restricted, threatening people's living conditions. Preventing and controlling rocky desertification has become critical. So, we selected a typical serious rocky desertification area, the Longhe, Pingguo, Guangxi Province in southwestern China, as the study area, and assessed the karst rocky desertification characteristics and made a lot of work to improving the rocky desertification. The objectives of the study were to better understand different levels of karst rocky desertification risk and to provide scientific references about management and prevention of rocky desertification for local managers and policy-makers.

Study Area

Longhe located in Pingguo County, GuangXi, China, is a typical karst Fengcong (depression) mountainous area, with the average annual temperature of 20.2-22.6°C and the average annual precipitation of 1500 mm. From May to September is rainy season, which rainfall in August accounts for 65% of the annual total and the rest occurs from October to April. The lithology is dominated by the gently dipping, thick limestone and silica limestone of the Qixia Formation (P1q), Maokou formation (P1m) and Shangtong formation (C3) from the Carboniferous System. The thickness of soil is ~0.5 m in average, and the maximal deepness is up to ~2 m in depression. The forest are destroyed because of history reason, which only shrub remain and rocky desertification are dominated. There are about five hundred and thirty people, which economic earning rely on planting and breeding, so the living standard of local people is very low.

Characteristic of rocky desertification in Longhe

Rocky desertification in Longhe is very serious. According to slope, vegetation cover, soil depth et al., three types of rocky desertification areas were further classified into slight, moderate, and intense levels through visual human–computer interactive interpretation in a Geographical Information System according to vegetation cover rate, and bedrock exposure rate. When the attributes of a segment fall into one of the three criteria ranges, the level of rocky desertification can be confirmed. During field investigation processes, the types of typical rocky desertification landscapes were determined.

Intense rocky desertification is mainly distributed in the middle and top of mountain in which slope is bigger than 25°, soil cover rate is less than 20%, vegetation cover is low, soil distributed scatteredly in lapie and grike, soil erosion is very intensity. Moderate rocky desertification is mainly distributed in the middle of mountain in which slope is between 15° and 18°, soil cover rate is between 20% to 30% and vegetation is sparse shrub. Slight rocky desertification is mainly distributed in the low of mountain and depression in which soil and vegetation cover is higher than the following both, which is the main farm in the study area.
Rocky desertification easily occur in those area which slope is abrupt, the stability of topsoil is bad, population density is big and human activity is frequent and intense.

**Comprehensive treatment model to rocky desertification in peak-cluster depression**

Aiming to the double pressure in ecology and economy in Longhe area, a suitable format should be select and adapted to the local farming and natural conditions. The composite eco-agricultural model (jiang et al., 2008) of karst peak-cluster depression in Guohua, Pingguo has been built: In abrupt slope region, deforestation and graze are forbidden for a long time. Water conservation forest are developed in order to regulating epikarst water. In saddle back region, some plant, such as Flos lonicerae, Cajanus cajan, bamboo et al., are planted not only to gain economic benefit, but also to retain soil and water. In gentle slope and the foot of mountain, fruit tree and economic woods are planted with herbal medicine in order to lead to better crops and reduce disease. Farm are main in depression. Breed improvement to develop high dry food crops, development of special economic crop and animal breeding, soil improvement are studied and put into practice, at the same time, drainage system must be built in depression avoiding to flood in rainy season.

**Results**

After comprehensive improving measurement to rocky desertification since 2001 in Longhe experimental area, its ecological environment improved observably, resource utilization and production efficiency enhanced, and local economy developed rapidly. In ecological environment, deforestation and graze are forbidden, ecological forest, such as *Zenia insignis*, *Leucaena leucocephala* (Lam.) de Wit et al., has been built, land consolidation and changing the slope to the ladder have been put into practice, so the vegetation cover rate enhance from less 10% in 2001 to more than 50% now, and rocky desertification in Longhe area has been controlled. The living standard of local people has improved obviously. Food productivity has grew 11 per cent since 2001, and rural per capita net income increase from 500 yuan in 2001 to 1600 yuan in 2006 (jiang et al., 2008).

**Conclusion and discussion**

The work about improving rocky desertification have been done a lot in china. Such as in Huajian karst canyon area, in Shilin, hunming Yunnan, et al. In Honghe area, which is a peak-cluster depression area, much technique, such as land exploitation and utilization technology, vegetation recovery and succession technology, karst water resource exploitation technology, the planting technology of local economic crop, soil melioration, depression drainage technology, are studied and put into practice, and have achieved good results.

Rocky desertification control should be guided by earth system science, based on geological physiognomy, combined with ecology, agriculture, sociologia and economics science. We should search the connection and evolvement between geosphere, soilsphere, biosphere, atmosphere and hydrosphere, discussed the mechanism of fragile karst ecosystem and recover and rebuilt the ecosystem in karst rocky desertification area.

**References**


