

# **The Research on Ecological Environment Protection in Three Gorges Dam and Reservoir Area**

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**Abstract:** In this thesis, the ecological environment situation, the protection and problems in Three Gorges Dam and Reservoir Area are analyzed firstly. The corresponding treatments to these issues are then proposed: Vigorously develop the propaganda and the education work, enhance the public consensus; perfect protection planning, improve working mechanisms; work out related protection laws and regulations, work according to law; take comprehensive measures to strengthen ecological environment protection; enhance the ecological environment protection by using the scientific and technological support; carry on the theory innovation, the technical innovation, policy innovation and the management innovation.

**Key words:** Three Gorges Dam; Ecological environment in Reservoir Area; Protection; Research

## **1 The general situation of Three Gorges Dam and ecological environment in Three Gorges Reservoir Area.**

### **1.1 The general situation of Three Gorges Dam**

Three Gorges Dam is located in San Douping town, Yichang city, Hubei province, consisting of the hydraulic structures, such as river dam, hydropower station factory building, double-lane five-stage shiplocks and one-lane vertical ship lifts etc. The dam is 2335 m long, 185m high. Its normal storage level is 175 m, the total installed capacity is 39.300 billion m<sup>3</sup> (including 22.15 billion m<sup>3</sup> in flood prevention capacity). It contains 26 power generating units which can generation 0.7 million kw power per unit. The total capacity is 18.2 million kw, the annual energy generation is 84.7 billion kw·h. The gross investment of this project is RMB 90.09 billion yuan (price of the end of May of 1993), of which RMB 50.09 billion Yuan is for the project construction, and the other RMB 40 billion Yuan for the resettlement. The total period of this project construction is 17 years

(from 1993 to 2009, but it has already been advanced to finish in 2008).

The comprehensive benefits of Three Gorges Project are as follows, flood-control, power generation, shipping, environmental protection, water supply, irrigation, traveling etc. All these benefits accord with the cross-centennial grand project of the national sustainable development strategy. So the construction of the Three Gorges Dam is undoubtedly a milestone in the historical process of socialist modernization drive of our country.

The construction of the Three Gorges Dam has accelerated the coordinated development in the resettlement, the economy and the society. It also has produced a tremendous impact on the ecological environment in the Reservoir Area.

### **1.2 The general situation in Three Gorges Reservoir Area**

The Reservoir Area spans the Daba mountain and the Exi Shandi, which is located in the 28°31' - 31°44' north latitude, 105°44'-111°39' east longitude. It involves 20 towns of Chongqing and Hubei province. Its

total area covers 79 thousand km<sup>2</sup>, its total population is about 30 million (including rural-urban resettlers, 1.2 million people). The land area in the Reservoir Area is approximately 0.13 million km<sup>2</sup> (including arable area 2.14447 million hm<sup>2</sup>, mountainous region covers approximately 64.1%). We can see that it is a typical area with vast population and limited farmland.

Three Gorges Reservoir is also the biggest river course reservoir in China. When The Three Gorges River project normally stores water 175 meters according to the design proposal, the water area covers 1084 km<sup>2</sup>; the total storage capacity is 39.3 billion m<sup>3</sup>. (including flood control capacity, 22.15 billion m<sup>3</sup>). Except Changjiang, there are more than 400 secondary rivers, such as Wujiang River, Jialing River, Daning River, Xiangxi River and so on. The reservoir line altogether reaches 5.711 thousand km.

At present, the Three Gorges Reservoir Area exists such problems as high mountain and steep slope, vast population and limited farmland, serious man-earth relationship, severe water and soil erosion, low forest coverage, the geological disaster frequency sends, serious pollution, So millions of resettlers' movement and placement increases ecological environment pressure on the reservoir area. No wonder it is our country's environmentally sensitive, weak and easy-polluted area. [1]

## **2. The situation of ecological environmental protection in Three Gorges Reservoir Area**

Our communist party and country regard ecological environmental protection as a basic national policy, adhere to the thoughts of people-oriented spirit, scientific development concept and harmonious social building. Attaches Great importance to and protect the ecological environment in Three Gorges Reservoir Area synthetically, utilize the benefit

of generating electricity in Three Gorges Dam to invest in the environmental protection and to guarantee the ecological environment in the reservoir area to benign transformation and sustainable development. Some measurements have been taken as follows:

### **2.1 Strengthen the leadership, adjust the policy.**

The ecology and environmental protection coordination group has been established under Three Gorges Project Construction Committee of the Council Department in 1995. The leading group of prevention and control of water pollution and Geological Disaster Control were established in succession in countries in 2001. "the overall plan on geological calamity prevention and cure" and "the prevention plan on water pollution in Three Gorges Reservoir Area and upper reaches" had been approved. All these have guided and promoted the ecological environmental protection. After 1999, the Council Department successively proposed the policies of "two adjustments" (the placement of rural resettlers moving outside and structural adjustment in transferred industrial and mining enterprises) and "two preventions" (the prevention of geological disaster and water pollution), which play an important role in guaranteeing the ecological environmental security of reservoir area. Meanwhile, the country strengthens the inspection of law enforcement of environmental protection such as the water and soil conservation of reservoir area of Three Gorges, and strengthens the control over environmental protection of reservoir area of Three Gorges, and also checks and patrols the enterprises, water areas against reservoir area and along regularly or irregularly.

### **2.2 Take efficient measurement, guarantee the actual effect.**

First, Three Gorges Project ecological and environmental monitoring system have been

established by Three Gorges Project Construction Committee Office of the Council Department in 1995 together with State General Bureau of Environmental Protection. The ecology involved to the Three Gorges Projects and environmental problems are followed and monitored in the whole course, and the annual monitoring bulletin had been released at home and abroad for 13 years in succession. Second, the resettlement environment protection action plan has been worked out in the resettlement plan in every county. Third, in the past 8 years, nearly 0.2 million people in reservoir area have been moved outside from rural areas, which played a prominent function in lightening the contradiction between people and land and protecting ecological environment. Fourth, more than one thousand of industrial enterprises which are backward and would seriously pollute environment had been bankrupted and closed, which can cut down COD emission 15,000 ton per year. Fifth, strengthen the prevention and control of water pollution. It had invested 4 billion yuan in "prevention design on water pollution in Three Gorges Reservoir Area and upper reaches". 21 plants of urban sewage treatment have been built up in 20 counties. This treatment can handle the scale of 1,595,000 ton per day; 41 pieces of field of urban garbage disposal also have been built up, which can handle the scale 7380 ton per day. It can mainly control the water quality to qualify the national Surface Water Quality Standards II in reservoir area and the upper reaches by 2010. By the end of 2007, the sewage treatment plant planned to build in reservoir area and garbage disposal field have basically finished and come into operation. Sixth, accelerate the geological disaster prevention and control. 12 billion yuan has been invested in "the overall plan on prevention of geological calamity in Three Gorges reservoir area", (including 4 billion yuan in the first period of treatment and 8 billion yuan in the second period); 617 collapse-landslip body has been

treated (197 places have been treated recently); 742 places have been Monitored and Early Warninged. Now the administration project in first and second stage of planning in reservoir area has been completed smoothly. Seventh, the country gives support in policy and funds in projects of "blue mountains and green waters" such as comprehensive treatment in water and soil slope, shelter forest of Changjiang water and soil controlling, natural forest protection, small watersheds management, returning farmland to forests and grasslands, agriculture's ecological project, ecological construction comprehensive management etc. By the end of 2007, 2,000km<sup>2</sup> soil erosion has been prevented. And also 0.9 million hm<sup>2</sup> are arranged to afforest, return farmland to forest and grassland tens of thousands of hm<sup>2</sup>, 180,000hm<sup>2</sup> basic farmland are built, more than 200,000 hm<sup>2</sup> of economic forest including fruit land are built. All these efforts would reduce the area of soil erosion by 24%, and reduce enter silt of reservoir area by 60%. Eighth, it has set up 12 pieces of reservoir area in land and aquatic biology. It has implemented the iron line brake of lotus leaf, dredged protection work such as colored water cypress branch, Chinese sturgeon, blusher fish, rare characterized fish of the Changjiang River, the large quantities of rare plants, rare animals of reservoir area have been kept. Ninth, the dynamic monitoring projects on soil erosion in some related departments have adapted new and high technology such as "3S" (remote sensing system, geographical information system, global positioning system) so that the precision of monitoring can reach at 1:50000. The rate of accuracy on information can reach to more than 85%, which has reached the most advanced level in international. [2]

### **2.3 The effect of protection is obvious.**

According to "Ecology of the Three Gorges Projects and environmental monitoring communiqué" which State General Bureau of

Environmental Protection release regularly every year: it has made great progress in the society of reservoir area of Three Gorges, in economy development, resettlement, moving enterprise's structural adjustment and environmental protection. And ecological environments such as water quality in the reservoir area, water and soil conservation, etc. are basically good. [3]

### **3 The main problems of ecological environment in Three Gorges Reservoir Area**

Although the ecological environmental protection in Three Gorges Reservoir Area has made prominent effect, it still shoulders heavy responsibilities in the future because the ecological environment in the reservoir area of Three Gorges is fragile, people have conspicuous contradiction with land, in addition, a million resettlers' moving and placement has brought a great deal of variable factors to ecological environment in the reservoir area on a large scale. At present, there are some existing problems as follows:

#### **3.1 The conservation storage of the reservoir aggravates the geological calamity.**

Because the landslide and collapse is frequently happened in the Reservoir Area, furthermore, the rock often breaks out. So it will bring out the earthquake, landslide and collapse on the storehouse bank after the conservation storage of the reservoir.

#### **3.2 The conservation storage of the Reservoir has increased the difficulty of prevention on water pollution.**

After the conservation storage of Three Gorges Reservoir, the depth of water increases, the velocity of flow is slowed down, the river self-purification ability is weakened, and some part of tributary storehouse gulf which is influenced by returning water is easy to appear the eutrophication phenomenon of water areas.

#### **3.3 Millions resettlers' resettlement in the Reservoir Area creates much more pressure on ecological environment.**

The Three Gorges Project's construction drowns a lot of land and resettlements one million resettlers from urban and rural, also needs to move 2 cities, 11 county towns, 116 market towns, reconstructs lots of industry and mining enterprises, rural highways, bridges, the harbors, wharves, the electric powers, communications, and so on. The resettlement to rebuild on a new site needs to take land more than 10,000hm<sup>2</sup> with the placement. Thus it causes the contradiction between human and land to be more incisive. At the same time, more than 200,000 countrysides resettlers must take the massive lands, which in turn will destroy vegetation, intensify soil erosion, creates much more pressure on the ecological environment.

#### **3.4 The ecological environment problem in eliminate to fall area of the reservoir is prominent.**

After the construction of the Three Gorges Project, there will became a seasonal drawdown area (its dropping variance is 30m) of the reservoir between the bank belt (145m) to the water level (175m). The area reaches 348.93 km<sup>2</sup>. Under the influence of the water level fluctuating with seasons, it is easy to have the avalanche geology disaster, intensify the reservoir landslide, the reservoir shore avalanche, damage the farming and the forest land, endanger the partial cities market town, the scenic area security and the stability of reservoir shore, then it takes bad effect on the reservoir area water shore ecosystem.

### **4. Some related countermeasures**

To further strengthen the protection of the ecological environment of the Three Gorges Reservoir Area, Ensuring that Three Gorges Dam play the overall efficiency, Ensuring that

the Three Gorges reservoir area into a prosperous, beautiful environment, and resettlers live in peace and harmony in society, resources and environment sustainable development of the emerging ecological area, The following countermeasures are especially proposed:

#### **4.1. Vigorously develop the propaganda and the education work, enhance the public to the protection and treatment and the participation enthusiasm.**

This work should mobilize people and depend on the people. It also must be through the publication, the broadcast, the television, the network and such many binds of media to have the pointed propaganda education. Let the people understand the current situation and existing problems in the Reservoir area. So that it can boost up people's consensus and support, make them have an idea of environmental protection, let them positively participate in the ecological environment protection and treatment work , promote the reservoir area ecological environment healthy development.

#### **4.2 Constitute and perfect ecological environment protection plan, establish and improve this work mechanism**

The Reservoir Area should study and formulate the overall strategy for environmental protection, systematically organizes to establish "General Planning for the Three Gorges Reservoir Ecological Environment Protection"; establishing and strengthening the work system; adhere to such principles as persist the governmental leadership, all quarters participation, the comprehensive management; advance with steady steps; Emphasize principle and so on actual effect; Use theories and thoughts of ecological environment, ecological economics and region economy sustainable development; follow the natural and social objective law, unified planning, rational distribution, step-by-step implementation, rely

on scientific and technological support, Effectively coordinate the economic development, resettlement, and the sustainable use of resources and the relationship between the protection of the ecological environment; promote the place economy development; Help the resettlers to escape form poverty and become rich; Enhance the ecological environment good protection; develop a harmonious society; Keep in harmony between human and nature [5]

#### **4.3. Work out related protect laws and regulations, Work according to laws.**

The Three Gorges Reservoir area ecological environment protection work is mainly about the social benefit and the environment benefit. Therefore the government should be the main undertaker of the work. And it should carry out a series of strategies by means of legislation and administration. The country, ChongQing, and the Hubei province people's government should organize the strength to study, formulate and appear the legal laws and regulations as soon as possible. We do these is to clear about all quarters relations, the benefits and responsibilities, to make the work have law to obey and support in order to carry out the work legally and rationally.

#### **4.4. Take comprehensive measures to strengthen ecological environment protection.**

First, establish and perfect reservoir management structure, formulate supporting methods and measures in system; Adopt economical means, administrative means and legal means to carry on the work to guarantee the reservoir area water-used security, the geological security and the ecological environment security. Second, drive the clean production in full. We should strengthen "the three wastes" to the existing industry and mining enterprise; Make strict with "three controls one standard" work; Strengthen the water, the gas, the noise preventing and controlling work in the

reservoir area; Guarantee the city and countryside life waste water, the industry waste gas, the noise and the vessel waste water to come up to the standard. Third, is to diligently prevent and control the agricultural area pollution. Develop “one biogas pond with improvements of kitchen, washroom and sty”, control the person poultry excrement to discharge at will drains, popularize low toxicity, low residue pesticide and measure soil formulation to apply fertilizer technique, prevent from “disorderly over agrochemical and turn fatly” etc. a series of methods. Fourth, do comprehensive treatment to water and soil loss, unify the project treatment, the biological treatment, and high-tech prevention together to treat the mountain, the water, the forest, the field, the road necessary renovates; Carry out the “beautiful scenery blue sky project” such as the Changjiang protection forest construction, forming the reservoir green shelters, the natural forest resources conservation, the small watershed water and soil treatment, returning farmland into forest or grasses, the conservation of water and soil project, the agriculture ecological engineering, the ecology construction comprehensive program of public order and so on. Fifth, carry out ecological resettlement orderly. Ecological resettlement is a strategic measure to solve the over-population and terrible, sensitive natural environment, to make sure the safety of ecological environment. According to estimation, there will be 0.2 million people need to be resettled. So the country, ChongQing, the Hubei province government and the department should research the policy-laws and management method. Establish the ecological resettlement plan in good time; Use many kinds of resettlement models to carry on the resettlement such as agriculture, the secondary and the tertiary industry, looking for jobs on their own, exporting service, education training, and shifts of the countryside’s resettlers. And we should adopt many kinds of ways to raise finance.

Enlarge the policy information propaganda and technical training dynamics which can help do the ecological resettlement orderly. Sixth, improve the monitoring system of Three Gorges Reservoir ecological environment. Establish the fundamental work for this protection and treatment work. Seventh, implement scientifically the ecological scheduling in the Reservoir. Reservoir scheduling should be balance the flood control, power generation, shipping, water and ecology. Make reasonably ecological scheduling plans in the Reservoir. Ensure the reservoir water environment and rivers ecology to be health.

#### **4.5 Enhance the ecological environment protection benefit by using the scientific and technological support.**

Technology is productivity, so the technical strut is playing a crucial role in the reservoir area ecological environment protection and treatment. It will promote the level and benefit of this work significantly. There are some measures: One, the government must formulate and implement some favorable policy which is advantageous to the scientific research work, the technical innovation. And it must provide good research trial and the production management, “the software and hardware” environment; simultaneously strengthen domestic and the international communication between technical cooperation and the technical exchange in order to study the advanced technology and the mature protection and the treatment models. Two, strengthen the work of disaster prevention and reduction, establish the disaster comprehensive defense system, including take measures against natural disaster, the disaster reduction technology system, the disaster monitors, and the early warning system and so on, to enhance the ecological environment protection and treatment. Three, popularization and application circular economy, strengthen comprehensive management of the reservoir area ecological

environment. Utilization in the countryside circulation economy in the promotion, we must develop the modernized agriculture mountain, the water, the forest, the field, the road necessarily by using the modern science and technology the ecological engineering; Gradually establish the countryside circulation economy and the ecological agriculture technology system, including optimal composition of the reservoir area ecological agriculture system, comprehensive utilization technology of the sideline products wastes, the vertical arrangement technique concerning plant growth, animal husbandry and fishery, the environmental protection and ecological engineering technology, the highly benefit ecological agriculture technology, the precision agriculture processing technology and so on to realize the agricultural sustainable development. Utilization in the cities circulation economy in the promotion, we must strengthen the cities waste comprehensive utilization and the worn out resources recycling use, the key advancement highly effective feeble-minded cities sewage treatment technology and the life trash resources technology research and the development, apply and promote the domestic and foreign advanced energy conservation technology, the pollution preventing and controlling technology, the ecological rehabilitation technology, the environment biological technology, promote the cities to regulate pollution and the circulation economy development. Four, carry out the scientific work of the biological treatment, project treatment, and the high-tech treatment in the eliminate and fall area. Research project technology involves the measure of environmental protection, material, design, construction. Research biology treatment involves the technology and measure of bears floods the amphibious culture of plants and the vegetation restores and the ecology protected mode. They two are to fully enhance its comprehensive benefit. Five, extend some

scientific work as soon as possible such as water environment treatment and recovery, development the sewage to regenerate the entire flow technology, the economical highly effective sewage sales commission technology, rain water circulation of water repair technology. Six, we must introduce and adopt the new technology, new craft, new material, and the advanced science and technology to strengthen the ecological environment protection synthesis supervisory work. Strengthen the reservoir area ecological environment monitor, the early warning and the supervisory work.

#### **4.6 Carry on the theory innovation, the technical innovation, policy innovation and the management innovation.**

In the process of protection and treatment work, there are some important and new problems such as the ecological scheduling in the Reservoir, the water environmental protection and recovery, the geologic disaster prevention and control, the treatment in the eliminate and fall area, comprehensive treatment in water and soil loss, biodiversity conservation. All these are to be researched in time and make theory, technology, policy, management innovation. One, on the base of comprehensive Analysis of the ecological impact water problems in Three Gorges Reservoir scheduling, actively explore the theories and methods, such as simulating natural hydrological situation of the reservoir discharge mode, reducing the impact of the reservoir temperature stratification, Sediment control, Reservoir eutrophication, pollution control, maintain the water ecological health in the Reservoir Area and the basic function of the downstream river water demand, etc. Research and innovate Ecological reservoir scheduling methods and technology, such as “Clean water savings, muddy water excretion”, “artificial peak” and “Main Stream and tributaries' scheduling”.[5] Two, as to the protection and recovery of water environment,

we had better introduce the world developed country synthesizes the running water resources and the water pollution management theory, like the water resources synthesis management, the facing sustainable water management, requiring water management theory, and water area management and so on, the management theory, pattern and technology unify the Three Gorges reservoir actually to carry on the innovation development, transform from formerly the pure water pollution control for the omni-directional water environment recovery. Three, we should study and set up a new mode and technology to use water, develop a healthy social water cycle project, including controls the water used, sewage depth processing and the effective use, the sludge from wastewater treatment plant return farmland, restores the city rain water circulation way, the agricultural area pollution source pollution control as well as the water resources overall plan management and so on. [6] Four, research the new theory, new method, new technology, new craft and new material to prevent the geologic disaster pointedly, to enhance the efficiency and the benefit of the geologic disaster prevention diligently. Five, enhance the treatment in the eliminate and fall area and management works which concern financial-raising, storage capacity, sand accumulation, technological treatment, the new land use nature transformation and examination and approval, in aspect to make management benefit. Six, establish the demonstration project in the small watershed environment to do comprehensive treatment about water and soil loss. Accumulate the experience for providing the model to realize the large-scale water environment restoration and the wide range water and soil comprehensive treatment. Seven, make creative thoughts and management in biodiversity protection, In order to do this work well. It's essential to take such measures : use "the multi-strip leg walk", the union of administrative action and the market behavior ,

the overall plan use of national resources, the social forces, the folk strength, the technical power to raise finance in every way. Optimize protection scheme, preservation technology and management to diligently do the biodiversity protection work well.

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#### **The author's brief introduction:**

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