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Study on comprehensive planning of rocky desertification in karst area of Chongqing

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Abstract: Chongqing is a key area for comprehensive treatment of rocky desertification in karst areas of China. Strengthening the comprehensive management of karst rocky desertification area, for the maintenance of ecological safety of Three Gorges Reservoir area, expanding the karst rocky desertification area people survival and development space, and improving the regional ecological conditions, have important practical significance to the construction of ecological civilization and building a harmonious society. Based on the investigation, analysis and arrangement of the data in the rocky desertification area, the paper puts forward the corresponding measures and phased targets for the treatment of the Rocky Desertification in the karst areas of Chongqing.

1. Introduction
Chongqing is the key area of national comprehensive management of karst rocky desertification area, located in the upper reaches of the Yangtze River, the hinterland of the Three Gorges Reservoir area, high mountains and steep, barren land, serious soil erosion, natural disasters, landslide, collapse and debris flow occurred frequently, a serious threat to the ecological safety of the Yangtze River region and the safe operation of the Three Gorges project. Strengthening the comprehensive management of karst rocky desertification area, for the implementation of Scientific Outlook on Development, the maintenance of ecological safety in Three Gorges Reservoir area, expanding the karst rocky desertification area people survival and development space, improving the regional ecological environment, promoting national unity, the construction of ecological civilization and building a harmonious society have important practical significance.

2. Research area overview
Chongqing city covers an area of 82 thousand and 400 square kilometers, including 81 thousand and 800 square kilometers of karst counties. The geological structure of the country is complex, and the terrain is dominated by hills and hills. It belongs to a subtropical humid climate type. There are 37 districts and counties in the karst area of Chongqing, including 888 townships, 101 subdistrict offices, 1787 neighborhood committees and 9848 village committees. By the end of 2006, the total population of karst area was 30 million 550 thousand people, including 23 million 288 thousand agricultural population and 388 population per square kilometer. The total regional output value was 292 billion 310 million yuan, and the total grain output was 9 million 677 thousand tons.

The geological structure and topographic features of Chongqing form the unique landform of karst area in Chongqing, First, the medium height mountain area of Northeast Chongqing, two is the low-
height mountain area of Southeast Chongqing, the three is the low mountain and hilly area of the parallel ridge Valley in the southwest of central and southwest Chongqing. Among them, the karst area of Northeast Chongqing and Southeast Chongqing is a rocky desertification area.

3. Present situation and harm of rocky desertification
Rocky desertification refers to the natural background of tropical and subtropical, humid and semi humid climatic conditions and karst and its development, disturbed by human activities. The vegetation is destroyed, causing serious soil erosion, forms of ecological deterioration, "earth cancer" said.

3.1 Status of rocky desertification
The karst area of Chongqing is 3 million 272 thousand hectares, of which the area of rocky desertification is 926 thousand hectares, accounting for 28.3% of the karst area. The potential rocky desertification is 858 thousand hectares, accounting for 26.2%; non rocky desertification is 1 million 488 thousand hectares, accounting for 45.5%. The area and proportion of light, moderate, severe and extremely severe rocky desertification in rocky desertification land are shown in table 1.

| Rocky desertification Grade | Project | Light Rocky desertification | Moderate Rocky desertification | Severe Rocky desertification | Extremely severe Rocky desertification |
|-----------------------------|---------|-----------------------------|-------------------------------|-----------------------------|---------------------------------------|
| The measure of area         | 271 thousand | 527 thousand | 114 thousand | 14 thousand |
| The proportion of           | 29.3% | 56.9% | 12.3% | 1.5% |

Table 1 The proportion of rocky desertification in different karst areas of Chongqing (area: HA)
The land use ratio of different land types in rocky desertification land is shown in table 2.

Table 2 Land use ratio of different land types in rocky desertification land (area: HA)

| Different utilization types | Cultivated land | woodland | Grassland | Unused land |
|----------------------------|-----------------|----------|-----------|-------------|
| The measure of area        | 25.1 \text{万} | 57.8 \text{万} | 0.3 \text{万} | 9.33 \text{万} |
| The proportion of          | 27.2\%          | 62.5\%   | 0.3\%     | 10\%        |

3.2 Causes of rocky desertification
The formation of rocky desertification land is the result of the combination of natural factors and human factors, among which human factors play a leading role.

Natural factors include the following aspects:
① Geological structure. Carbonate rocks are widely exposed in Chongqing karst area, anti erosion ability, slow soil formation process, soil depth, which is one of Chongqing karst area background and the basic reason of rocky desertification;
② Topographic features. The ground surface is broken in Chongqing karst mountain area, and the high mountain steep slope and unique landform structure aggravate soil erosion in Karst Area;
③ Climatic conditions. The warm and humid monsoon climate provides the conditions for the development of karst landforms, and provides an intrusion for the formation of rocky desertification erosion force;
④ Natural disaster. The frequent occurrence of natural disasters in karst areas in Chongqing caused vegetation damage and soil erosion, and aggravated the degree of rocky desertification.

Human factors include the following aspects:
① Steep slope reclamation. The shortage of cultivated land resources and the contradiction between man and land in karst area lead to deforestation, destroying grass, steep slope cultivation and soil erosion serious, it is the main reason that forms rocky desertification;
② Over cutting. Karst area of woodfuel use high proportion of cutting the plant community, soil erosion and fragile ecosystems. The difficulty of vegetation restoration is increasing year by year, which further increases rocky desertification;
③ Overgrazing. The carrying capacity is too large, keeping extensive vegetation in karst area, aggravated the damage, resulting in rocky desertification and Heavy;
④ Irrational development and construction. In the karst area, blind quarrying, mining and other production activities destroy forest vegetation and cause rock nudity and severe soil erosion leads to rocky desertification of land.

3.3 Rocky desertification hazard
Rocky desertification results in severe soil erosion and ecological deterioration, which is manifested in the following aspects:
① Affect the ecological security of the Three Gorges Reservoir area. Northeast of Chongqing Three Gorges Reservoir area of Chongqing city is the main distribution area of rocky desertification, soil erosion, large amount of sediment into the Yangtze River sediment, reduce flood discharge capacity, a serious threat to the normal operation of the ecological security in the Yangtze River and the Three Gorges reservoir;
② Restricting human survival and development. Rocky desertification leads to soil nutrient loss, thinning of soil layer and gradual exposure of rock, which makes the arable land resources decrease year by year, and worsens the trend of deterioration of ecological environment and reduces the carrying capacity of land population;
3. Lead to frequent natural disasters. Rocky desertification causes more serious soil erosion and reduces vegetation coverage, becoming one of the frequent causes of natural disasters such as floods, landslides and landslides;

4. Restrict the sustainable development of economy. Rocky desertification has become a source of poverty and a major obstacle to regional economic development in Karst areas. The key counties of poverty alleviation in 14 counties of Chongqing and 4 key counties for poverty alleviation at the municipal level are all in rocky desertification areas, and the harsh living conditions seriously restrict the sustainable development of the economy.

4. Present situation and existing problems of comprehensive treatment of rocky desertification

In support of the country in recent years, Chongqing city in the karst area has implemented the protection of natural forests, returning farmland to forests, soil and water conservation, the reservoir green belt, poverty alleviation and other key projects, completed the construction of 6 million 230 thousand acres of forest, 14 million 820 thousand acres of forests, 514 Small Watershed Governance, the construction of basic farmland 622 thousand mu, to resettle 53 thousand people. Forest vegetation coverage was improved effectively, soil erosion was reduced, and the deterioration trend of rocky desertification in karst areas was effectively alleviated, which played an important role in promoting regional economic and social sustainable development. However, rocky desertification is not as an independent and systematic project, there are still some problems, outstanding performance is: one is the lack of investment, governance is not a scale, it is difficult to play a comprehensive benefits; the two is the lack of overall planning, governance measures single; the three is the industry departments lack of communication and coordination, it is difficult to form together, the treatment effect is not obvious.

5. Planning objective of comprehensive control over Rocky desertification

Karst rocky desertification should be to improve the ecological environment and improve the living standards of farmers, achieve the goal of sustainable development, the comprehensive treatment of rocky desertification in karst area and the economic and social development and poverty reduction into consideration and realize harmonious unity of ecological benefits, economic benefits and social benefits, and promote the sustainable development of social economy in Karst area.

5.1 General objective

Through the implementation of vegetation protection and construction, adjustment of animal husbandry structure, improve soil and water conservation engineering facilities, strengthen the construction of rural energy and ecological migration, rational development and utilization of resources, the new vegetation area of 578 thousand hectares, the vegetation coverage increased by 7.1 percentage points. Governance karst area of 2 million 494 thousand hectares, stone desertification area of 655 thousand hectares, to ensure that the living standards of the people living in karst areas continue to improve, and promote social and economic into a sustainable development track.

5.2 Stage target

The whole process of governance is divided into two stages, the pilot phase and the overall stage of governance. The first stage, through the implementation of closed forest vegetation, afforestation, grassland, artificial grass, the development of animal husbandry, strengthening the construction of farmland water conservancy facilities and supporting the project, completed in Youyang, Wuxi, Fengjie, Wushan, Pengshui, five pilot counties in the rocky desertification control pilot work, control of Karst area of 75 thousand hectares, stone desertification area of 44 thousand hectares. The management model of rocky desertification and the governance methods in different conditions are explored to accumulate experience for comprehensively carrying out rocky desertification control in the later period; After a period, through the implementation of comprehensive management of karst rocky desertification area project, control of karst rocky desertification area of 2 million 419 thousand hectares, an area of 611 thousand hectares, the new vegetation area of 534 thousand hectares, the vegetation coverage increased
by 6.5 percentage points. The living standards of the people in karst areas will continue to increase, and the economy and society will be on the track of sustainable development.

6. Comprehensive planning and zoning measures for rocky desertification

In order to improve the effect of comprehensive treatment, according to the different characteristics of the ecological environment, rational treatment of karst region in Chongqing natural conditions, causes of rocky desertification, social economic status, rocky desertification and control measures and ecological functions, determine the layout of the project for science, to arrange governance mode and technical measures, planned, step by step the advance of comprehensive control of rocky desertification, in accordance with the same karst geology, geomorphology, hydrology geological structure conditions and karst ecological environment problems are similar; and the natural boundary divisions remain the same, taking into account the integrity and continuity of the local administrative region; The Rocky Desertification in the same area roughly the same, the principle of division of technical measures of comprehensive control of rocky desertification is similar, divides the karst area of Chongqing city as the northeast of Chongqing medium height mountain rocky desertification area, southeast low- medium height mountain rocky desertification area and Central Chongqing Shimo parallel ridge valley comprehensive control zone, as shown in table 3.

| Governance partition               | Districts and counties under its jurisdiction | Rocky desertification surface Accretion and occupation ratio (HA) | Governance focus                                                                 | Control measures                                                                 | Planning governance Reasonable area (hectare) |
|-----------------------------------|-----------------------------------------------|------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------|
| northeast of Chongqing medium height mountain | Wuxi, Wushan, Kai City, Yunyang, Fengjie, Wanzhou, | 416 thousand 45%                                                 | Ecological environment protection and restoration, control soil erosion, curb rocky desertification, and protect water sources | some for grass and others for forests. Combination of forest and grass, with increasing vegetation, establish the characteristics of economic fruit forest base and high-quality forage base, ecological migration etc. | 316 thousand                                  |
| southeast of Chongqing low-medium height mountain | Qianjiang, Youyang, Xiushan, Pengshui, Wulong, Fuling, Shizhu, Nanchuan, etc. | 471 thousand 50.9%                                              | Prominent construction of water and soil conservation and control of rocky desertification | To increase vegetation restoration efforts, strengthen the bare rock mountain shrub and grass planting, feeding promotion, prevention and control over grazing pasture degradation | 311 thousand                                  |
| Central Chongqing Shimo parallel ridge valley | Longevity, Liang Ping, Dianjiang, Zhongxian, Tongnan, Tongliang, Dazu, Rongchang,Bishan , etc. | 38 thousand 4.1%                                               | Optimize the industrial structure of agriculture, and actively develop ecological agriculture | Strengthen the construction of irrigation and water conservancy, increase the effective irrigation area and output per unit area, improve the energy structure of rural areas and solve the energy shortage in rural areas. | 197 thousand                                  |

By closing the land for reforestation, afforestation and grassland construction in the form of karst area in Chongqing city the implementation of vegetation protection and construction of 578 thousand hectares, as shown in table 4.

| District and county | Forest vegetation protection and construction (HA) |
|---------------------|---------------------------------------------------|
|                     |                                                   |

Table3 Regionalization of rocky desertification control

Table4 Forest vegetation protection and construction plan
Subtotal Afforestation Artificial afforestation Grassland construction
northeast of Chongqing medium height mountain 291336 208470 48600 34266
southeast of Chongqing low-medium height mountain 262164 107810 95920 58434
Central Chongqing Shimo parallel ridge valley 24200 14320 6880 3000
Total 577700 330600 151400 95700

Through the improvement of livestock, housing construction, mechanical configuration adjustment forage livestock structure, improved varieties, accelerate the development of animal husbandry, as shown in table 5.

Table 5 Scale of construction of herbivorous animal husbandry

| District and county | Herbivorous animal husbandry development | Improvement of livestock (head) | Housing construction (square meters) | Forage machinery (set) | Silo (cubic meters) |
|---------------------|-----------------------------------------|---------------------------------|--------------------------------------|------------------------|------------------|
| northeast of Chongqing medium height mountain | | 43862 | 219310 | 4368 | 263172 |
| southeast of Chongqing low-medium height mountain | | 74798 | 373990 | 7450 | 448788 |
| Central Chongqing Shimo parallel ridge valley | | 3840 | 19200 | 382 | 23040 |
| Total | | 122500 | 612500 | 12200 | 735000 |

7. Summary
Chongqing city in the construction of ecological civilization, building a harmonious society as a guide to improve the ecological environment and improve the living standards of farmers and achieve sustainable development goals, according to local conditions, comprehensive management, the comprehensive treatment of rocky desertification in karst area and the economic and social development and poverty alleviation integrated consideration, the organic combination of biological measures, engineering measures and technical measures to solve the contradiction, the ecological construction and the farmers' interests, contradiction and change their traditional habits and modes of production and life, economic and social development of the urgent need and local resources carrying capacity is limited, unity of ecological benefits, economic benefits and social benefits, and promote the sustainable development of social economy in Karst area.

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References

[1] Long Jian, Li Juan, Huang Changyong. Environmental and soil degradation and its restoration in Southwest China [J]. Chinese Journal of water and soil conservation, 2002, 16 (5): 5-9;

[2] Zhang Runjia, Xie Shiyou, Wang Jiao. Chongqing karst rocky desertification area of [J]. Anhui agricultural sciences, 2008, 36 (8): 3316-3318;

[3] Wei Xingping, Yang Hua. Relationship between the distribution of rocky desertification and geographical environment factors in karst area of Chongqing [J]. Journal of Chongqing Normal University (NATURAL SCIENCE EDITION), 2014, 31 (5): 60-66;

[4] Long Mingzhong, Yang Jie, Wu Kehua. Comparative study on soil erosion in different grades of rocky desertification in Karst gorge area: a case study of Huajiang Huajiang demonstration area in Guizhou [J]. Journal of Guizhou Normal University (NATURAL SCIENCE EDITION), 2006, 24 (1): 25-30;

[5] Merritt W.S., R.A. Letcher, A.J. Jakeman. 2003 A review of erosion and sediment transport models[J]. Environmental Modelling & Software, 18: 761–799;

[6] Xiong Kangning, Li Jin, Ming Chung. The characteristics and key problems of the soil erosion in typical Karst Rocky Desertification Area [J]. Journal of geographical, 2012, 67 (7): 878-888.