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On water quality control in light of rocky desertification status in madeng town

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ABSTRACT

The problem of rocky desertification in Madeng Town in Xichuan County, Henan Province is one of the important factors affecting the water quality of the Danjiangkou Reservoir. Based on the soil and rock samples collected in Madeng town, Xichuan County, we determined their effects on the water quality by analysis of the experiments, and put forward the suitable ecological planting patterns so as to improve the ecological environment reconstruction and the local people's livelihood conditions in harmony. This is for the ultimate realization of rocky desertification control, and ensuring of water quality standards, and long-term efficiency in the middle route of the South to North Water Transfer Project.

KEYWORDS

Rocky desertification;
South to north water transfer project;
Soil and water conservation;
Countermeasures.

INTRODUCTION

With the development of society and economy, environmental problems arise. It is urgent to advocate a sustainable development mode, therefore, the theory of sustainable development attracted world wide attention from all walks of life since it came into existence. At the United Nations Conference on Environment and Development in June, 1992, the desertification control became an important part of sustainable development in the "Twenty-first Century Agenda". As a new topic, rocky desertification was first listed in the national economic and social development, and written into the "The Tenth Five-Year Plan: "To speed up the small watershed management, and reduce the loss of water and soil." The sustainable development of rocky desertification areas is the key to realizing the sustainable development in Southwest China's mountainous areas and even the whole country.

THE ROCKY DESERTIFICATION

Compared with the northwestern China's desertification, rocky desertification is a new environmental problem. In the late 1980s, some of our scientific workers put forward for the first time the rocky desertification concept during the conservation of water and soil in the south. Since then, a small group of scholars called this kind of phenomenon in karst regions karst rocky desertification. Rocky desertification is characterized by fragile ecological and geological environment as a basis, strong human activity as the driving force, land productivity degradation as its nature, and appearance of the landscape similar to a desert. Because of the low water storage capacity of the rocky desertification areas, droughts easily arise, which results in poor moun-

tainous areas, water scarcity, poor soil, forest decline. So rocky desertification is also known as the "land cancer".

The general concept of rocky desertification is rocky desertification in a narrow sense, which particularly refers to rocky desertification caused by water and soil erosion because of vegetation destruction in the southern humid areas of karst landform formed by carbonate rocks. As to the definition of rocky desertification, different scholars give different descriptions. Initially the general statement was: because the ecological environment of karst areas is weak, the vegetation is destroyed and soil erosion becomes severe, serious land degradation leads to the formation of a large area of exposed bedrock. This is called rocky desertification.

THE SITUATION OF ROCKY DESERTIFICATION IN XICHUAN COUNTY

For the people on the Central Plains, rocky desertification is a strange noun. Nowadays, the rocky desertification really occurred in the Central Plains of China. Plants can't grow in the rocky desertification land in Xichuan, and it also affects the safe drinking water, especially it threatens the water source of the Danjiangkou reservoir in the middle route of the well-known South to North Water Diversion Project. Xichuan County now has a rocky desertification area of 930,000 mu, accounting for nearly 21.5% of the total land area of 4230000 mu in the county. Surrounding the Danjiang reservoir are the Danjiang river, Qihe river, and the Taohe river. These rivers are related to 12 towns such as Jingguan, Siwan, Jinhe, Laocheng, a total area of 10,200 hectares. Rocky desertification land is distributed in the mountain top, the mountain rock is mainly limestone, the soil is subgroup cinnamon at sea level of 200~500 meters. The slope is greater than 16 degrees, the annual average of soil erosion modulus is 41 tons per hectare. Due to years of rainfall, soil erosion is severe, bedrock is exposed, gravel is stacked,soil is barren, and vegetation is sparse. The local people call it "the black stone mountain".

After the survey team's visits and field investigation, laboratory analysis of the collected samples (see TABLE 1 for the sample analysis from Xigou in Xichuan County), it can be seen from the test results that the content of various elements is quite different in different positions.

In the rocky desertification area, nutrient elements in the soil will lose as a result of rainwater washing, such as soil nitrogen and phosphorus content. The organic matter in the soil is life matter, including plants, animal secretions. The different content of organic matter not only reflects the presence of animals and plants in the region, but also the suitability for the survival of animals and plants. From this table, it can be seen that the region's mountain top and bottom are suitable for plants to survive.

Through the analysis of the local rock composition, we found a large amount of calcium oxide in the rocks with a proportion of over 50%, obviously they belong to the limestone. This kind of rock has the characteristics of dense rock which is exposed to air for a long time. A dense matter will be formed on the surface to protect the interior, which shows that due to the outside interference or damage, it is prone to erosion. And because of the protective layer of dense matter, the few rocks turned into soil. Thus without proper management, rocky desertification will continue, so we need to control rocky desertification.

AFFECT OF ROCKY DESERTIFICATION ON THE WATER SOURCE THE DANJIANGKOU RESERVOIR OF SOUTH- NORTH WATER DIVERSION PROJECT

The rocky desertification in Xichuan County has a direct affect on the actual proceeds of the South to North Water Transfer Project. The Danjiangkou reservoir basin has an area of up to 2,600 square kilometers in Xichuan County, accounting for 57% of the total watershed area. Rocky desertification problem in Xichuan causes serious soil erosion, and large amounts of sand, mud flows into the Danjiangkou reservoir, resulting in the sedimentation. According to the information, in the 20 years from 1960 to 1979, a total of 897,155,000 cubic meters of sediment deposited in the Danjiangkou reservoir, an annual average of 44,860,000 cubic meters, which seriously affects the reservoir life in addition to a serious impact on water quality. This caused the reservoir water quality turbidity, and nitrogen excess etc.

Rocky desertification causes serious influence on

people's production and living, threatening the social stability. Each year, the county loses 2,200,000 tons of soil because of rocky desertification. Soil erosion leads to nutrition deficiency of nitrogen, phosphorus, potassium, aggravates the barren land, and decrease the arable land. In the reservoir basin, this is more prominent. At present, the average cultivated land is less than 0.8 mu per capita in the county, of whom more than 10,000 people have less than 0.3 mu of cultivated land per capita; On the other hand, rocky desertification makes local water conservation ability poor. In winter, and spring, water depletion arise in rocky desertification mountain areas, which not only affects the agricultural irrigation water, but also causes the shortage of drinking water. Rocky desertification has caused deterioration of ecological environment in our region, endangered the life safety of rural people. If it is not treated timely, it will eventually lead to social problems such as the shortage of food, drinking water, firewood and timber. Land desertification is the number one environmental problem in Xichuan's ecological experimental area, and the root source of ecological disasters and poverty. It is the main obstacle to economic and social development in Xichuan. As a result of rocky desertification intensification and extension, the deterioration of the ecological environment, soil erosion is becoming more and more serious. Drought, and flood becomes more and more frequent.

SUGGESTIONS FOR ROCKY DESERTIFICATION CONTROL

Since the 1980s, our country has launched a number of projects in the rocky desertification areas, and implemented a number of rocky desertification control measures, at the same time,obtained a lot of experience and methods. For example, in karst areas ecological restoration and construction are solutions to rocky desertification, drought and other questions while more attention should be paid to the production and life of the local people. Engineering measures, biological measures, tillage measures are of rational allocation. Mountain, water, forest, cropland, and road are renovated, the industrial structure is adjusted to optimize the allocation of resources; According to the different natural environments, suitable measures are taken for local conditions. Scientific planning and adoption of comprehensive treatment and utilization of resources go hand in hand, and the masses of the people and the community's enthusiasm and creativity are fully mobilized by actively using the new scientific research achievements in rocky desertification treatment to increase capital, technology, labor investment in the rocky desertification control. Rocky desertification in China is especially a big disaster facing the southwest. At present, the comprehensive management of karst rocky desertification is obvious in some parts of Southwestern China, but the overall deterioration has not been effectively controlled. Practice and national conditions show that control of rocky desertification is a long-term and complex social engineering. So in the future research on rocky desertification control, we should adhere to the interdisciplinary and cross-sector control, to the principles of scientific planning, overall consideration, classified guidance, and comprehensive management; the interdisciplinary research is vital, especially by combination of humanities, sociology and natural sciences; we need to strengthen the construction of ecological demonstration areas of different genetic types of rocky desertification landscape, focus especially on the development and utilization of groundwater resources, and to strengthen the control of rocky desertification and technology support. The ultimate aim is to realize the harmonious development of man, nature and regional economy.

Artificial afforestation

So far, for reconstruction and restoration of the fragile ecological system in the rocky desertification areas, human intervention is still the most important way. In control of rocky desertification, artificial afforestation is a shortcut to quickly restore the ecosystem functions. According to the principles of ecological economics, suitable tree species selection in different regions is the key link of afforestation. On the basis of summarizing the research results and the present situation of Madeng town, Xichuan County, we find the suitable tree species for afforestation in different rocky desertification areas in order to benefit the rocky desertification control work.

Tree species selection principles

(1)The principle of native tree species. To choose

native tree species for afforestation. (2) The diversity principle. To diversify the species, forms of afforestation. (3) The reasonable allocation principle. According to the rocky desertification conditions, grow grass and shrubs with rational density. (4) the regional principle. Reasonable selection of management mode and afforestation tree species in different areas. (5) the principles of ecological adaptation. Grow grass or trees if suitable. (6) the ecological and economic benefits principle. To grow mainly ecological species with economic species to bring the land's economic production capacity into full play on the basis of soil conservation.

Requirements for selecting the afforestation tree species

(1) Endurance for soil drought and heat cycle changes. In the seedling period, the trees can grow in the moist soil environment, and resist the affect of short-term soil drought; can grow in the environment of small temperature differences, and in the hot summer weather of larger day and night temperature differences so as not to be burnt or die. At the same time, in the high temperature and drought, they can have usual physiological activity. (2) A good root system is required. The trees can grow in rock cracks, tend to suck in water and fertilizer. (3) Easy to survive, fast to grow, reforest or significantly increase surface coverage in a short period of time. (4) Has strong sprout ability. (5) Suitable for growing in neutral and alkaline calcareous soil.

Establishing protection forest

According to the specific conditions of the rocky desertification in Xichuan county, learn from successful cases of regional rocky desertification control to establish a protective forest model.

Valley protective forest

The river valley belongs to the subtropical climate, distributed on both sides of the tributaries below sea level of 600m. The area is populous with convenient water and land transportation, and most serious damage has been done to vegetation, water and soil loss is particularly serious. Protective forest construction should be protection forest of the economical type in the first place, there are mainly the following types and models:

(1) Valley slope protection forest

The valley slope (under 25 degrees) is generally land. This area is less densely populated". In the populous areas, conversion of cropland into forest, afforestation of barren hills and the adjustment of rural industrial structure are the protection forest of efficient economical types.

(2) The steep valley slope protection forest

The majority of steep valley slope (26 degrees ~35 degrees) is arable land, which is fit for the ecological economic protection forest of high economic benefits.

(3) The steeper valley slope protection forest

Steeper valley slope (above 36 degrees) is mostly barren hills. It is mainly for the development of efficient protection forest.

Comprehensive slope management mode——— conversion of slopes to terraces

Slope land is the main source of rocky desertification, soil erosion and loss account for a majority of rocky desertification areas, therefore, prevention of soil erosion of slope farmland is the key to reducing mud and sand flowing into the reservoir which means a lot to the promotion of ecological environment and social economy in rocky desertification areas.

The terraced fields are a basic soil and water conservation project. By changing the terrain, they can reduce sand, improve soil, increase production, improve

TABLE 1 : Test results of soil samples from Xigou, Madeng town, Xichuan County

Sample site	Total Nitrogen (%)	Total Phosphorus (%)	Total Potassium (g/kg)	Available phosphorus (mg/kg)	Slow Potassium (mg/kg)	Available Potassium (mg/kg)	Organic Matter (%)	pH (Ph)	Water (%)	Height (m)
Xigou mountain top in Madeng town	0.592	--	--	39.5	696	408	4.18	6.3	--	442.00
Xigou mountain side in Madeng town	0.293	--	--	18.6	1456	204	3.13	6.3	--	420.959
Xigou Base in Madeng town	0.226	--	--	17.7	1528	200	1.64	6.3	--	373.263

the production conditions and ecological environment. Terracing technology refers to building level terraced farmland with a slope below 25 degrees.

Ecological restoration project

According to the national standards of closing hillsides for afforestation, the main layout of closing hillsides to facilitate afforestation conditions in moderate rocky desertification regions. Natural forest is distributed around the present woodland, shrub land and non rocky desertification areas. The main layout of ecological protection forest should be on the river banks, reservoir banks, near the highways and fields.

Typical economic forest is high tech, intensive industry, it is closely related to the effective management level, so we must strengthen the management. Typical economic forest not only prevents rocky desertification, but also increases people's income, and makes rural people rich.

CONCLUSION

The Danjiangkou reservoir in Xichuan County is the water source of the middle route of the South to North Water Transfer Project. The water quality will be directly related to the water quality in Beijing, Tianjin and Shijiazhuang. Now there still exist big problems in Xichuan. The rocky desertification will directly influence the water quality of the Danjiangkou reservoir. The problem is mainly the loss of soil and water. Soil nitrogen and phosphorus are indispensable factors for the growth of plants, but if these two elements go into the water, they will do harm to water quality. In this case, it is necessary to prevent the desertification. Preventing desertification can not only green the environment, but also conserve the soil and water as well as ensure water quality. Through a series of reform measures such as returning farmland to forests, building the fruit bases, the environment of Xichuan can be greatly improved. It can be said that this is a good way to kill two birds with one stone;

The South to North Water Diversion Project provides a very good opportunity for the development of Xichuan. Once the rocky desertification control is successful, it can also be used as a model of rocky desertification control in Southwestern China. This will be a significant contribution to the nationwide rocky desertification control. At present, it is vital to treat the rocky desertification problem to ensure the water quality in order to supply clean water for Beijing.

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