Theoretical and Technical Analysis of Vegetation Restoration and Construction in Loess Plateau

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Abstract: Vegetation restoration and construction in Loess Plateau is a key project of ecological construction in China, which has great strategic significance. This paper mainly discusses the scientific theory and technology in vegetation restoration and construction, and in the practice, theories can be used as the scientific guidance to make the technology fully and continuously popularized and applied, which makes vegetation restoration and construction achieve obvious effects.

1. Introduction

Located in the north-central part of China, Loess Plateau is one of the four plateaus in China. It is one of the birthplaces of ancient civilization of Chinese nation as well as the most concentrated and largest loess area on the earth. Soil erosion and vegetation destruction are the main environmental problems in this area, which interact with and influence each other. Vegetation restoration and construction is the fundamental way to control soil erosion and improve the ecological environment. Although the long-term control has achieved some results, due to the harsh natural conditions, backward economic level, and some human factors, the survival rate and conservation rate of forest and grass vegetation in Loess Plateau are quite low. Besides, the ecological and economic benefits are poor.

2. Main Problems Existing in Vegetation Restoration and Construction

The prominent problems in the construction of soil and water conservation and vegetation construction in Loess Plateau are low survival rate, low conservation rate, low ecological and economic benefits. The preservation rate of man-made forests only accounts for about 30%, which is far lower than the national average. In addition, the type of forests is monotonous, most of which are poplar and locust. The preservation rate of artificial grassland only amounts to 20%. The plantation volume of 10-20 years old forests is only 7.5-13.5m3/hm2, which is less than the national average annual plantation volume. 80% forest stand in this area cannot reach the level of 60-70m3/hm2 of the general high-yield forest volume (15 years old), and the volume of most forest stand is “low” or “extremely low”. For a long time, the benefits of water and sediment conservation account for less than 10% of the total benefits of vegetation measures, which are implemented in more than 2/3 of the control area.

Loess Plateau has a vast area and is situated in the region where the humid climate is transiting to the arid, which makes its internal conditions very different. Therefore, only by scientific and reasonable planning can we truly adapt to local conditions and achieve the effect of “half the results with double efforts” in vegetation restoration. But at present, there is no reasonable plan for vegetation reconstruction and restoration in Loess Plateau. Because of the bureaucratic wildness and the absence of seedling base, only those seedlings they have can be planted. Without the concept of matching trees with suitable site conditions, a large number of trees are planted in the unsuitable forest areas. As a result, most dry to die or become stunted trees, aggravating the formation of dry soil layer. At the same time, the planning of seedling base, economic forest base, pest control and other aspects are not perfect, making the vegetation construction, on one hand, lack good seedling supply, and on the other hand, often fluctuate due to market changes and pest harm.

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Because of the deficiency of planning, the vegetation construction has not reached a stable and sustainable development state. The natural conditions of Loess Plateau are poor and drought with little rain and barren soil, especially the degradation of the local soil environment resulted from long-term soil erosion. If there is no advanced technology as the support, local vegetation restoration and construction will be seriously hindered. At present, many areas where are suitable for tree growth and where forest has existed in the history have often ended in afforestation failure. The basic reason lies in the backwardness of afforestation technology. Firstly, the structure of tree species has not be arranged according to the rules of biota succession, and site conditions have not be improved by engineering measures to create good conditions for vegetation restoration. Secondly, according to the traditional afforestation technology, it is difficult to overcome the deficiency of soil drought and barren in the aspects of method and time, resulting in the phenomenon of seedlings death and poor growth. In the process of afforestation, due to inobservance to the standard requirements, seedlings' roots have poor contact with soil, which directly results in the occurrence of dehydration or even death of seedlings.

For a long time, because of unclear responsibilities and rights of various departments, the project of vegetation restoration and reconstruction of Loess Plateau has often been in a situation of "someone plant but no one cares", leaving vegetation to its own peril. Meanwhile, because local people are often short of food, the phenomenon of deforestation and wasteland has occurred from time to time. Moreover, after afforestation, forest lands are not completely sealed, therefore, seedlings are often grazed, trampled, gnawed to death, or pulled out directly by local farmers as firewood. Unfavorable management and serious damage lead Loess Plateau to be without forests after afforestation every year, which makes some people lose confidence in the restoration and reconstruction of vegetation.

3. Theoretical Problems of Vegetation Restoration and Construction

In the history of Loess Plateau, most areas once had vast forests and grasslands with good natural ecosystems. However, with the increase of population and unreasonable mode of production such as extensive harvest and overgrazing, vegetation was badly damaged. The natural vegetation of Loess Plateau has obvious zonal and non-zonal characteristics. At present, forest coverage here is very low, only accounting for about 7%, which will amount to 12.2% of the total land if about 76700 square kilometers of shrubbery are added. However, the reclamation index is more or less 30%, among which, the reclamation index of hilly and gully region with serious soil and water loss has even reached 40% to 50%. Wasteland as well as grasslands have also been degraded by the long-term overgrazing of local people.

The study of vegetation succession in Loess Plateau is of great strategic significance to its ecological construction, especially to the project of returning farmland to forests and grasslands. Because of natural and man-made reasons, the original vegetation in Loess Plateau has long been no longer existing, replaced by natural secondary vegetation and artificial vegetation. The succession stage of vegetation community here is from vegetation community to shrub community to early forest community and lastly to top community. The ecological construction of vegetation is facing many scientific problems, especially the emergence of water-using dry soil layer in artificial vegetation, which hinders the succession of vegetation restoration.

Loess is a huge reservoir of water, but Loess Plateau has a typical continental monsoon climate, where is cold in winter and dry while is warm and humid in summer. The evaporation is generally higher than the actual precipitation. Loess Plateau has strong soil water holding capacity, but its water reserve capacity is relatively poor. The contradiction between soil water supply and consumption of artificial forest land in Loess Plateau is prominent. In addition, water deficit of artificial forest land in different vegetation zones is also very serious.

At present, there is a gap and contradiction between the ideal goal and reality of Loess Plateau. Short-term recovery behavior, neglect of recovery benefits and costs, and fuzzy regional differences lead to the deviation of recovery results from recovery goals. The correct approach should be reasonable planning and gradual implementation. It is also vital to build long-term goals to ensure

the implementation of plan. No matter how well the plan is done, if it is not implemented, it is only empty talk.

Global climate change and natural vegetation, as the main components of support system to global life, will be directly and indirectly affected by global temperature changes. Generally speaking, under the influence of global climate change, the temperature of Loess Plateau will rise, and the evaporation will increase too as the temperature rises. People concerned with this issue need to do more academic research, because the impact on Loess Plateau is long-term.

4. Technical Problems of Vegetation Restoration and Construction

Loess Plateau has a special geographic environment, with low vegetation coverage and serious soil erosion, which can be effectively alleviated by suitable tree and forest growth. Its function of wind-proof and sand-fixation also can reduce the degree of land desertification in Loess plateau. Moreover, trees planted can also be sold in adulthood, thereby improving the economic benefits and promoting sustainable development. This measure plays an important role in promoting the development of Loess Plateau and increasing people's income. Therefore, vegetation restoration and construction must be carried out in a rational and scientific way, and ensure that the plan can be implemented.

A harmonious pattern between economic development and utilization in Loess Plateau with natural environment protection should be established. The artificial vegetation community, which is echoed with the terrain, should be constructed in a comprehensive way to form a compound agricultural economic system. Economic zones are classified according to the landform categories, and then the economic development plan is studied. The use of direct and indirect development depends on the structural characteristics of terrain conditions.

Accelerating the development of forestry commodity economy can not only improve the ecological environment, but also increase economic income. The economic structure is afforestation, fruits, fruit processing, and wood production. It is considered to be important to increase the proportion of economic forests and commercial forests as well as coniferous forests and economic shrubs. We should optimize the structure of forest species and tree species and achieve the best combination of ecological and economic benefits.

It is a sustainable development path in line with the regional natural law to increase rainfall concentration and reduce evaporation by changing micro-topography. Main technical measures to collect rainwater include reverse terraces, horizontal ditches, horizontal platforms, fish-scale pits, etc. It is effective to improve the quality and efficiency of seepage control of water surface by compacting photographing and permeability-reducing admixture.

During rational use of pesticides, it is worth our attention to the choice of chemical pesticides and dosage forms, rational rotational and mixed use, selection of high-efficiency, low-toxicity and low residual toxicity pesticides. Do not use low volume or ultra-low-volume spray as far as possible. It is also important to choose suitable time to apply pesticide and avoid using it to a large number of natural enemies.

It is effective to ensure the prevention and control work by increasing capital investment. We should enhance scientific research and continuously improve the scientific and technological contents of prevention and treatment. On the basis of constantly strengthening the construction of demonstration sites for prevention and control technology, it is required to summarize, perfect, assemble, support and popularize existing technologies as well as continue to cooperate with scientific research departments to further study long-term control methods.

Sand control engineering, physical engineering, chemical engineering and plant engineering can be used to play the role of wind and sand fixation to maintain the ecological construction of soil and water.

5. Conclusion

At present, vegetation restoration and construction in Loess Plateau still have a long way to go.

There are a lot of corresponding problems to break through. Of course, naturally restored vegetation suits the local natural environment most and the community formed is most stable. For Loess Plateau region, it is necessary to sum up the lessons of forest and grass construction in the past years, strengthen the conversion of farmland, prohibit grazing, Seal Mountains to afforest, restore the local vegetation scientifically and reasonably, and take the road of sustainable development. At the same time, scientific research institutions should also strengthen relevant research, and work together to restore and control the vegetation in Loess Plateau.

References

[1] Wu Pute, Zhao Xining, Zhang Baoqing, Gao Xiaodong. Potential of Rainwater Resourcfulization and Its Supporting Effect on Ecological Restoration in Loess Plateau [J]. *Journal of Hydropower*, 2017,36 (08): 1-11.

[2] Zhang Jianxiang, Zhang Duoyong, Zhang Bo, Zhao Yifei, Liu Wanfeng. Multiscale Variation of Vegetation Landscape in Loess Plateau and the Relationship with Topography[J]. *Journal of Ecology*, 2015,34(03): 611-620.

[3] Xie Baoni, Qin Zhanfei, Wang Yang, Changqing Rui. Temporal and Spatial Variation of Net Primary Productivity of Vegetation in Loess Plateau and Influencing Factors [J]. *Journal of Agricultural Engineering*, 2014, 30 (11): 244-253.

[4] Liu Yu, Fu Bojie. Topographic Differentiation of Vegetation Coverage Change and Impact of LUCC in Loess Plateau [J]. *Arid Land Geography*, 2013, 36 (06): 1097-1102.

[5] Zhang Xiaopei, Yang Guihe, Wang Dexiang, Feng Yongzhong, Ren Guangxin. Effects of Different Vegetation Restoration Patterns on Soil Biological Characteristics in the Gully Region of Loess Plateau [J]. *Journal of Northwest University of Agriculture and Forestry Science and Technology (Natural Science Edition)*, 2008 (05): 149-154+159.

[6] Xu Jiongxin. Critical Phenomenon of the Relationship between Vegetation and Precipitation in Loess Plateau and Its Significance in Vegetation Construction [J]. *Acta Ecologica Sinica*, 2005 (06): 1233-1239.

[7] Ma Xianghua, Jiao Juying. Advances in the Study on the Interaction between Vegetation Restoration and Soil Environment in Loess Plateau [J]. *Soil and Water Conservation*, 2004 (04): 157-161.

[8] Zheng Fenli, He Xiubin. Effects of Vegetation Destruction and Restoration on Soil Erosion Evolution in Loess Plateau [J]. *Chinese Soil and Water Conservation*, 2002 (07): 25.