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Thinking of the Ecological Restoration of Small Watershed Rivers in Mountainous Areas — Taking Panjiahe Small Watershed in Western Mountainous Area of Yuzhou as an Example

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Abstract: The development of rural urbanization and the improvement of industries and agricultural development have improved the income of rural residents, which corresponds to the lag of urban infrastructure construction and the aggravation of water pollution. In this paper, Panjiahe River in the western mountainous area of Yuzhou is taken as the research object. Through field investigation, the main causes of ecological environmental damage are explored, and the successful experience of ecological restoration in other areas is learned. Countermeasures for water pollution, soil erosion and other phenomena in mountainous cities and towns are put forward. It is found that there are many workshops and livestock farms in the basin, and the construction of sewage pipe network is basically blank, which can not meet the needs of urban residents.

Keywords: Mountain Town; Small Watershed; Ecological Restoration; Biological Invasion; Countermeasures

1. Introduction

With the continuous improvement of urbanization in rural areas, the living conditions of rural residents have been greatly improved, resulting in the use of resources without planning, the sharp increase of pollutant emissions, reduction in environmental carrying capacity, and the urgent repair of the ecological environment. Taking Panjiahe small watershed as a typical case, through field investigation, this paper explores the causes of pollution in the watershed with systematical countermeasures for ecological restoration, so as to provide reference for pollution prevention and control of small watershed in mountainous towns.

2. Basic situation of Panjiahe small watershed

Panjiahe small watershed is located in the western mountainous area of Yuzhou. The river, with a total length of 16.5km, a drainage area of 76 square kilometres and an average annual runoff of 2.08 million cubic meters, flows through Fangshan, Huashi and Shundian towns. The basin is located in the transitional zone from Funiu Mountain to Yingchuan Plain, with annual average rainfall of 650mm, which has obvious seasonality.

3. Current situation of Panjiahe small watershed

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3.1 Water pollution

It is found that the total amount of pollutants discharged in Panjia River Basin exceeds the environmental allowance of the basin, and the water body has basically lost its self purification capacity, which is mainly divided into the following aspects.

3.1.1 Rural surface source pollution

The widespread use of chemical fertilizer caused eutrophication of water through rainfall, irrigation process into the river. With the extensive use of pesticides, a large number of undissolved pesticides will enter into the soil, river, polluting the soil and water with rainfall and flood irrigation.

With the acceleration of urbanization in rural areas, more and more rural people gather in cities and towns, and the corresponding amount of domestic sewage increases. Without effective treatment, sewage will directly flows into the river, causing serious deterioration of water quality.

Some rivers are dry, and some rivers even become the main objects of rural garbage and sewage discharge with a large number of harmful substances and heavy metals seeping into water and soil to form pollution[1].

3.1.2 Rural point source pollution

For "small and scattered" enterprises and workshop type processing plants in the basin, without sewage collection, treatment measures or treatment and prevention measures, it is not in place to effectively dispose the produced sewage.

Some livestock and poultry farms are distributed along the river. Without much attention to the treatment of animal manure in the process of breeding, these farms do not clean it in time. In rainy days, animal manure is washed into the river, resulting in water pollution and eutrophication.

3.2 Soil erosion

Panjiahe small watershed is located in the hilly area in the northwest of Yuzhou City. The artificial spoil of urban construction is an important source of soil erosion, and the annual soil erosion modulus of all kinds of spoil slopes is more than 50000-70000 T / km2, 9-11 times larger than that of bare wasteland, 19-24 times higher than that of spoil heaps. Meanwhile, small urbanization changes a large area of the ground into an impermeable layer and the original hydrological characteristics of the local area. It increases the runoff modulus, the total flood volume and peak flow, and the frequency of river flood disasters in the process in a shorter confluence time[2].

3.3 Biological invasion

As a biological invasive species, hollow lotus seed dish forms a dominant population in the river[3]. Water quality is polluted after decay, which makes the water worse and stinks. Its propagation speed is very fast, and it consumes a lot of dissolved oxygen, resulting in the decrease or extinction of fish population[4]. The rapid growth of alternanthera philoxeroides slows down the flow velocity, thus aggravating the sedimentation of the river. It leads to poor flood discharge in flood season and hinders the safety of flood discharge, which also easily cause the wear of hydraulic machinery and serious influence on the irrigation and drainage of agriculture.

4. Analysis of the causes of the present situation of Panjiahe small watershed

4.1 Water pollution

The aggravation of rural water pollution is caused by the increase of rural pollution sources, the enhancement of discharge, the interference of human production and life in the process of surface runoff transportation. The rural sewage treatment system is very weak, and the people have no place to deal with domestic sewage, so they can only let the sewage cross flow. Finally it will flow into the river through small tributaries and gullies, leading to water pollution and eutrophication.

The competent departments of urban planning and industrial development do not fully consider the bearing capacity of resources and environment in the basin, so the basin development planning is not scientific and reasonable. Relevant departments did not form an efficient cooperation mechanism, resulting in "barbaric growth" of all kinds of construction in the basin[5].

The environmental management mechanism in rural areas is incomplete, and the environmental protection institutions in rural areas are very weak. At the same time, due to the decentralization of power, the management power of relevant departments is small. Besides, the execution is weak and management awareness is not

strong. It is difficult to manage the domestic water pollution in rural areas.

4.2 Soil erosion

Urban planning and construction personnel have no strong awareness of protecting urban ecological environment, and the benefits of ecological protection are very low in the short term. In the construction of small towns, there is no plans for soil and water conservation. In riverbanks and reservoirs, a large number of spoil and slag are dumped.

The supervision and law enforcement work lag far behind the process of small town construction. At the same time, the degree of soil erosion is further aggravated due to the difficulty of the investigation and treatment of soil erosion cases, the irregularity and laxity of law enforcement personnel.

4.3 Biological invasion

River chief system has not been effectively implemented. River chief responsibility board is prominently erected beside the stinky river section, with alternanthera philoxeroides covering the river course. At the same time, there is no long-term stable investment of governance funds, and the funds for watershed governance are insufficient, which makes it difficult to form a large-scale clean-up.

5. Some measures for the management of Panjiahe small watershed

5.1 Ideological and policical orientation

In view of the low quality of the population, culture and science in rural areas, we can use various popular forms among the people, such as literature and art performances, network new media and so on. At the same time, awareness of environmental protection should also be educated to the next generation. It is necessary to add the content of ecological environment protection in the classroom and teaching materials.

Ecological protection policy system, research, supporting policie for rural water resources protection and rural economic development should be established. The government adopts multiple ways, reasonable policies and advanced technology to demonstrate guidance, so as to achieve a win-win situation of farmers' income increase and environmental protection[6], bringing benefits to the people. At the same time, the laws and regulations of rural water environment protection should be improved. Considering the actual situation in rural areas, the government needs to formulate the local legislation of water environment suitable for the rural water environment system as soon as possible to improve the situation that the prevention and control of rural water pollution can not be relied on[7].

In many cases, the problem of rural pollution is that "No one can help it". The environmental protection institutions of the people's governments below the county level in China are not perfect. Therefore, for the rural ecological management, a special management department can be set up, to centralize management power. At the same time, the institutions should enrich the rural environmental protection force with strengthening the publicity, inspection and management of rural pollution to build a rural daily environmental detection system[6].

5.2 Construction of rural sewage treatment system

In rural areas, with low living standards and relatively scattered sources of domestic pollution, the use of water for direct flushing and centralized urban sewage treatment system for transportation and treatment is uneconomical and unsustainable. Classifying the pollution sources can be connected with separating black water (with feces) and grey water (washing water). The black water is treated by anaerobic biogas tank or biogas septic tank, and the grey water is reused after manual or natural treatment[8].

5.3 River channel regulation

5.3.1 Upstream water and soil loss section

In the planning and design, protection and utilization of the original water area and water conservation facilities are worthy of attention, and research on hydrological characteristics should be strengthened. The development and construction projects shall strictly follow the prepared water and soil conservation plan with a soil erosion monitoring system[2].

5.3.2 Treatment of downstream water pollution section

The treatments include stabilizing environmental water quality and cleaning up river channel in time. During the seasonal change period, cleaning up the defoliation and wilting aquatic plants entering the river channel in time can reducing water pollution. The rubbish dumped in the river channel and both banks and the silt of the river channel also need to be cleaned up to improve the flood carrying capacity of the river channel. Rectification and closure of enterprises heavily polluted along the river, and enterprises whose pollution treatment fails to meet the standards within the time limit or are banned.

5.3.3 Treatment of hollow lotus seed dish

At present, there are usually three types of physical, chemical and biological methods to remove hollow lotus seed dish. Physical control methods are mainly artificial fishing, crushing or removing roots and stems of crops, and concentrated drying or burning them[3,9]. Chemical control methods mainly use chemical agents to kill hollow lotus seed dish. The chemical control experiments made by fluroxypyr, glyphosate, bentazon emulsion, chemical control experiment by Xiuhong Wang and others show that 10% glyphosate water has the best short-term control effect, 20% fluroxypyr emulsifiable concentrate has slow effectiveness but the final control effect is ideal[10]. Biological control method mainly uses insects, microorganisms and their metabolites to control alien species. Compared with chemical weeding, it has the advantages of no environmental pollution and no drug damage[11]. The introduction of lotus grass jump straight chest armor can be used to control the growth of hollow lotus seed dish[12]. The research of Meimei Xiang showed that the mixture of fluroxypyr and nongda with lotus seed grass off every chain spore had synergism in controlling hollow lotus seed dish, which could not only enhance the efficacy, but also reduce the environmental pollution[13].

At the same time, hollow lotus seed dish can benefit the local area. The content of potassium in hollow lotus seed dish is high, which is a good potassium fertilizer resource[14]. At the same time, hollow lotus seed dish can be used as animal feed[15]with certain medicinal value. The clinical results show that hollow lotus seed dish has obvious therapeutic effect on measles, encephalitis B, hemorrhagic fever and other diseases[16]. Hollow lotus seed dish is also effective in pollution control. It is mostly used in sewage treatment[17]. The research of Weidong Huang and others shows that it is feasible for hollow lotus seed dish to produce biogas in a push flow anaerobic reactor[18]. Research of Shumei Wang showed that the super absorbent resin can be prepared by using hollow lotus seed dish[19]. Zhen Zhang and other researches have shown that it can has good remediation effect on polluted soil by absorbing heavy metal elements[20]. Hollow lotus seed dish can properly used in the process of controling soil and water pollution .

5.4 Development of ecological agriculture

First of all, revelant institutions need to strengthen the publicity of ecological agriculture, so that the concept of ecological agriculture is deeply rooted in the hearts of the people, and the concept of ecological development can be fully integrated into all aspects of agricultural production[21].

Developing and popularizing the eco agricultural technology suitable for the development of rural environmental protection are crucial. For example, through biogas ecological agricultural technology, biogas can be invoked as a fuel for greenhouse insulation in vegetable greenhouse planting, so as to provide an environment for greenhouse vegetable planting. The large amount of CO2 contained in biogas can also promote the growth of greenhouse vegetables[22]. At the same time, a large amount of CO2 contained in biogas can create conditions of high CO2 and O2. It regulates the respiratory intensity of vegetables to inhibit the production of fruit and vegetable mould bacteria, which has the effect of fresh-keeping[23]. Moreover, biogas slurry can be used as farmyard manure or mixed with animal feed to increase the yield[22].

6. Conclusion

Difficulties in policy and law enforcement, wrong estimation of environmental carrying capacity and damage of rural production and life style to the environment are the main causes of ecological environment damage in Panjiahe small watershed. The corresponding countermeasures are as follows; Firstly, it

is necessary to ensure the establishment and improvement of the environmental protection policies applicable to rural areas. Secondly, the law enforcement team of rural environmental protection should be improved, and the establishment of the monitoring system of rural environment and soil erosion needs to be implemented. Last but not least, through the promotion of the changing production and life style of rural residents, and establishment of the rural sewage treatment system, the government must concentrate human and financial resources to remove the hollow lotus seed dish in the river and develop ecological agriculture.

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