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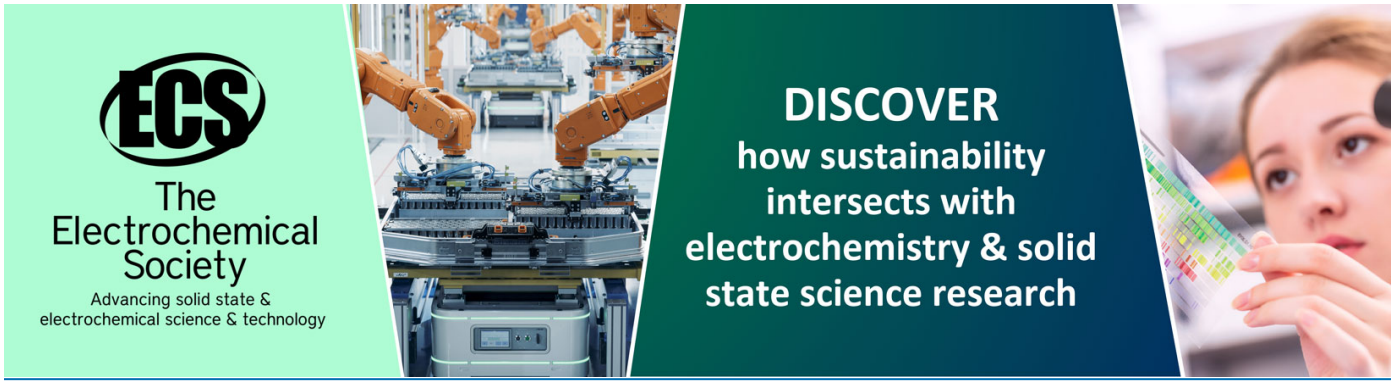

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Abstract. With continuous development of economy, human beings are increasingly destroying the environment. Therefore, attention must be paid to conservation of soil and water. The environmental issues in China are very serious currently, which are mainly reflected in soil erosion and water shortage, moreover, the phenomenon of soil desertification has become very serious in our country, and the ecological environment has been destroyed, flood or soil desertification both cause damage to the environment. Therefore, the work of conservation of soil and water and sediment reduction is of great significance. This paper mainly studies the benefits of conservation of soil and water and sediment reduction in China.

Keywords: Conservation of soil and water; sediment reduction; benefit.

1. Introduction

As the phenomenon of loss of soil and water has become more and more serious in recent years, it has also drawn great attention from our government. In allusion to the problem of loss of soil and water, China has also adopted a series of targeted measures in order to better improve the utilization rate of water resources, thereby solving the problem of loss of soil and water. However, there are always many problems in the process of governance, because conservation of soil and water is a long-term and comprehensive project. In addition, under different construction conditions, the effects and roles of conservation of soil and water measures also vary greatly, and they need to be carefully and comprehensively described quantitatively. In the following, this paper discusses and analyzes benefits of conservation of soil and water measures and sediment reduction, and summarizes some views and opinions.

2. Major Hazards Related to Water Losses and Soil Erosion

The loss of soil and water in various countries is continuously developing in recent years, especially in Asia. In some countries which have a lot of arable land, there are a lot of lost arable land and soil. Although some water losses and soil erosion can be understood as caused by natural conditions, it is also enough to prove that the proportion of In recent years in areas where human activity is relatively large, the main human activities are carried out in the form of occupation of forests and overgrazing, if soil erosion occurs, it must be very serious and very contaminated environment such as drought, siltation and desertification, Fig.1 is a diagram of protection measures for soil and water.

Fig.1 Diagram of protection measures for soil and water

3. Type of Conservation of Soil and Water Measures

3.1. The measures of planting forest and grass for conservation of soil and water

The planting forest and grass measures of conservation of soil and water are to carry out afforestation construction in the area where water losses and soil erosion occurs, and planting trees can make the forest acreage to be increased, during rainfall, Under the action of plants, it reduces the ability of soil erosion, reduces raindrops contact the ground, and plays an important role in conserving water. Vegetation can block runoff and regulate river hydrological conditions; it can reduce the scouring force of water on soil, also has an important impact on soil improvement, so that the water and soil environment can be improved to the greatest extent. The measures of planting forest and grass of conservation of soil and water are conservation of soil and water measure with long history, it is also very convenient when planting, and will not bring negative effects on the soil. However, it is also necessary to value the planting of vegetation; the adaptability of vegetation is different in different regions, it is necessary to analyze the nature of the soil and select suitable soil for planting to meet the needs of soil cultivation to the greatest extent and play the role of conservation of soil and water measures. This measure of planting forest and grass is mainly through the interception of litter layers, cut-off, and plant roots for conservation of soil and water, it can enhance soil fertility without damaging the surface, after long conservation, the effect of conservation of soil and water will be obvious. Crops in planting forest and grass measure are also special kinds of forest and grass maintenance measures; there are two methods for planting crops. One is crop rotation, and the other is intercropping and mixed seeding, crop rotation is to choose rotation methods according to the production objects; intercropping is to plant two or more crops on the same land at the same time, mixed seeding is to sow more than two crops on the same land in the same periods.

3.2. Cultivation measures for conservation of soil and water

The conservation of soil and water measures mainly focus on the realization of three characteristics, namely soil conservation, water conservation and fertilizer conservation, which can maximize the efficiency of crop production, improve crop yield, change the traditional crop farming methods, and improve the surface structure and local micro terrain structure to the greatest extent. In the early days, our ancestors used the high and low bed planting method, this planting method was to make the land into high and low furrow, so that when it was dry, the low bed land could be planted, while in some wetter areas, the high bed land could be planted, this kind of farming method would not cause great harm to the soil, Some problems will also occur in the process of soil planting, but they will not have a

great impact on soil and water conservation. Later, the field replacement method appeared, this method is the rotation use of bed and ditch, this kind of planting method can make the soil be repaired in time, in the process of soil repair, it will increase the soil fertility and achieve the effect of increasing production, the increase in output is generally 25% -50%. Furrow planting are still used in many large agricultural provinces, such as the Northwest China.

3.3. Project measures for conservation of soil and water

The project measures for water and soil conservation are also a very important way to carry out conservation of soil and water. In process of using this way, through changing the terrain of some areas to retain the surface runoff, and it has an important impact on agricultural production. It can also use water and soil resources and light resources to perfect the ecological environment, reduce the soil erosion capacity to the greatest extent, and make full use of soil resources, but it will not damage the water and soil structure. From ancient times to modern times, China is a country full of wisdom; there are many ways for using conservation of soil and water, there were prototype terraced fields for soil and water conservation in the Han Dynasty, dams were built in some areas, in the 18th century, we should also pay attention to the problem of surrounding debris flow, some regions have work of torrent governance, and these are the conservation of soil and water projects. So far, the current conservation of soil and water projects in China include: mountain flood drainage projects, hillside protection projects, small water storage projects and ravine protection projects.

4. Benefit Analyses of Conservation of Soil and Water and Sediment Reduction

The benefits of conservation of soil and water and sediment reduction refer to the proportion of runoff and sediment reduction. The topography of our country is relatively complex, and benefits of conservation of soil and water and sediment reduction are studied actively. However, different scholars have significant differences in the specific results of the study, due to the different regions and environments, it is impossible to carry out horizontal comparison. This paper studies the benefits of conservation of soil and water and sediment reduction in accordance with the slope changes of typical runoff communities in China, in the process of studying the benefits of conservation of soil and water and sediment reduction, we can know from the analysis that if the slope is between 10°and 20, the runoff area accounts for 40%, which can represent the average level of runoff in our country. We can use the slope with the middle slope of 15 as the most significant slope for conservation of soil and water and sediment reduction, and it is the standard slope as well, through the analysis of relevant experts, the length of the slope should be 20m, the width should be 5m, and the exposed areas which meet the above conditions are the standard area.

From the average level, the runoff reduction benefit of conservation of soil and water will generally be more than 55%, and the sediment reduction benefit will also be more than 65%. In particular, the slope terraces, horizontal terraces and slope terraces will all be higher than the level. Through the research of some experts, we can know that compared with the method of planting forest and grass, the role of conservation of soil and water project about sediment reduction is significant, but this project also has significant defects, such as high cost, time-consuming and labor-consuming, which cannot be vigorously promoted in a long period of time. Planting forest and grass measures also have the advantages that soil and water conservation projects do not have, and can play a basic role in conserving water sources, improving local microclimate and greening environment. Therefore, it is necessary to select the appropriate way of conservation of soil and water and sediment reduction in accordance the specific situation.

As we all know, there are a vast territory and a lot of natural resources in China. However, due to the complexity of some terrain conditions, the difference of cultivated land ratio of steep slope is also large. Although some researchers have carried out a comprehensive study and analysis about the benefits of conservation of soil and water and sediment reduction measures, they have also carried out a lot of field work. However, it is often difficult to make a unified comparative analysis of the detection results because each researcher uses different observation areas. Therefore, in order to better solve this issue

and promote smooth progress of conservation of soil and water measures, first, we need to establish a complete set of regional standard system, and the data obtained by different researchers are collected and arranged in a unified way, so that they can be compared under a unified measurement standard. In this way, more accurate benefit analysis data of conservation of soil and water can be obtained in different conservation of soil and water measures.

According to analysis of conservation of soil and water and sediment reduction benefits of different types of planting forest and grass measures for, crops are less affected by water and sediment reduction, it shows that the main cause of water losses and soil erosion is due to steep farmland. Biological measures are mostly under the function of soil consolidation; the most effective solution is to adopt the method of returning the grain plots to forestry, so as to achieve the ideal effect of conservation of soil and water and sediment reduction.

Through relevant measures of conservation of soil and water projects, we can change the corresponding local topography, the benefits of conservation of soil and water is generally superior to biological forest and grass and cultivation. However, the project costs a lot and takes a long time. In addition, the measures related to biological forest and grass and farming are more able to protect the ecological environment, conserve water sources and green environment, which cannot be replaced by engineering measures. Therefore, it is necessary to comprehensively consider geological, topographical and economic conditions and other factors to select a reasonable scheme and allocate resources reasonably, so as to meet the requirements of conservation of soil and water to effectively prevent loss of soil and water.

In process of determining the relationship between parameters of water and sediment reduction benefits, relationship $y=ax+b$ can be applied, the percentage of water reduction is expressed by x, and the percentage of sediment reduction is expressed by y.

In the application of biological forest and grass measures, it can be found that the value of b as a regression coefficient is greater than 0, it fully shows that once the final result of water reduction benefit in the use process of the measures is 0, the measures always have a certain function of sediment reduction. The reason for this phenomenon is related to the characteristics of the measure itself. The biological forest and grass on the ground and the root system of vegetation usually have the function of filtration and consolidation of water and sediment, so they have a strong role in reducing water losses and soil erosion, and ultimately achieve a higher benefit of sediment reduction.

In the application of cultivation measures, it can be found that the value of b as a regression coefficient is less than 0, which fully shows that once the final result of water reduction benefit in the use process of the measures is 0, then the negative value will be generated in the benefit of sediment reduction, which will increase the sediment yield. It also proved that the soil was disturbed to a certain extent in the process of farming, which made the degree of soil erosion more serious. However, when the regression coefficient a is 1999, it is proved that when the water reduction benefit is 1%, the sediment reduction benefit will be 2%. Therefore, in the process of application of farming measures, the sediment reduction benefit is more prominent on the basis of water reduction.

5. Case Studies on Benefits of Conservation of Soil and Water and Sediment Reduction

At present, there are many analysis and calculation methods for the benefit of conservation of soil and water and sediment reduction projects, but there are still many problems to be further studied. On the basis of the statistical analysis of hydrologic and sediment of N tributaries in different water losses and soil erosion areas in Yellow River, this paper finds that most sediment entering the Yellow River caused by soil and water loss is concentrated in several times of flood water in the flood season, and the flood due to rainfall has the characteristics of short duration and high intensity. In this paper, the relationship of loss of soil and water and rainfall characteristics is used to estimate the sediment reduction benefits of conservation of soil and water projects in the midstream of the Yellow River.

5.1. The relationship among rainfall, flood and sediment in flood season

There is 40-600 mm rainfall every year in Loess Plateau, there are July, August and September, and most of them are in the form of rainstorm. A lot of sediment in the river is produced by one or two rainstorms and floods. In order to analyze the relationship between rain and flood sediment in the midstream of the Yellow River, daily rainfall data of July-September are more than 30m, the average rainfall is calculated by basin, and then the flood volume, sediment volume, total flood and sediment of each process in the same period of each basin are calculated, respectively. The main tributaries of midstream of the Yellow River have a daily rainfall of more than 30 m in July-September, and the relative proportion between the accumulated rainfall and the annual rainfall and the sediment is shown in Table.1. AS can be seen from Table.1, daily rainfall of each tributary greater than 30m only accounts for about 20% of the annual rainfall, while the sediment volume accounts for about 80% of the annual sediment runoff.

Table 1. Proportion of accumulated rainfall and sediment volume in the flood season to annual rainfall and sediment (%)

river name	1984-1999		2000-2013	
	rainfall	sediment	rainfall	sediment
Jinghe River	19.6	88.3	19.3	86.9
Luohe River	19.7	79.1	22.4	81.6
Weihe River	17.8	76.9	15.5	98.4
Fenhe River	25.6	56.1	24.1	71.4
Kuye River	26.6	93.3	23.8	90.5
Huangfuchuan River	36.4	78.6	25.4	97.5
Zhujiachuan River	21.0	85.6	14.2	84.6
Sanchuan River	23.4	86.0	22.7	93.7
Xinshui River	26.9	74.0	22.0	95.4
Wudinghe River	21.9	73.7	31.3	82.3

5.2. Large-scale rainstorm characteristics and dam break in the midstream of the Yellow River

The coverage area of heavy rain is larger the midstream of Yellow River and the precipitation was concentrated. According to statistics, the year with more than 30mm rainstorm in each year and the coverage area of the rainfall is 2000-5000km2, which accounted for 66.7% of the total statistics. It is found from the existing rainfall period records and self-recorded data that the one hour rainfall near the center of each heavy rain is 12-20 mm, generally is 50-70 mm, and the maximum can reach more than 100 mm. Therefore, rainfall within a few hours accounted for a large part of the rainfall. The rainfall time distribution is concentrated, which is manifested in the entire rainstorm area. According to statistics, rainfall is often concentrated within 6 to 7 hours, and its rainfall can account for 50% to 95% of the total rainfall for the maximum 3 days. The spatial distribution of the rainstorm is also relatively concentrated, it can be seen from the storm level map that the coverage area of the rainstorm is generally 2.5% to 10% of the area in the midstream of the Yellow River, and rainfall accounts for more than 50% of the rainfall in the midstream of the Yellow River.

The dams and reservoirs are scattered all along in midstream of the Yellow River which have formed a set of conservation of soil and water project systems that have a role in controlling soil and water conservation. However, in a few years, they are often burst by heavy rain, causing greater harm. At present, the conservation of soil and water dams and small reservoirs in the middle reaches of the Yellow River generally have low design standards and unsuitable projects, on the other hand, due to the lack of co-operation with afforestation, grass planting and slope treatment, dam failures often occur in the event of heavy rain.

5.3. Analysis variability processes of daily rainfall, flood, and sediment

The rainfall intensity in the midstream of the Yellow River plays an significant role in water loss. The 3-year moving average of each hydrological element is now divided by the average value of 1984 to 1999 to obtain its variability, which is calculated year by year. By drawing its variability process line and the measured process line of each element, it can be concluded that the trends of different hydrological elements in each tributary are similar. Wuding River as an example, it can be found that comparing variability processes of water, sediment, rain in the flood period, and annual rain and sediment ratio, as shown in Fig.2), the daily rainfall with greater than greater than 30 mm in the flood period is closely connected with the variability process of sediment.

According to geographical location and climatic differences of the tributaries, the rainfall, sediment and other different elements are plotted on the diagram in three points (Fig.2). Among them, the west of main stream of the Yellow River is one part, and another one part is the east, and the Jinhe River, Luohe River and Weihe River are one Part. The following analysis is made by taking Huangfu River, Kuye River, Wuding River, Tingshui River, Zhujiachuan River, and Sanchuan River as examples, as shown in Fig.2.

It can be found from Fig.3 that from the 1980s to the beginning of 2000, the daily rainfall variability with greater than 30mm of the whole Longkou town-Hekou Town, after 2000, the change was gentler than the previous period, and this phenomenon is particularly evident to the west of the Yellow River. After 2000, there were no heavy rains in this area before 1990, and the variation amplitude decreased. Among them, the variation amplitude of sediment of the Kuye River and Huangfuchuan River was larger, while the Wuding River decreased significantly. The variation condition of sediment in each piece is shown in Fig.4, the Tingshui River, Zhujiachuan River, Sanchuan River, and Fen River decreased significantly after 2000, especially the Fenhe River.

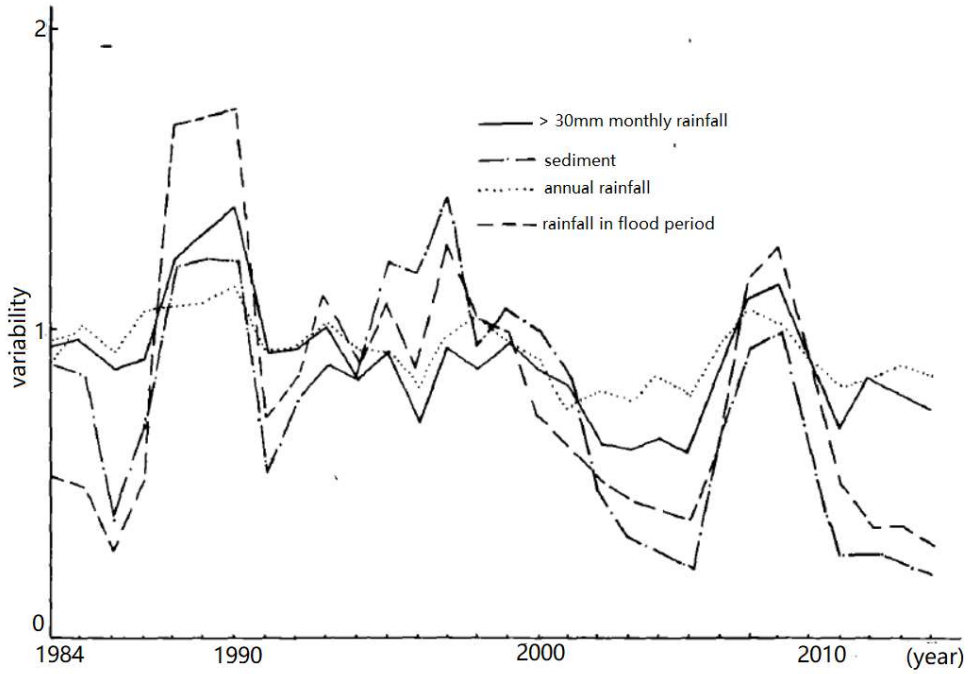

Fig.2 Variability process lines of water, sediment, rain in the flood period and annual rainfall in in the Wuding River

Fig.3 Rainfall variability

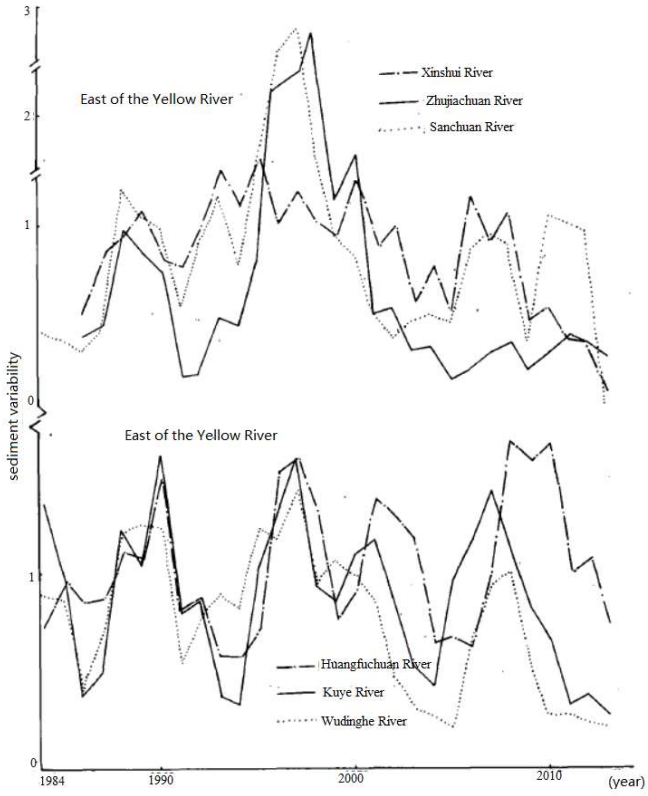

Fig.4 Sediment variability

The data is used to calculate the area whose daily precipitation is greater than 30mm and the corresponding amount of sediment, and its cumulative correlation line is drawn. Taking the Weihe River as an example, from the analysis of the cumulative correlation diagram of each tributary, the daily rainfall greater than 30mm is closely connected with the sediment. The accumulative correlation lines of the Jinghe River, Weihe River, Kuyehe River, Huangfuchuan River, Zhujiachuan River and other tributaries from the 1980s to 2010 were basically straight lines, while the Luohe River, Wudinghe River, and Fenhe River have deflections to varying degrees, which reflects influence of human activities on sediment.

6. Conclusion

In the process of controlling water losses and soil erosion, we should make scientific and reasonable allocation and use for conservation of soil and water measures, conduct deep investigation and analysis for the benefits of water and sediment reduction, so as to truly play the important role and effective value of conservation of soil and water measures, thereby achieving purpose to conserve water and soil.

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