

Recovering and Rebuilding Ecological System of Lower Reaches of Tarim River and Lop Nur Region in Xinjiang

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Abstract: Under the impact of natural condition and historical factor, the area of lower reaches of Tarim River and Lop Nur region has been dried up for many years, and it has caused a lot of serious ecological consequences. In this paper the basic ways of ecological system's recovering and rebuilding have been put, and introduce Eco-benefits of emergent water transportation project to lower reaches of Tarim River.

Keywords: Ecological system, Lop Nur, Recovering, Way

1. Introduction

There are an area of about 4.08×10^5 km² and a population of 7.0×10^5 people in the area of lower reaches of Tarim River and Lop Nur region. The region is located in the eastern part of Tarim Basin, within Bayingolin Mongolian Autonomous Region of Xinjiang, closes to Gansu Province in the east, near lower reaches of Tarim River in the west, the north is Jueluotage Hill of Tianshan Mountain, the south is the north foot of Aljin Mountain.

2. Eco-environmental situation and existing problems

2.1. Climatic characteristics

This region is in the hinterland of Eurasian continent, which belongs to extremely arid continental desert climate in warm temperate zone. Although the weather condition is bad, the climatic resources are very rich, such as solar radiation, wind energy etc, which are higher in the same latitude, and suitable to promote the use of solar stoves, solar water heaters, solar greenhouse, solar cells, and so on. Wind power resources enable small wind-driven generator to operate during nine months normally. The abundant effective photosynthetic radiation (Li, 1991), adding to large temperature difference between day and night, is conducive for plant to process photosynthesis and accumulate photosynthetic product, hence, the potential of improvement of solar energy utilization in agricultural production is great in lower reaches of Tarim River.

2.2. Water system features

The length of the river course of lower reaches of Tarim River from Qiala down to the inlet of Taitema Lake is 428 km. Taitema Lake has dried up in 1972. Only on the case of artificial water transportation at present, the seasonal water is poured into the Taitema Lake. There are three low and level water logged depressions in the eastern of Tarim Basin, the higher one is Taitema Lake (810 m) in the southwest, the middle one is Kalaheshun Lake (790 m), and the lower one is Lop Nur (780 m) in the northeast.

2.3. Geomorphological features

Most area of lower reaches of Tarim River is alluvial plain, the relief of Taitema Lake in the southern is the lowest. Because the river has frequently changed its course in history, a broad riparian zone has formed. From the edge of the desert to its hinterland, the types of sand dunes transits from the fixed or the semi-fixed to the mobile with the height of 5-15 m generally. In the southeast of lower reaches of Tarim River there are Aljin Mountains and Kunlun Mountains, which are high and steep. The relief level from the mountains to the north becomes lower gradually and reaches to the foot of mountains eventually, the Geomorphological types corresponding to which in turn appear: diluvial or alluvial fan in

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the front of mountains, separate oases, alluvial plain, wind erosion or lacustrine plain. The latter is at the eastern edge of Taklimakan Desert, which joins together with Taitema Lake, Kalaheshun Lake, as well as ancient Lop Nur.

2.4. Biotic community

All of rivers in Tarim River basin have a common feature that is the groundwater generally supplies for the rivers before it outflows from the mountains, and conversely the river water supplies for groundwater after it outflows from the mountains (Xinjiang Comprehensive Scientific Investigation Team, 1964). Because of coming water from Tarim River and other rivers rising from the north slopes of Aljin Mountains and East Kunlun Mountains, "Green Corridor" has formed in above regions, with the features of intermittence and a width of 1-10 km, which consists of *Populus euphratica* zone along the rivers, edge zone of alluvial fan, as well as oases spreading all over the place. In this region, the vegetation coverage is better, and farming as well as forest-fruit industry is more prosperous. The main vegetation in lower reaches of Tarim River and edge zone of alluvial fan is *Populus euphratica*. There are one kind of amphibian species, seven kinds of reptiles, ninety six kinds of birds, twenty three kinds of mammals in this region, and some special fishes in Tarim River, for example, *Aspiorhynchus latieps* etc..

2.5. Existing problems in ecological environment

With the water amount flown into the main stream is decreasing all the time, and the ineffectually wasted water resources in the main stream is very serious, and the lasting deterioration of eco-environment in lower reaches of Tarim River has appeared: 1) The water amount has decreased definitely flowing into the main stream from source streams; 2) the mineralization degree of well water has also ascended from 1.3 g/l to 4.5 g/l in 1998; 3) A large area of *Populus euphratica* has perished on both sides of the main stream.

3. The basic ways of ecological system's recovering and rebuilding

3.1. Solve the water-supply problem in lower reaches of Tarim River by adequate methods

If the water resources could be allocated by adequate ways and the water supply in lower reaches of Tarim River would increase, it would be possible for Taitema Lake to maintain an everglade or a lake which has an area of dozens of square kilometers. Because Taitema Lake is a part of Lop Nur in broad sense, it could be said that the former landscape of Lop Nur like a water village is partly restored.

3.2. Construct an effective water-saving pipe system

A standard water transportation pipe system should be set up in lower reaches of Tarim river. It is 173km long from Daxihaizi reservoir reaches to Taitema Lake on lower reaches of Tarim River, and it plays a role of main artery in Green Corridor, which can be used to irrigate automatically in a certain time with a fix quantity and a certain ratio of nourishment.

3.3. Construct desertification controlling system

To protect and cultivate *Populus euphratica* better and reintegrate *Tamarix* spp. shrub along the water transportation pipe and the national highway, at the same time to set up five different desertification controlling testing and demonstrating bases including Yingsu, Alagan, Kaogan, Luobuzhuang and Taitema Lake, the whole area can be brought along.

3.4. Construct ecological sustainable development projects

3.4.1. Distinctive system of agriculture and animal husbandry in oasis

To develop oasis on ecological situation and production simultaneously, to implement strategic structure restructure. The ratio of the occupied field by grain-cotton, forest-fruit and grass would be adjusted from 8:1.5:0.5 to 5:2:3.

3.4.2. Halophyte industry project

There is abundant halophyte resources concentrate distributing in this area, the kinds of which account for 49% of the total number in China and 8% of the whole world. All of them are suitable to cultivate aptly in this area, to form a halophyte industry project with scale benefits. Halophyte has the

ability to accumulate salt, and so it can make the land desalt if grown on alkaline land.

3.4.3. Distinctive traveling and ecological traveling

The long history, abundant historic sites, unique sights, outstanding circumstance, spectacular ethical culture and customs, particular natural human landscape, for example, Ancient Loulan City, Silk Road, Desert and Oasis, Yardang landform, *Populus euphratica* etc., all of which have provided ascendant conditions for developing local distinctive traveling and ecological traveling, may become another new support industries in economic development.

3.4.4. Ecological migration and urbanization project

Urbanization has a great influence on the socio-economic and cultural development, environmental restoration and protection. In city chain around the Tarim Basin, only in the southeast corner lacks of a medium-sized city. The city can centralize the remote resident combined with ecological migration, and improve people's culture and living standards, and decrease ecological pressure in the mountainous area and the margin area of oasis; and it can promote national unity and stabilize the border society, then it is easy to administrate and utilize the national investment and allocate the natural resources uniformly.

3.4.5. Construct an advanced management and operation system

Whereas the ecological recovering and rebuilding relates to four counties and one city as well as six farms of second agricultural division of Xinjiang Production and Construction Corps, the main body of interest is different, and the water resources is also of different, the ecological and economic conflicts are remarkable around water resources, and the market adjustment mechanism in process of resources using has not yet established, adding to the particularity of ecological restoration and rebuilding projects, therefore, the management or innovation should be enhanced in the following aspects: 1) Carry through the plan and design project and preliminary study; 2) Establish a sound water resource management system and allotment mechanism; 3) Strengthen construction of laws and regulations, to carry through management in accordance with the laws; 4) Strengthen popularization, education and training on the project.

4. Eco-benefits of emergent water transportation project to lower reaches of Tarim River

4.1. Overview on emergent water transportation project to Green Corridor in lower reaches of Tarim River

From 2000 to 2003, the emergent water transportation project had implemented for five times. The course in lower reaches of Tarim River has accepted a total water of $17.8 \times 10^8 \text{ m}^3$, in which from Daxihaizi down is $16.58 \times 10^8 \text{ m}^3$.

4.2. Eco-benefit of emergent water transportation project to Green Corridor in lower reaches of Tarim River

In order to do prototype observation of emergent water transportation project better, to provide first-hand information for recent Tarim Basin comprehensive management, and to provide scientific basis for effective assessment of water transportation, many contents were observed including surface water, ground water, soil water, vegetation response, and so on (Xia *et al.*, 2007). Since the project implement, 1) the impacted area in the lower reaches has become larger; 2) the groundwater level has being risen gradually; 3) Ground water quality has been improved significantly; 4) soil moisture is gradually increasing on the whole; 5) the vital force of natural vegetation has restored partly; 6) animal community situation has also improved.

5. Conclusion

The Recovering and Rebuilding Ecological System of Lower Reaches of Tarim River and Lop Nur Region in Xinjiang put forward in this paper is an improvement further on the basis of former achievements. The implement of this project has a very important significance for local people to improve ecological environment, mineral resources exploitation, economic and cultural development, social stability, and national unity. It also provides developing experience for other extreme drought areas of the world.

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References

Li J. (1991): *Climate in Xinjiang*. Beijing, Weather Press.

Xia X., Wang F., Zhao Y. (2007): *Lop Nur in China*. Beijing, Science Press.

Xinjiang Comprehensive Scientific Investigation Team, CAS (1964): *The hydrological status in southern Xinjiang [M]*. Beijing: Science Press.