



## *Research article*

# **An analysis of sustainable development from the perspective of the formation and development of the Loess Plateau**

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## **ABSTRACT**

For a long time, geographers have revealed various causes of the formation of the Loess Plateau and its evolution process by studying the factors of geological structure, climate environment, hydrogeology and other factors. According to the research results, the formation of the Loess Plateau is not only influenced by the geological structure, but also closely related to various factors such as climate change and hydrogeology. It is worth mentioning that the utilization and management of water resources also play an important role in the development process of the Loess Plateau. Finally, we will put forward corresponding suggestions and countermeasures for the current problems and challenges to promote the sustainable development and ecological environment protection of the Loess Plateau region.

**Keywords:** : Loess Plateau; soil and water loss; sustainable development; soil erosion; ecological compensation mechanism

## **1 Introduction**

The Loess Plateau is located in the northern part of central China, spanning the seven provinces and regions of Shaanxi, Gansu, Ningxia, Inner Mongolia, Shanxi, Henan and Qinghai provinces, covering a total area of about 635,000 square kilometers. In China's complex and diverse terrain, the Loess Plateau, as a very important geographical region, has unique geomorphic features and rich natural resources.

The soil composition of the Loess Plateau is mainly loess, which is fine in texture, rich in organic matter and nutrients, and is suitable for the growth of crops. However, due to its unique geographical location and climatic conditions, the Loess Plateau is faced with serious soil erosion problems. For a long time, the excessive exploitation and unreasonable use of human beings have made the land degradation of the Loess Plateau intensified, and the ecological environment damage is increasingly serious<sup>[1]</sup>.

Since ancient times, the Loess Plateau has been an important grain producing area in China, known as the "granary of Jiuzhou". The Chinese civilization was also born and developed here, which is actually the cradle of civilization<sup>[2]</sup>. At the same time, the Loess Plateau is also one of the important ecological barriers in China.

With the increasing progress of science and technology and the attention of the government, the ecological environment of the Loess Plateau area has been gradually improved. Many ecological restoration and control measures have been realized, and remarkable results have been achieved in soil and water conservation and vegetation restoration. In the future, we should continue to adhere to the concept of sustainable development, protect this unique land, so that the beautiful scenery and rich resources of the Loess Plateau can be inherited forever<sup>[3]</sup>.

## **2 The geological characteristics and formation process of the Loess Plateau**

The Loess Plateau is located in central China, between east longitude 100°52 ' to 114°33 ', and 33° to 42° north latitude. It is connected with the North China Plain in the east, the Qinling Mountains in the west, the Yangtze River Basin in the south and the Yinshan Mountains in the north. It is a typical arid and semi-arid region in China. The Loess Plateau inside thousands of gullies, crisscross, mountains, hills, basins scattered.

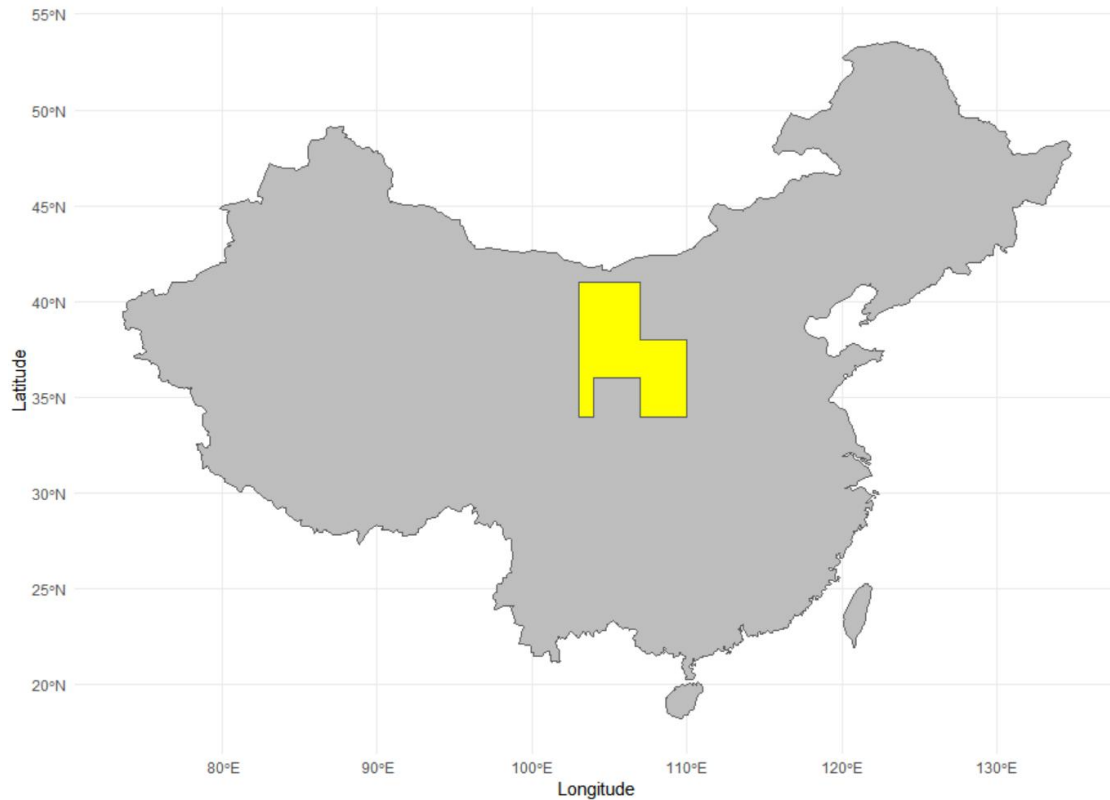


Figure 1 The extent of the Loess Plateau

From the perspective of geological structure background, the Loess Plateau is in a large intra-land overlapping basin developed on the basis of the shallow sea platform of the Paleozoic craton in North China. The basin is bounded by Yinshan-Daqingshan-Langshan in the north, reaching Qinling Mountains in the south, starting from Helan Mountain to Liupan Mountain in the west and Luliang Mountain in the east. It covers a vast area and is the second largest sedimentary basin in inland China. Basin experienced the early Paleozoic craton carbon rock platform, late Paleozoic sea and land to each other, Mesozoic inland lake basin phase several sedimentary period, to-Cenozoic, due to the influence of the late yanshan movement and the Tibetan movement stage of strong tectonic activities and tectonic features, the ordos basin by peripheral plate convergence, collision orogenic, many times, and eventually led to the luliang uplift, six plate and the formation and development of yinshan magmatic rock zone. Especially in the pleasant mountain period, the Indian Ocean plate collided with the Eurasian plate, the Gutetes ocean closed, while the Pacific plate subduction and decreased westward, the whole interior of the Ordos basin rose, and a series of Cenozoic depression basins developed at the periphery, which were covered by a large area of quaternary loess<sup>[4]</sup>.

In general, the geological characteristics and structure of the Loess Plateau are one of the important factors in its formation. Through the long geological action and tectonic changes, a unique landform is formed. For the formation and development of the Loess Plateau, we need to study deeply in order to better protect and utilize this precious natural resource.

### **3 The development history of the Loess Plateau**

Human activities are one of the important causes of environmental changes on the Loess Plateau. With the growth of population and economic development, large-scale agricultural development and urban construction lead to excessive land reclamation and soil erosion. A large number of logging, and slightly tillage make the soil exposed, aggravating the wind and sand erosion, leading to the process of land desertification. At the same time, the excessive use of chemical fertilizers and pesticides and the excessive exploitation of water resources have caused the farmland soil pollution and water depletion, and brought serious pollution and damage to the ecological environment.

The impact of agricultural development on the ecological environment is mainly reflected in two aspects: one is the destruction of land resources, the other is the reduction of biodiversity. The Loess Plateau is an important grain production area in China. Due to long-term excessive cultivation and development, land resources are gradually exhausted and soil fertility decreases, which has a serious impact on the growth and yield of crops. At the same time, many plants and animals are also in danger of extinction due to the destruction of the ecological balance. The deterioration of the ecological environment not only affects the ecosystem balance of the Loess Plateau, but also brings serious survival pressure to the human society.

In order to improve the ecological environment of the Loess Plateau, we need to take effective measures. We should strengthen the protection and management of land resources, limit the speed of agricultural development, and avoid the waste and destruction of land resources caused by excessive exploitation. We should promote the transformation of agricultural production mode, promote ecological agriculture and organic agriculture, reduce the use of chemical substances such as chemical fertilizers and pesticides, and protect soil and water resources. At the same time, it is

necessary to strengthen the monitoring and protection of the ecological environment, protect the endangered species, and promote the recovery of biodiversity.

**4 The environmental issues and management of the Loess Plateau**

The Loess Plateau is located in the middle reaches of the Yellow River in China. Due to the damage of the ecological environment, the water holding capacity is poor. From the existing research results, the damage of vegetation is the direct damage of the soil resistance to impact. Loess soil will disintegrate and scatter in water, in fact, there is no impact resistance<sup>[5]</sup>, so it is easy to occur soil erosion phenomenon. Under the long-term natural action and human activities, the soil erosion problem of the Loess Plateau is increasingly serious, which brings great influence to the ecological environment and agricultural production.

Soil erosion will not only cause the loss of land resources, but also lead to soil erosion, aggravate the degree of land barren and drought, hinder the sustainable development of agriculture and increase the pressure of human survival. In order to effectively prevent and control soil erosion, we should take active actions as table 1 as below:

Table 1 Active actions	
<b>Afforestation for Soil Stability&amp;Water Retention</b>	Through afforestation, increase the soil's ability to stabilize and retain water, effectively reducing soil erosion and protecting the soil environment.
<b>Scientific Fertilization to Enhance Soil Fertility</b>	Reasonably apply organic and chemical fertilizers to boost soil fertility and water retention, supporting sustainable agricultural development.
<b>Rational Land Cultivation to Reduce Erosion Risk</b>	Plan land use wisely and avoid excessive deforestation and over-cultivation to minimize land exposure and effectively reduce the risk of soil erosion.

In addition to the above points, strengthening the construction of soil and water conservation projects is also an effective means to prevent and control soil erosion. Measures such as building terraces, vegetation cover and building ditches can effectively slow down the water flow speed and reduce soil loss.

**5 Strategies for sustainable development of the Loess Plateau**

As an important ecological barrier and agricultural base in China, the Loess Plateau is particularly important for sustainable development. In order to realize the sustainable

development of the Loess Plateau region, the first thing is to strengthen the construction of ecological civilization. The construction of ecological civilization refers to protecting the ecological environment while economic development and realizing the unity of economic, social and ecological benefits. On the Loess Plateau, we should promote green development, adopt a sustainable development model, and reduce the damage to the ecological environment. At the same time, we should strengthen environmental governance, improve the efficiency of resource utilization, and promote the restoration and protection of the ecological environment.

In addition to the construction of ecological civilization, the establishment of ecological compensation mechanism is also an important measure to protect the ecological environment of the Loess Plateau. Ecological compensation refers to the economic compensation for environmental providers in order to protect and restore ecosystem functions. In the Loess Plateau region, the establishment and perfect ecological compensation mechanism will encourage local governments and residents to participate in ecological environment governance, and jointly help to restore the ecological environment. In addition, ecological compensation can also promote the development of ecological industries, create more employment opportunities, and play a leading role in promoting the sustainable development of the local economy.

In general, the sustainable development of the Loess Plateau needs comprehensive measures, not only to strengthen the construction of ecological civilization, but also to establish an ecological compensation mechanism. Only through scientific planning and effective management measures, can the sustainable development of the Loess Plateau be realized.

## **6 Conclusion**

As an important geographical region in China, the Loess Plateau has its unique geomorphic features and rich natural resources. However, due to its unique geographical location and climatic conditions, the Loess Plateau faces serious soil

erosion problems. With the increasing progress of science and technology and the gradual attention of the government, the ecological environment of the Loess Plateau area will be gradually improved.

Human activities are one of the important reasons for environmental changes in the Loess Plateau, so effective measures are needed to control soil erosion and protect the ecological environment. In order to realize the sustainable development of the loess Plateau, it is necessary to strengthen the construction of ecological civilization and establish the ecological compensation mechanism. At the same time, we also need to adhere to the concept of sustainable development, protect this unique land, so that the beautiful scenery and rich resources of the Loess Plateau can be sustainable inheritance.

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