Research Progress of Slope-ditch Composite System

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Abstract

The main function of the slope protection project is to prevent the soil erosion on the slope surface and in the slope by changing the local geological structure, and to intercept rainwater as much as possible so that it can infiltrate into the herbaceous plants or shrubs on the slope surface to effectively reduce or Prevent the formation of slope runoff. When the slope is in danger of gravity erosion, proper drainage works and supporting structures can be built to prevent the occurrence of landslides. The general idea of the channel is to take small watersheds as the unit, adopt the comprehensive management mode of "upper block, lower drain, no water down the mountain, no mud out of the ditch", implement simultaneous treatment of ditch and slope, focus on the channel protection project, engineering measures and Biological measures are taken together, trench engineering measures are combined with slope engineering measures, through various trench braking engineering measures and slope retention engineering measures, supplemented by various runoff retention and small-scale water conservation engineering measures; vigorously planting trees and afforestation, Implement the conversion of farmland to forests and (grass), and give full play to the overall protection benefits of key gully control projects and small-scale storage projects. The focus of the plan is water conservation engineering measures for river valleys and slopes, other small water conservation projects, and forest and grass ecological projects.

Keywords

Slope; Research Progress; System; Slope-ditch.

1. Introduction

Slope engineering measures can change the small topography of the slope, block runoff on the spot, stop water from flowing into the ditch, and play a role in protecting water from moisture. The sloping grassland was transformed into afforestation land that "retains water, protects water, and protects fertilizer". According to the characteristics of slope erosion in small watersheds and the requirements of gully control, the slope soil and water conservation projects that can be adopted include: horizontal terraces, high-standard horizontal ditch, horizontal terrace land preparation and fish scale pit land preparation. Afforestation and planting of grass on the slope can greatly improve the moisture retention effect of the slope, ensure the survival rate of forest and grass, and play the role of consolidating soil, improving soil and changing the microclimate [1]. In addition, contour tillage, strip intercropping, grass field rotation, etc. can be used on the parts of the slope that are not easy to prepare, which can effectively improve soil physical and chemical properties, increase soil organic

matter and aggregate structure, improve soil permeability, water storage and fertilizer retention, and enhance soil Anti-corrosion and impact resistance. The characteristics of the overall soil erosion in the loess hilly and gully area are: undulating beams, steep slopes and deep gullies, and serious surface and gully erosion. Surface erosion mainly occurs on sloping farmland, followed by barren hills and slopes; gully erosion mainly occurs on slope cut gullies, juvenile gullies and gully heads. Combine the characteristics of soil erosion and topographic features. The overall layout of soil erosion control is: adhere to simultaneous treatment of ditch and slope, comprehensive treatment, and form a protection system for beams, ridge slopes, valley slopes, ditch heads, and trenches.

2. Research progress of slope-ditch composite system

2.1 Analysis of the relationship between slope and gully soil and water conservation

With the accelerated development of my country's urbanization process and the improvement of the urban infrastructure system, various development and construction projects have developed rapidly. At present, such as in highways, public civil buildings, water conservancy projects, etc., there are often side slopes formed naturally or formed by excavation and backfilling. In the absence of water and soil conservation measures, slopes can easily cause erosion, surface erosion and other water and soil loss through rainfall runoff, etc., and severely affect the stability and normal operation of engineering buildings. Therefore, in the water and soil conservation plan of each project, protective measures must be designed according to the characteristics of the slope. The surface soil of the slope is relatively loose, low in strength, and the moisture content varies greatly. It is susceptible to external rainfall and transpiration, which are the main inducements for soil erosion. The slope foot is the suitability of plants and causes soil erosion [2].

The water and soil erosion of the channel and the slope is the most serious area of the mountain area. When raining, it first converges from the top rainwater collection area and dumps down through the slope surface, taking away a large amount of sediment from the slope surface, thereby increasing the runoff erosion capacity and converging Channel. The channel accepts a large amount of runoff and sediment from the side slope, and a large amount of sediment in the channel converges to form a more erosive channel sediment flow, and even becomes a river channel. The high-strength erosive sand and water flow caused serious soil erosion phenomena such as the advancement of the gully head, the undercutting of the gully bed, and the expansion of the gully bank. These phenomena have increased the instability of the slope. The undercutting of the gully bed and the expansion of the gully bank damage the bottom foundation of the slope, which makes the slope prone to gravitational erosion such as landslides and collapses, as well as mixed erosion such as mud-rock flows. Slope and gully soil erosion affect each other and are in an inseparable relationship. Therefore, it is necessary to consider both gullies and slopes in their treatment. With small watershed as a unit, biological measures and engineering measures are combined, unified consideration, rational layout, and comprehensive management [3].

2.2 Concept and classification of slope treatment engineering

Slope can be classified according to its genesis, stratum lithology, service life, etc. This article is classified according to the material composition of the slope, which is divided into three types: rock slope, soil slope and earth-rock slope.

The rock slope is characterized by a large inclination angle, poor vegetation growth conditions, or lack of it. The surface of the exposed rock slope is monotonous and dark, which is easy to destroy the overall landscape effect of the project. Therefore, plant measures are taken to green the slope under the premise of ensuring the stability of the slope. For rock slopes, slope protection methods are often adopted to protect the slope with a thick-layered base material with hanging nets and vegetation concrete to protect the slope. The construction process of the thick base material of the hanging net is: bolt drilling, grouting → hanging net → thick base material → protective net → maintenance. The anchor rod has a reinforcing effect on the slope surface, ensuring the stability of the slope surface, and can also play the role of hanging nets. Wire mesh, geonet, etc. can be used for hanging nets,

which play an important role in the overall stability of the substrate. The composition of the thick base material is a mixture of green base material, planting soil, fiber and vegetation seeds in a certain proportion [5]. Vegetation concrete greening slope protection is a new technology for protecting and greening rock slopes using specific concrete formulas and seed formulas.

The soil-rock slope is a slope composed of soil mixed with crushed stone or crushed stone and a mixture of soil and rock such as crushed stone or crushed stone with soil. Three-dimensional vegetation nets are commonly used for slope protection, hydraulic spraying grass planting, ecological grouting technology for slope protection, and ecological Slope treatment measures such as vegetation biological protection. The mechanism of the three-dimensional vegetation net slope protection refers to the use of active plants combined with engineering materials such as geosynthetics to construct a protection system with its own growth ability on the slope surface, and the technology of strengthening the slope through the growth of plants. Cover the surface of the slope with a layer of geosynthetic material and plant a variety of plants according to a certain combination and spacing [4]. The growth activities of the plants achieve the purpose of root reinforcement and stem and leaf erosion prevention. After ecological slope protection technology, it can be used on the slope surface. Forming dense vegetation cover, forming a tangled root system in the topsoil layer, effectively inhibiting the erosion of the slope by storm runoff, increasing the shear strength of the soil, reducing the pore water pressure and the self-gravity of the soil, thereby greatly improving the slope Stability and erosion resistance.

3. Application examples of slope-ditch composite system

The slope-ditch composite system can be understood as the principle of comprehensive management with small watershed as a unit. In the process of management, the goal is to control soil erosion and improve the ecological environment, and adhere to the principle of comprehensive management of mountains, water, forests, fields, and roads. Scientific planning, reasonable layout, suitable for local conditions, suitable for trees, using a combination of slope treatment and gully treatment; combining biological and engineering measures; combining water diversion and mountain construction with road construction, and combining rainwater collection and utilization with timely supplemental irrigation, The method of combining trees, shrubs and grass to comprehensively control water and soil loss in small watersheds.

Li Runjie et al. analyzed the current situation of soil erosion in the gully surrounding Xining City, the causes of occurrence, and the problems existing in the previous governance process. Most of the 12 small watersheds in the outskirts of Xining are in the erosion development period. Gravity is accompanied by serious water erosion, and the debris flow is extremely harmful. The gravity erosion of the gullies is mainly distributed in the gully heads and gullies. The function of the trench project is to fix and raise the erosion base level, slow down the ratio of the trench to the longitudinal slope, and reduce the flow rate of mountain torrents. The projects include ditch control silt dams, earth-rock mills, ditch bank protection, waterlogging ponds, etc. Take the basic sequence of "from the head of the ditch to the mouth of the ditch, and from the branch ditch to the main ditch". Many groups of trench protection system projects are formed, which can store water, block mud, and silt afforestation (grass) to greatly alleviate the harm caused by trench erosion to cities and towns. Slope engineering measures can change the small topography of the slope, block runoff on the spot, stop water from flowing into the ditch, and play a role in protecting moisture and culverts. Transform the low-yield sloping farmland with "running water, soil, and fertilizer" or sloping grassland with severe soil erosion into afforestation land that "reserves water, soil, and fertilizer". In view of the characteristics of slope erosion in small watersheds in the suburbs of Xining and the requirements for gully control, the main slope soil and water conservation projects that can be adopted are: horizontal terraces, high-standard horizontal ditches, horizontal terraces and fish scale pits. Based on the experimental observations in the Changlinggou, Wayaogou and Huoshaogou channel governance demonstration areas established for different channel characteristics, the channel governance plan was proposed, and

engineering and biological governance measures were implemented. Obvious benefits have played a good reference role for soil erosion control in this area and similar areas.

4. Existing scientific problems and research ideas

Through literature analysis, it can be seen that the current water and soil erosion control follows the small watershed as the unit, pays full attention to the governance work in the upper reaches of the channel, gives priority to the implementation of the goutou (gounao) governance, and carries out the governance work in accordance with the order of governance from top to bottom. It should be based on a long-term perspective. To overcome the idea of quick success and instant benefits, avoid the practice of "getting useless and avoiding useless", realize the scientific arrangement of treatment measures for the downstream wide gully and upstream narrow gully, and use the comprehensive treatment of the upstream gully to ensure the comprehensive treatment of the downstream gully. Safe operation and benefit play. Slope surface (especially slope farmland) is the main source of soil erosion in mountainous areas. However, in specific management, in the absence of comprehensive slope management, a lot of manpower and financial resources are spent on trench management, although in a relatively short period of time Some results have been achieved in China, but after heavy rains and floods, there are often scenes where most of the embankment is siltated by sediment, the sand presses the land, and the embankment collapses, which greatly dampens the enthusiasm of the general public to carry out river basin management work. Cause a huge waste of people and property. Therefore, we must change the erroneous views and practices that only pay attention to gully treatment and ignore slope treatment, adhere to the principle of treating the slope first and then the gully, and finally realize the simultaneous treatment of the gully and slope. As there are many reasons for soil erosion, it is necessary to always adhere to the principle of comprehensive management to achieve both symptoms and root causes. However, in some areas, many small watersheds have not reached the goal of comprehensive management. Some areas are keen to engage in image projects and performance projects. In the implementation of comprehensive management of small watersheds, too much energy has been concentrated on the construction of embankments, the combination of embankments, roads, and roads. Land leveling and other face-saving projects have achieved temporary image goals, but it is difficult to ensure long-term safety. Therefore, we must adhere to the principle of comprehensive management of mountains, water, forests, fields, roads, and villages, and avoid image projects. The specific topography, vegetation composition and other natural conditions of each channel in mountainous areas are quite different, and the main causes of soil erosion and treatment ideas are also different. Therefore, the principles of adapting measures to local conditions and fortifying due to disasters should be adhered to in the management of mountainous channels. Don't just copy the experience of others. It is not possible to blindly apply the practices and experience of other comprehensive treatment of mountain gullies, not pay attention to combining the actual conditions of the river basin, focus on gully treatment, and underestimate the treatment of slopes (or even not treatment of slopes). This practice must be resolutely corrected.

From this, it can be seen that the process of slope and gully treatment must be comprehensively studied, and the influence of the gully treatment project and the slope treatment project must be analyzed in depth, and the slope and gully treatment engineering system must be regarded as a complete set of slope-ditch. Road composite system, looking at the overall situation and studying the ecological effects it brings. Through the implementation of this process, the comprehensive ecological safety control technology of the slope-ditch composite system is proposed, and it is popularized and applied. This should be used as the technology To study the scientific problems to be solved. The research idea is to select small watersheds with slopes and gullies, or with slope and gully treatment projects at the same time, combined with the characteristics of water and soil loss in the small watersheds, social and economic development, and comprehensively consider the impact of the slope-ditch composite system on the ecology. Safety impact and control technology.

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