

Ecological Forest Construction for Source Protection and Soil and Water Conservation in the Lvliang Mountain Area of the Middle Yellow River

This is not an ADB material. The views expressed in this document are the views of the author/s and/or their organizations and do not necessarily reflect the views or policies of the Asian Development Bank, or its Board of Governors, or the governments they represent. ADB does not guarantee the accuracy and/or completeness of the material's contents, and accepts no responsibility for any direct or indirect consequence of their use or reliance, whether wholly or partially. Please feel free to contact the authors directly should you have queries.

Li Xinping
Shanxi Academy of Forestry Sciences
2023.05



Report Outline

- 1.Regional background
- 2.Progress in ecological environment construction
- 3.Existing problems
- 4.Climate Change Trends in the Lvliang Mountain Area
- 5.Several suggestions for ecological forestry construction

1 Regional Background

The Lvliang Mountain area is located in the middle reaches of the Yellow River and the eastern end of the Loess Plateau (35 ° 30 "to 39 ° 40" north latitude, 110 ° 35 "to 112 ° 20" east longitude), and is one of the important water sources and sediment sources in the middle reaches of the Yellow River. The main peak of Lvliang Mountain has an altitude of 2831 meters, and the loess hills have an altitude of 1200 to 1400 meters; Mountains, hills, and plains account for 40.4%, 57.2%, and 2.4% respectively.



2 Ecological environment governance process

Over the past 70 years, a series of ecological construction projects have been implemented in the Lvliang Mountain area, including forestry ecology, soil and water conservation, and mine restoration. The harm of wind and sand and soil erosion have been effectively curbed, and the sediment transport has been significantly reduced. The regional ecological environment has shown an overall positive development trend.

时间段	1950年—上世纪60年代中期	上世纪60年代中期—70年代末期	上世纪70年代末期—90年代末期	2000年—2010年	2010年至今
治理模式	坡面治理	沟坡联合治理	小流域综合治理	退耕还林还草	退耕还林还草和治沟造地
主要目的	控制坡面侵蚀 增加粮食产量	控制坡—沟侵蚀 拦截泥沙 增加粮食产量	控制坡—沟侵蚀 拦截泥沙 增加粮食产量 改善生态环境	改善生态环境 降低土壤侵蚀 提高粮食产量 增加农民收入	改善生态环境 提高粮食产量 提高农民收入 降低土壤侵蚀
主要措施	梯田 植树造林	梯田 淤地坝 植树造林	梯田 淤地坝 植树造林 自然修复	自然修复 骨干坝 植树造林 梯田	取土填沟 自然修复 骨干坝
发展规律	工程治理为主	工程治理为主	工程治理开始向生物治理转变	生物治理为主	工程治理与生物治理相结合

(1) Forestry Ecological Engineering
The "Three North" Shelterbelt Project: started in November 1978, with a planned period of 70 years, divided into three periods and eight phases. The fifth phase of the project is currently under construction, and a total of 460000 hectares have been completed by 2018.



The project of returning farmland to forests and grasslands has been fully launched since 2002. As of 2018, a total of 380000 hectares of farmland have been returned to forests, and 510000 hectares of barren mountains have been afforestation and greening.



The Natural Forest Resource Protection Project: On September 22, 1998, Shanxi Province completely ceased natural forest logging; At present, Phase II has been implemented, with a total of 370000 hectares of mountain closure protection completed.



The forest coverage rate in the Lvliang Mountain area of the middle reaches of the Yellow River has increased from 6.8% in 1977 to 24.2%, and the forest vegetation has significantly improved.

(2) Soil and Water Conservation Engineering

The Lvliang Mountain area has a soil erosion area of 35700 km², accounting for 76.8% of the total area of the region, making it the most severely affected area in Shanxi Province. Various soil and water conservation projects have been implemented in the Lvliang Mountain area. The area of soil and water loss control is 2160000 hectares, 30000 hectares of horizontal terraces are constructed, 40000 hectares of protected tableland are protected, 116 backbone dams and 23 medium-sized dams are newly built, 1884 water source projects and 991 water-saving projects are constructed, and the degree of soil and water loss control reaches 62.5%. The sediment transport has decreased from 120 million tons at the end of the last century to the current 17 million tons, and the Yellow River has become clear.



(3) Ecological Protection and Restoration Project of Mountains, Rivers, Forests, Fields, Lakes and Grasses

The pilot project for ecological protection and restoration of mountains, rivers, forests, fields, lakes, and grasslands in the middle and upper reaches of the Fenhe River in Shanxi Province was launched in 2019, with a total of 81 engineering projects and a total investment of 8.307 billion yuan. The project has carried out water source conservation and management in the upper reaches of the Fenhe River, agricultural land and slope improvement, and comprehensive management of surface subsidence and geological disasters; The forest coverage rate in the pilot area will reach 30%, the soil erosion control rate will reach 63%, the mining ecological restoration rate will reach 80%, and the water function zone compliance rate will reach 95%.



(4) Ecological restoration project for abandoned open-pit mines in key areas of the Yellow River Basin

The Lvliang Mountain area is rich in mineral resources, with over 500 mines of various types, accounting for approximately 8% of the total area. There are over 2200 geological hazards and hidden dangers in various types of mines. Long term mining has resulted in large-scale ground hollowing and subsidence, landscape destruction, intensified soil erosion, and deterioration of the ecological environment. In 2020, Shanxi Province vigorously promoted the ecological restoration project of abandoned open-pit mines in key areas of the Yellow River Basin, and the main body has been fully completed.



3 The Problem

(1) Lack of comprehensive and systematic governance planning, unclear development goals

Ecological protection and restoration projects are mainly established based on individual ecological elements, and industry departments operate independently without forming a systematic comprehensive governance plan.

Ecological restoration relies on national engineering promotion, and grassroots governments only passively complete project tasks assigned by the country, rather than formulating overall plans based on the needs of local ecological environment construction, with unclear development goals.



(2) Some ecological engineering construction emphasizes form, cannot be based on nature
Afforestation often planting large saplings and hoping to achieve success overnight.

Large trees are also planted in areas with insufficient soil water supply, and many trees grow slowly and age prematurely due to insufficient water supply, becoming "small old trees".



Ecological forestry projects rarely build different types of forests based on ecological needs, whether they are water conservation forests or soil and water conservation forests. They usually implement large-scale land consolidation and planting with uniform density (1667 plants per hectare)



(3) Insufficient ecological restoration space

With the implementation of the "three zones and three lines" for land use control, the space for ecological restoration in some places has been compressed. Many abandoned and remote 'wasteland' is actually cultivated land, or land that has failed afforestation and reclamation. These lands have all been labeled as "one map" and cannot be used for planting trees and grass, resulting in many ecological restoration projects not being able to land.

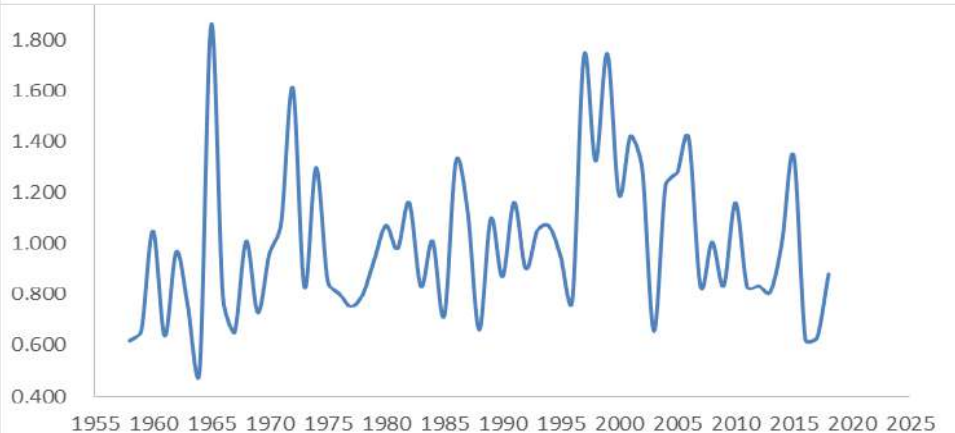
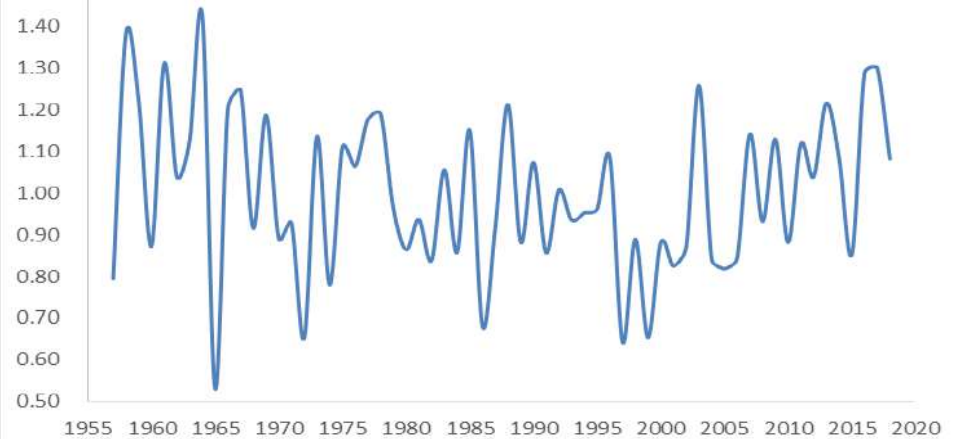
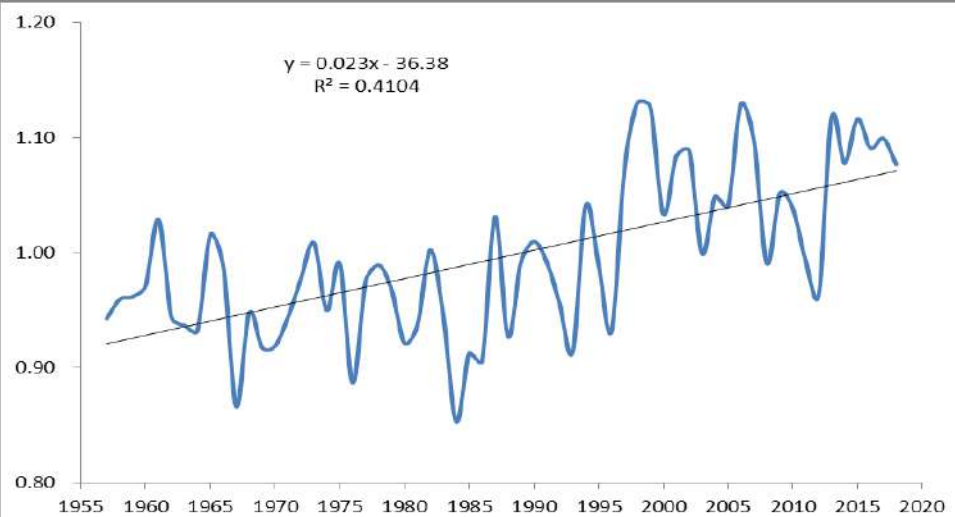


4 Climate Change Trends in the Lvliang Mountain Area

In the past 62 years, the temperature in the Lvliang Mountain area of the Yellow River Basin has significantly increased, with an increase of 0.23 °C /10a. The winter warming contributes the most to the annual average warming, and the warming performance is more prominent at the lowest temperature.

The annual precipitation is not significantly decreasing, with a decreasing trend of 4.68mm/10a, and the annual precipitation reduction increases from north to south.

The dryness index shows a non significant increase trend, the difference in precipitation and evapotranspiration increases, and the water shortage shows a non



5 Several suggestions for ecological forest construction

(1) Develop a comprehensive ecological restoration plan and clarify construction goals

① The county-level government is the main responsible party for ecological protection and restoration. At the county level, a comprehensive system plan for ecological protection and restoration should be formulated through legal procedures, with clear development goals and long-term implementation. Instead of constantly changing scheme with the change of government leaders.



② Configure plants and determine effective vegetation coverage as needed

The ecological benefits of forest and grass vegetation require a certain area and corresponding structure to be achieved. According to the environmental characteristics and ecological issues of the Lvliang Mountain area in the middle reaches of the Yellow River, the forest coverage rate in mountainous areas should be maintained at over 65%, the forest and grass vegetation coverage rate in hilly and gully areas should be above 45%, and the forest coverage rate in tableland and plain areas should be above 20%.

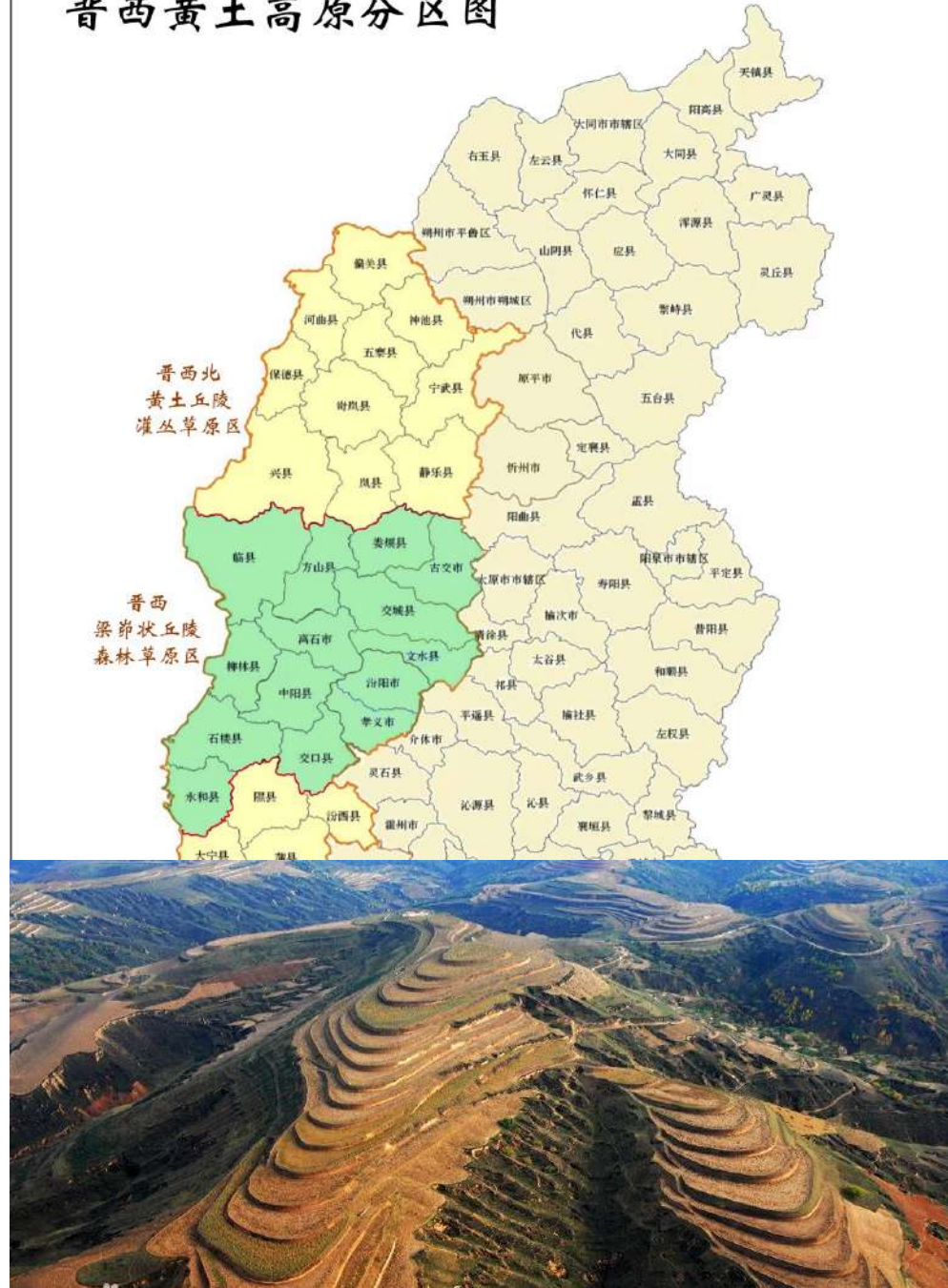




From the perspective of preventing soil erosion, the effective coverage of vegetation on slope engineering should reach over 60%.

② Loess Gully Area in Western Shanxi. From Zijin Mountain to the Motianding of Daning County in the south, it is a warm temperate semi-arid climate gray cinnamon soil Forest steppe area, including Yonghe, Shilou, Xingxian and Baode areas. The soil erosion in this area is the most severe, and **erosion ditches are a key area** for ecological protection and restoration. **Shrubs** are mainly used to build protective forests on the slope, economic forests are planted on the slope, terraced fields are built at the top of the beam, and silt dams are built in the river valley to transform into good farmland, forming a comprehensive management system for soil and water conservation

晋西黄土高原分区图



③ The residual plateau and gully area in southwestern Shanxi.

From Motianding to Longmen Mountain in Xiangning County, it is a warm temperate semi humid cinnamon soil deciduous broad-leaved forest area, including most areas of Daning and Jixian, Xiangning, Xixian, Puxian, and Fenxi counties. The main ecological problems in this area are **collapse and gully erosion at the edge of the plateau**. The key to ecological protection and restoration is to plant trees and grass to protect the edges and slopes, build silt dams in valleys, and creating protective forest belts on the plateau.

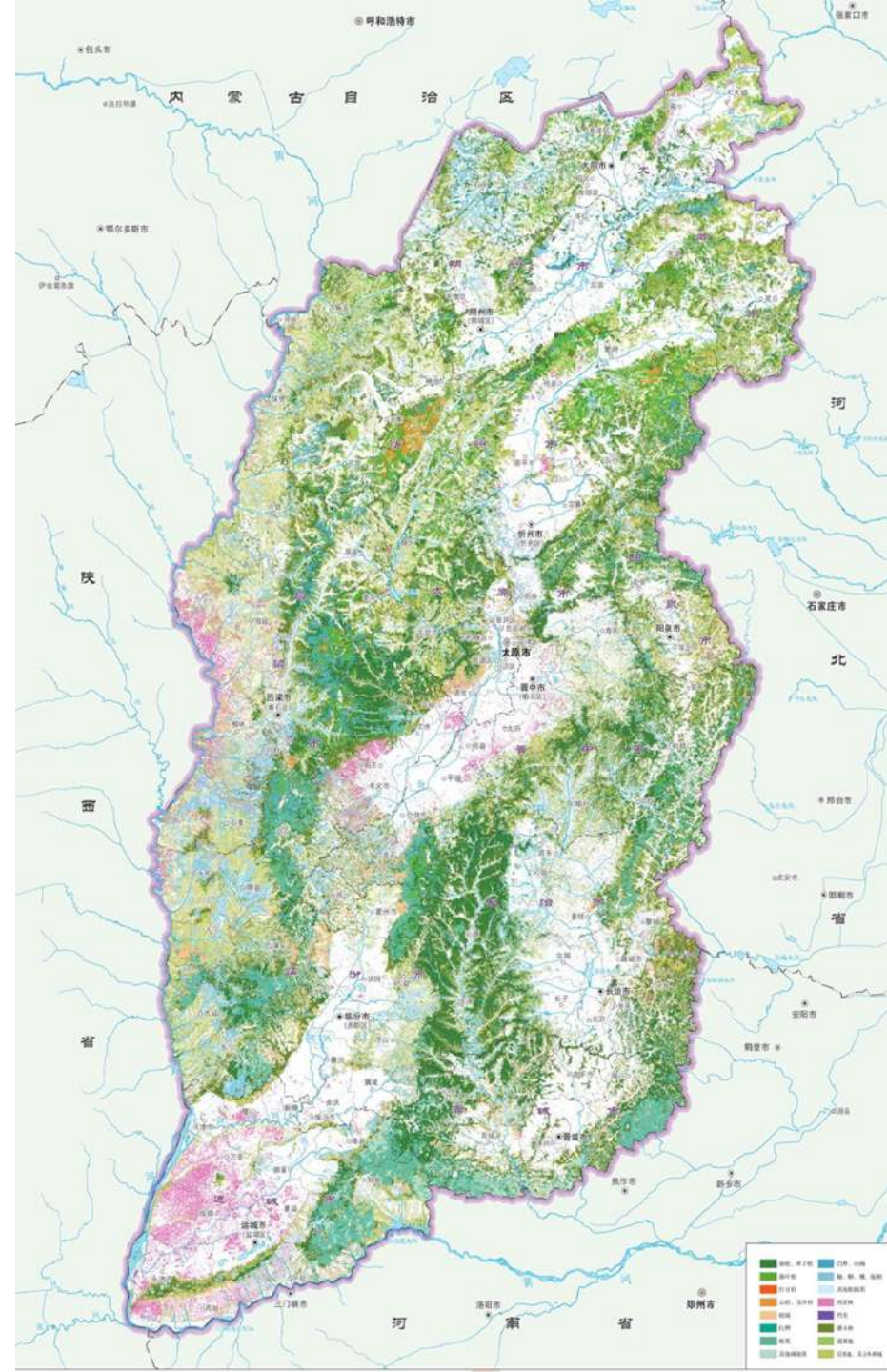
晋西黄土高原分区图



④ The central mountainous region.

The Lvliang Mountains are located in the central part of the Loess Plateau, with an altitude of over 1500 meters and a precipitation of over 550 millimeters. Belonging to a temperate semi humid brown soil environment, there are four forest areas: Heicha Mountain, Guanchen Mountain, Guandi Mountain, and Lvliang Mountain.

This area is the main distribution area of natural forests in Shanxi Province, with well preserved natural vegetation. The purpose of ecological protection and restoration is to **conserve water sources and maintain biodiversity**, with a focus on **strengthening regional forest environment maintenance**, promoting vegetation restoration and natural renewal, and better leveraging the ecological multifunctional role of natural forests.



(3) Imitate natural communities and artificially promote vegetation restoration

The Loess Plateau has been cultivated for a long time, and the original vegetation has disappeared. In harsh habitats with nine out of ten years of drought, natural vegetation restoration is difficult and slow. The ecological restoration of the Loess Plateau should utilize the process of planting trees and grass to assist in the establishment of natural communities and promote vegetation restoration.



① Moderate land preparation

Large scale land preparation has a strong disturbance on the natural slope surface, which is not only prone to water and soil loss, but also reduces species diversity due to the destruction of the soil seed bank. During the process of land preparation and planting, the intensity of disturbance should be controlled, and a certain natural area should be retained to provide conditions for constructing a near natural vegetation community.



② Density Control

Plants are social creatures, and the smaller the individual, the greater the requirement for density; As the volume increases, the unit density decreases. Planting density should be determined based on plant characteristics and soil moisture carrying capacity. At the same time, at different stages of forest development, continuously adjust plant density, maintain soil water balance, and ensure stable and sustainable development and succession of vegetation communities.

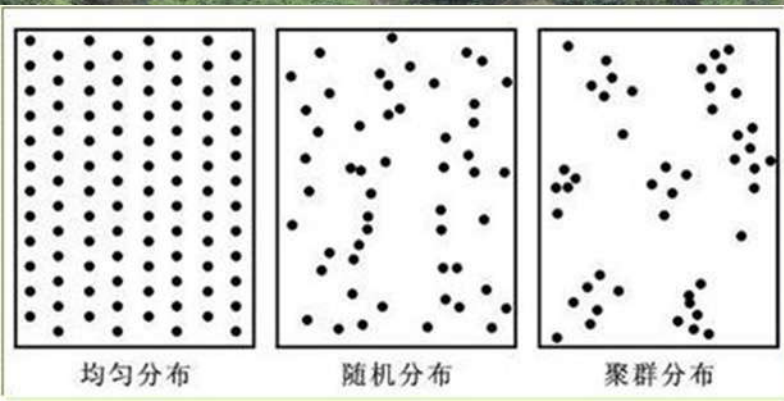
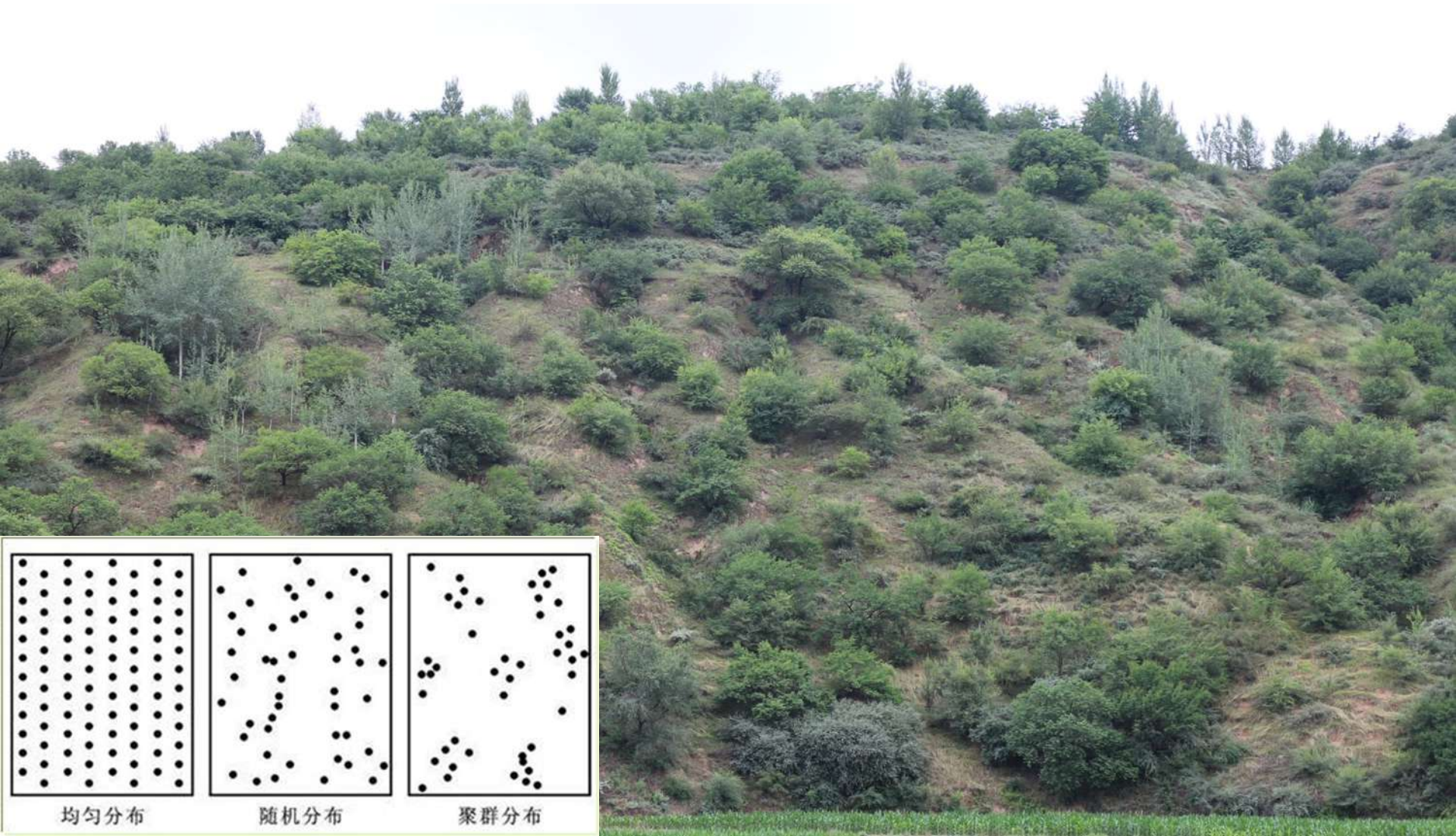


③ Micro terrain planting

The slope surface of the Loess Plateau is fragmented, and there are various micro terrains distributed on the slope surface, such as cut ditches, shallow ditches, collapses, gentle platforms, and steep ridges. These micro terrains make the slope uneven, affecting the redistribution of rainfall on the slope, resulting in differential distribution of soil moisture and vegetation on the slope. The order of biomass of various micro terrains from large to small is: collapse>cut ditch>shallow ditch>undisturbed slope>gentle platform>steep slope, which is basically similar to the order of soil moisture content.



Under natural conditions, plants gather in suitable habitats with almost no random or uniform distribution. Vegetation restoration should utilize the habitat differences caused by microtopography to select plants. One kind of micro terrain is planted with one kind of plant, and various plant groups are inlaid irregularly on the slope, forming a nearly natural vegetation structure.



Thank you for listening !

