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Ecological Environment Problems of the Three Gorges Reservoir Area and countermeasures

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Abstract

The ecological and environmental problems of the Three Gorges Reservoir Area have different effects on its ecological security. This paper aims to make certain contributions in this area by examining the ecological problems of the TGA. It reveals that Scarce arable land, water and soil erosion, non-point agriculture pollution are critical environmental issues. On the positive side, countermeasures that are discussed include: developing eco-agriculture, reforestation and constructing a green belt in the peripheral zone of the reservoir, and economic adjustment and control to the agriculture nonpoint pollution.

Keywords: Three Gorges Reservoir Area; ecological environment problems; countermeasures

1. Introduction

The Yangtze River is the fourth longest river in the world. The Three Gorges Reservoir，which went into operation in 2003 and had reached its maximum design water level in autumn 2008 and 2009，is the largest newly built reservoir worldwide. It has three main purposes: to reduce the flood hazard downstream of the Three Gorges dam; to provide electricity to meet the industrial and domestic demands in eastern and central China; and to improve navigation along the upper Yangtze River . The reservoir area encompasses 20 cities, districts, and counties in Chongqing municipality and Hubei province. Because of the widespread population pressure, deforestation and reclamation, vegetation cover degree decreases markedly, slope-cultivated lands increase, water and soil loss are very serious, crop yields are low and unstable, eco-environment is vulnerable.

This paper aims to make certain contributions in this area by examining the ecological problems of the TGA. Section two briefly discusses the ecological problems in the reservoir area. In section three some effective measures for ecological rehabilitation in the reservoir area are addressed. These measures

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include: development high efficient eco-agriculture; reforestation; economic adjustment and control to the agriculture nonpoint pollution.

2. Ecological Problems of Three Gorges Reservoir Area

Arable Farmland in the Reservoir Area is Scarce

The Three Gorges reservoir area has a complex and rugged topography, with mountains and hills accounting for a large share of the total land area. Over 74% of the landscape is mountainous and 21.7% is low hills, while valleys and small plains make up < 4.3%. Arable farmland in the reservoir area is scarce. The cultivated land per capita is about 0.07ha in the submergence area. Rural residents make up 72.3% of the total population in the reservoir region. The areas above the 175m inundation line are more populous, the human carrying capacity of the land in the reservoir area has, essentially, been exceeded .

Deterioration of Water and Soil Erosion

Research has revealed that for every 1% reduction in forest cover in the Three Gorges region, soil erosion increases by 128.47 t/km2 p.a. Erosion rates are strongly correlated to slope. The amount of soil eroded from slopes makes up 60.6% of the total erosion, equivalent to 53,333 ha of fertile topsoil with a loss of chemical nutrient elements of 1.2 million tons per annum. Statistical data on 127 projects in the reservoir area in 1996 demonstrated that induced water and soil erosion have affected an area of 35.1 km2, destroyed vegetation and land cover over 36.9 km2, and discharged solid waste of 10 million m3, most of which was poured directly into the rivers.

Human activity is a major factor accelerating soil erosion in the reservoir area. Due to long-term human activities including the overuse and inappropriate opening up of new land, soil erosion has become a serious environmental issue. Soil erosion occurs in over 90% of the total Three Gorges area, with 45.5% of the soils being heavily eroded with an erosion coefficient of greater than 4,000 t/km2 p.a. In the reservoir area, there are some 266,600 ha of steep land on slopes of more than 25°, accounting for 18.6% of the total area.

Nonpoint Source Pollution of Agriculture

The special eco-environments in the Three Gorges Reservoir Area help to the agricultural nonpoint source pollution，which will threaten the course of the Three Gorges Engineering. The nonpoint source pollution of agriculture is a phenomenon of social economy, and its being and development has deep-seated cause of society and economics. Three Gorges reservoir area is an important sensitive eco-economy area, and also typical poverty mountain area. Because of its special geography location and structure of agriculture, there is a great pressure. Economic loss induced by nonpoint source pollution of agriculture is tremendous.

3. Practical Countermeasures

Reforestation and Green Belt Construction

Cropping on hillsides is a main factor that exacerbates soil erosion and land degradation. Nonetheless, agrarian production on sloping land has played a key economic role in the reservoir area. Fifty-six percent of food grains are produced on sloping land. The present policy of returning the cultivated land to forest or grassland on slopes of 25°or greater will benefit the rehabilitation of the environment in the reservoir area in the long term. However, it will reduce grain production, possibly resulting in food in security .The implementation of the reforestation policy will greatly increase the pressure on rural resettlement in the reservoir area because of the limited arable land that is available and exploitable. To prevent new soil erosion, environmental rehabilitation in the reservoir region is urgently required.

Developing Eco-Agriculture

Eco-agriculture is a kind of modern agriculture system, which can produce better economic benefits, social benefits and ecological benefits by modern management method, according to ecology theory, economy theory and eco- economy theory. It will benefit the sustainable development of the Three-Gorges.

Because of the complicated physiognomy and fragile eco-environment in Three Gorges Area, industrialization of the efficient eco-agriculture should be advocated as the main direction of the future economic development, and the most effective development mode of the efficient eco-agriculture should be adjusted according to the local conditions, so that Three Gorges Area can be constructed as a new industrial intensive economic zone and a new efficient eco-agricultural zone, where the development is comprehensive and the emigration reallocation is at a high level.

Alternative land use systems and especially agro-forestry are currently being promoted in the reservoir area to enhance soil retention and improve soil quality. A study has identified that the fertility of different soil types in the reservoir area has been improved, consisting of the total organic, chemical and nutrient status, soil microbial biomass, and other indices for measuring soil physical and bio-chemical characteristics. Biological technologies and chemical measures are applied to the infertile soil to improve its fertility. The land is then applied with vegetation, which holds soil and stabilizes them. Vegetation and livestock adaptable to such soil are introduced and together they form a bio-chain. Consequently, the fertility and structure of soil are improved, preventing water and soil erosion.

Economic Adjustment and Control to the Agriculture Nonpoint Pollution

For the sake of efficiently bringing the means of economy adjustment and controlling into effects the agriculture market and its market system in Three Gorges Reservoir Area would be enhanced. Furthermore, the development and management patters should be transferred. Based on the present eco-agriculture construction, organic-agriculture should be developed positively, and promoted agricultural market development that the farmer household and organization's cultivation and living pattern that did harm to environment be affected, regulated, or transferred. The local government encouraged and led them getting well with the sustainable agriculture, and realized the bilateral-won benefits that the agriculture nonpoint pollution could be mitigated and the greatest social welfare could be reached in Three Gory Reservoir Area.

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