

RURAL SANITATION, ECOSYSTEM AND CHINA WESTERN REGION DEVELOPMENT STRATEGY

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China Western Region Development Strategy (CWRDS) is one of the most important policies that Chinese Government put forward at the beginning of the new century. It is anticipated to play a fundamental role in the process of Chinese modernization. The most impressive character of the CWRDS is its focuses on the sustainable development. Holistic ways are adapted to sustainable develop the region. The improvement of rural sanitation is one of the key issues in the strategy. China has made great progress in the epidemic prevention since the 50ths when new China was founded. As the development of economy and science, the importance of rural sanitation in the protection of ecosystem becomes more and more conspicuous. This paper attempts to analyze the positive roles that rural sanitation plays in the protection of ecosystem, and ways of how to integrate it with the development of the western regions.

The Pressing Situation in the Western Region

The western region that is quoted in this paper refers to the 12 provinces and autonomous regions (cities) that are stretched in the western parts of China. The western region covers a vast territory with a large population. Its ecosystem is vital for the whole country. Due to over-exploitation of resources, its ecosystem has deteriorated. This has resulted in the vicious circle and made the ecosystem more and more fragile.

Soil Erosion China is one of the countries in the world that faces serious soil erosion. Every year, about 3.67 million square km of land, which accounts for 1/3 of its whole territory, suffers soil erosion caused by wind and rain. In the western region, the problem is more serious. The effected areas account for 70% of the whole region. Each year, about 2 billion tons of silt is flooded into the Yangtze River and Yellow River.

Deforestation and unreasonable exploitation of grassland Excessive exploitation and unreasonable human activities have led to deforestation and desertification in the western region. In Inner Mongolia Province, 54% of cultivatable grassland is suffering from desertification. When the Cai Da Mu Basin was opened up, tons of grass and turf was dug out and burned, which led to the destruction of the ecosystem. 20 million mu out of the total 30 million mu of turf in one prefecture of this region has disappeared.

Desertification One of the direct result of deforestation and damage of grassland is desertification. Statistics show that before the 70ths, 1580 square km land of was turned into desert every year. When entered the 80ths, this figure was raised to 2100 square km per year, and erupted to 2460 square km in the 90ths. Consequently, thousands of land has become desert in the northwest parts of the western region. While in the southwest parts, due to its fragile landform, lands are easily become uncultivable. Once the trees and plant were cut, the karst formation exposed to sun and rain, the lands turn impossible for any cultivation. In Guangxi Province alone, 34.5 million mu's land has become uncultivable, which accounts for 11% of total cultivated land of the province.

Water Resource Scarcity Due to the reduction of precipitation, water levels of many rivers have dropped lower and lower. The total area of Shanxi, Gansu, Xingjiang, Qinhai, Ningxia and Inner Mongolia Provinces accounts for 1/3 of the total area in China, but the water resources of these provinces only accounts for 8% of the total in China. Shanxi is a very dry province, averagely per person has about 1,311 cubic meters' water. The situation is more adverse in Gansu and Ningxia Provinces. Guangxi is a province with abundant water but unevenly distributes. In the northwest rural areas of this province, people are still suffering from water shortage and inadequate water supply. A small pond of water, or water in a rainwater collection tank is sometimes the total water they rely on for the whole year.

Water Pollution In the process of urbanization and industrialization, water is polluted. This problem is getting worse and worse. In some areas, not only the surface water has been contaminated, but underground water is also polluted. Water samples drawn from the 1995 deep wells in the 6 provinces and regions in northwest China showed that among 69 cities in these provinces and regions, underground water of more than half of these cities has been seriously contaminated. Another environmental problem is the pathogenic pollution due to the discharge of sewage water, and the disposal of un-treated solid waste and human excreta. The karst formation is the typical landform in the provinces and regions of southwest China, the infrastructure in these areas is usually very poor, and the coverage of sanitation facility service is inadequate, sewage water is discharged before any treatment, human excreta is reused as fertilizer before it is sanitized. As a consequence, the incidence rate of intestinal diseases is very high in this region. There is a definitely need to explore a way of how effectively sanitize human waste to bring down the incidence rate of intestinal diseases.

Rural sanitation and Ecosystem

The adverse circumstance hinders the development and result in poverty. In another hand, the unreasonable human activities in the course of fighting against the poverty aggravate the situation. Lessons in the past required that protection of ecosystem must be prioritized when formulate the development strategies. Government interference, such as policies to regulate the environment protection, direct government support, establishment of ecosystem compensation mechanism and effective measures are key to the improvement of the environment. It is the time for the western region to establish overall plan for ecological restoration under the general framework of sustainable development, restore of ecosystem by preservation of natural forest, close hills for natural regeneration, establish shelter belt systems, develop of no-wood production and encourage the development of small towns. Attention is necessary to address the important role of rural sanitation in environment protection, and measures should be adapted accordingly.

Soil Erosion and Environment Restoration Provision of toilet is the basic condition to prevent water and soil from polluting by pathogen. Studies indicated that the provision of toilet greatly reduces soil contamination, and the number of Ascaris eggs in soil was reduced by 70%, and hook worm eggs was reduced by 89%. The direct benefit is the reduction of intestinal infectious diseases. A World Bank funded Rural Water Supply and Sanitation Project was launched in 1992. Under the project, 10 villages were chosen as the demonstration villages to conduct health education and construction of water supply schemes and toilets. A study showed that the incidence rate of intestinal infectious disease was reduced by 94% and 57-66% reduction of Ascaris cases, and fly density is reduced by 62-67% in these villages.

Rural Sanitation and Water Source Protection Provision of toilets prevent

water source contamination and secure drinking water quality. After treatment to human excrement, the BOD5 and CODcr is reduced by 90% and the average BOD5 content in the end product is 166mg/L, and CODcr is 515mg/L which meets the 3rd Grade of national standard for Sewage Water Treatment Standard. Thus, the benefit of environmental is enormous.

Sanitation & Organic Fertilizer China has a long history in using human waste as fertilizer for agriculture activities. The real problem in China though is that some farmers apply untreated human sewage directly to the fields, and thus caused contamination. Provision and use of toilets not only can prevent contamination, but also provide good organic fertilizer and enable the sustainability for rural development. Researches showed in the course of sanitizing process, the nitrogen in urine converts to ammonia, which make it a higher degree of fertilizer for plants. The experiment conducted in Wuming County, Guangxi Province found that the end-product from a bio-gas toilet is usually 20-30% higher efficiency in fertility than that from other type of toilets. Fruit tree grows better and quicker by using the fertilizer from a bio-gas toilet. It also bears bigger and sweeter fruits than other trees.

Urine diverting toilets turn human waste into a safe and high degree of fertilizer

A person excretes 25-50 liters of feces in a year which can provide 0.55 kg nitrogen, 0.18 kg phosphorous and 0.18 kg potassium. The fiber in feces is turned into humus after composted. Among the 400-500 liters' urine that a person is estimated to produce in a year contains 4 kg nitrogen, 0.4 kg phosphorous and 0.9 kg potassium. All these nutrients are in the form that easily absorbed by plants. Urine is considered an ideal fertilizer for plants because it is sterile and lower in heavy metal content. Successful experience from the 5 pilot villages in Yongning County, Guangxi Province proved that urine diverting dry toilets are effective in sanitizing human wastes and can provide high degree of organic fertilizer. After use of the organic fertilizer from urine diverting toilets, the yield of sugarcane, watermelon and peanut is increased, and the income of per farmer is increasing year by year.

Energy and Vegetation Protection Due to the poorer living condition in the western region, farmers have to use wood, hay or rice & wheat straw for cooking, heating and sometimes for lighting too. These practices led to the deforestation and environment degradation. The use of bio-gas toilets is a remedy to these problems. A bio-gas toilet system provides green energy for cooking, lighting and heating. It changes the fuel structure, and saves wood and hay from being burnt for cooking and reduces the use of coal and gas. Experience from Gongcheng County showed that a bio-gas toilet system provides energy that is equal to 2000 kg wood annually. After the large-scale construction and use of bio-gas toilets system in this county, the forest coverage was increased to 70.84% in 1996 from 54.2% in 1984.

Save Water A conventional toilet uses 30 times the volume of the excreta that is about 15000 liters clean water to flush the 50 liters feces and 500 liters that a person excrets in a year. This wastes a lot of our precious water resource. New toilet technology makes great achievement in water preservation, particularly the urine diverting toilets. A urine-diverting toilet is also called urine diverting dry toilet which requires little water or no water. The feces is treated through decomposition and dehydration process, while the urine is flushed into a container by using 100-200 ml water. If a person requires 2000 liters water to flush his or her urine per year, which means that per family will require about 8000 liters water per year if assumed each household has 4 persons. If the toilet coverage rate needs to be increase by 10%, that means 850,000 new urine diverting toilets need to be built, which can save 6.8 million

liters water per year. The advantages of urine diverting toilets are obvious, especially for the western region where water scarcity is prevalent in most the areas. The result of a study conducted in Shanxi Province proved that the urine diverting dry toilet is one of the best sanitation alternatives to the arid and cold condition. The Dongbei Region is the region includes provinces in the northeast, northwest and northern parts of China, which covers an area of 3.33 million square km and 34.6% of total Chinese territorial area. Those regions are relatively arid and cold, the urine diverting dry toilets will be one of the best sanitation alternatives in the region.

Wastes Reuse and Wastes Recycle Although recycling of human wastes is not a new idea in China, but it represents the most sophisticated concept in environment protection. Human excreta are processed on site and reused as a valuable fertilizer. Prevention before hand rather than treatment afterward. The approach that is based on disposal should be shifted to the one aimed at zero-discharge and recycling. In doing so, fresh water resource will be saved and the ecosystem will be well maintained.

Greenhouse Effect The greenhouse effect will be reduced if the carbon content in human excreta is added to soil rather than released into atmosphere. The cause of global warming is the build-up of carbon dioxide (CO₂). Reducing the CO₂ emission from fossil fuel burning and the clearing of rain forests will help the reduction of CO₂. Returning sanitized human excreta to soils will enhance soil fertility and is good for plant growth . A modest doubling of the amount of carbon in non-forest soils, from the current low level of 1% (as a result of erosion) to 2% over the course of 100 years would balance the net annual increase of atmospheric carbon over that time.

Health Consciousness and Environment Improvement Rural sanitation including environment upgrading and health education achieves the improvement of people's health and a better environment. When the environment is improved, investment and tourism will be attracted to these areas. Once farmers' consciousness is increased, they will spontaneously participate in the protection of environment which is crucial for the success of the China Western Region Development Strategy.

Summary and Conclusions

Environment protection listed on the top among Chinese policies and sustainable development is the key to the western region development strategy. The implementation of China Western Region Development Strategy (CWRDS) gives rural sanitation an opportunity to reveal its advantages. Rural sanitation is the point to tackle for health improvement, moral education, ecosystem protection and economic development.

Integrate sanitation improvement with epidemic disease prevention Prevention and control of diseases is the priority in rural sanitation. The adverse natural conditions in the western regions cause poverty but also bring high incidence and prevalence of epidemic diseases. Hence these reasons, focus of our work in rural sanitation will be given to those high-risk areas, such as the coastal areas, marshes, scenic spots and areas with high incidence rate of intestinal diseases. The principle is "achieve a big benefit with a small input".

Integrate sanitation improvement with economic development The fragile ecosystem in the western regions is degraded to its limit as some people call it the "Eco-crisis". Improvement of rural sanitation is an effective way in preventing this crisis from getting worse. We should popularize the use of urine diverting dry toilets

and bio-gas toilets, and bring them into full play in the western region development strategy.

Integrate sanitation improvement with the economic development To integrate the construction of toilet with the improvement of local economy. The chain of "Planning-Feeding-Processing", in which the value of resources and farm products could be greatly increased, should be established according to the situation of regional resources, eco-economic principle and the rules of market economy. This will promote the development of fruit and vegetable production, animal husbandry, grain production and forestation, thus to accelerate the development of rural economy.

Roles in Small Towns Construction and Social Development Development of small towns and industrialization are the important components in the 10th Five-year Plan. The merge of small towns will decrease the percentage of rural population and ease the burden and dependence that farmers once put on environment. Implementation of the policy of "stopping cultivation for reforestation and closing hills for natural regeneration" will bring forward a favorable condition for environment protection. When designing the blueprint for small town construction, one should keep in mind the construction of public facility and household toilets, only by doing this, the beneficiaries of modernization will be brought into full initiative.

Systematic Approach and Long-term Management The ecological environment should be managed and stereo planting should be developed through biological and engineering measures. These measures are assembled according to ecological principles and system engineering to realize the strengthening of the farmland productivity while optimizing the construction of farming, forestry and animal husbandry. With these measures, one can not only make the relationship between regeneration and cycling utilization of resources in harmony but also make the capacity of the self-maintaining and self-designing of agro-ecosystem improve, furthermore can strengthen the stability and sustainability of the system.