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Study on ecological environment impact and soil and water conservation technology of power transmission and transformation projects in typical ecologically fragile areas in western China

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Abstract. In the steady development of social and economic, the field of power transmission and transformation engineering construction in our country gradually forms a new electric power development pattern, providing a solid foundation for the innovative development of electric power enterprises in a new era. Since power transmission and transformation projects will cause serious soil and water loss, which will have a direct impact on the stability of ecological environment in various regions, which is not conducive to the construction and operation of power transmission and transformation projects and the long-term development of social economy, how to construct a safe and standardized construction environment, scientifically deal with the ecological environment problems of power transmission and transformation projects, and rationally use soil and water conservation technology? It is the main problem that Chinese scholars study and discuss at present. On the basis of understanding the environmental status of typical ecologically fragile areas in western China, and according to the development of soil and water conservation technology in power transmission and transformation projects, this paper mainly studies the online monitoring system and application technology of soil and water conservation for power transmission and transformation projects in a certain area, so as to provide effective basis for the construction management of power transmission and transformation projects in the new era.

Keywords: western region; Ecologically fragile area; Power transmission and transformation projects; Ecological environment; Soil and water conservation.

1. Introduction

Nowadays, China has made excellent achievements in the research on the causes of soil and water loss, regional division of soil and water conservation, comprehensive management of soil and water conservation, etc. However, the implementation effect of soil and water conservation is not good because the ecologically fragile areas are affected by the contradiction between people and land, self-regulation ability, self-recovery ability, energy cycle imbalance and other factors. Therefore, in the future, it is necessary to continue to explore the water and soil conservation

technology in ecologically fragile areas and the factors affecting the ecological environment of power transmission and transformation projects, so as to propose more perfect ecological environment management measures. In essence, ecologically fragile areas refer to natural bodies that are vulnerable to the interaction of global climate change and human-land contradictions, which are mainly characterized by climate warming and extreme climate events, and cannot properly cope with adverse events. They are characterized by environmental heterogeneity, marginal effects, instability, and high sensitivity. Under normal circumstances, ecological vulnerability is mainly caused by hereditary vulnerability, fluctuating vulnerability, staggered vulnerability and other factors. According to the existing land distribution in China, the ecological fragile areas are mainly divided into the following types: first, the ecological fragile areas of forest and grass in northeast China; Second, the ecologically fragile area of agriculture and animal husbandry in northern China; Third, the ecologically fragile area of desert oasis junction in northwest China; Fourth, the southern red soil hilly land ecological fragile area; Fifth, karst mountainous rocky desertification ecological fragile area in southwest China; Sixth, the southwest mountainous agricultural and pastoral ecologically fragile area; Seventh, the ecological fragile area of compound erosion on the Qinghai-Tibet Plateau; Eighth, the coastal water-land boundary zone ecological fragile area. Although the distribution area of ecologically vulnerable areas in China is wide and the actual classification is more, the characteristics of soil and water loss are predictable and zonal, so valuable information can be obtained whether it is theoretical analysis or out investigation, which can facilitate scientific researchers to formulate effective treatment measures as soon as possible.[1-3]

With the innovative development of China's power enterprises, more and more researches on ecological environment and soil and water conservation technology in the field of power transmission and transformation engineering construction have gradually become the focus of attention of power transmission and transformation engineering. From the perspective of the application and development of soil and water conservation technology in power transmission and transformation projects in China, most scholars mainly focus on two aspects: on the one hand, it refers to the application status of soil and water conservation technology; on the other hand, it refers to the development trend of soil and water conservation technology. From the perspective of the construction management of power transmission and transformation projects in typical ecologically fragile areas in western China, the construction and operation of power transmission and transformation projects will have a negative impact on the ecological environment, and soil erosion is a relatively complex systematic process, which includes a number of influencing factors. Both project construction and project operation will change the ecological environment of the construction area. In particular, the native vegetation on the surface will be directly destroyed. By studying the representative ecologically fragile areas in western China, and aiming at the impact of power transmission and transformation projects on the ecological environment, professional models are used to systematically analyze the role of various influencing factors in engineering soil and water loss. Finally, it can be found that land leveling and temporary earth and rock stacking have the greatest impact. Therefore, construction units and engineering enterprises are required to strengthen control during construction. In order to reduce the incidence of soil erosion.[4-6]

On the basis of understanding the typical ecologically fragile areas in western China and starting from the impact of power transmission and transformation projects on ecological environment, this paper mainly studies the technology and monitoring system of water and soil conservation in power

transmission and transformation projects, and defines the effective measures of water and soil conservation in power transmission and transformation projects combined with practical cases.

2. Method

2.1 Online monitoring system

In solving the ecological environment problem of power transmission and transformation project in the typical ecological area of western China, the most important thing is to master the basic information of water and soil environment. By collecting the relevant information of soil and water conservation in the construction project, the soil and water structure during the construction management of power transmission and transformation project can be comprehensively monitored, the soil and water environment of the project can be avoided, and safe rice can be buried for the subsequent work. In order to comprehensively monitor the actual situation of water and soil environment in power transmission and transformation projects, STM 32 series single chip microcomputer is regarded as the core processor, and the online monitoring system architecture as shown in FIG. 1 below is constructed. Dual communication construction mode and wireless transmission mode are used to obtain water and soil environment information:[7-9]

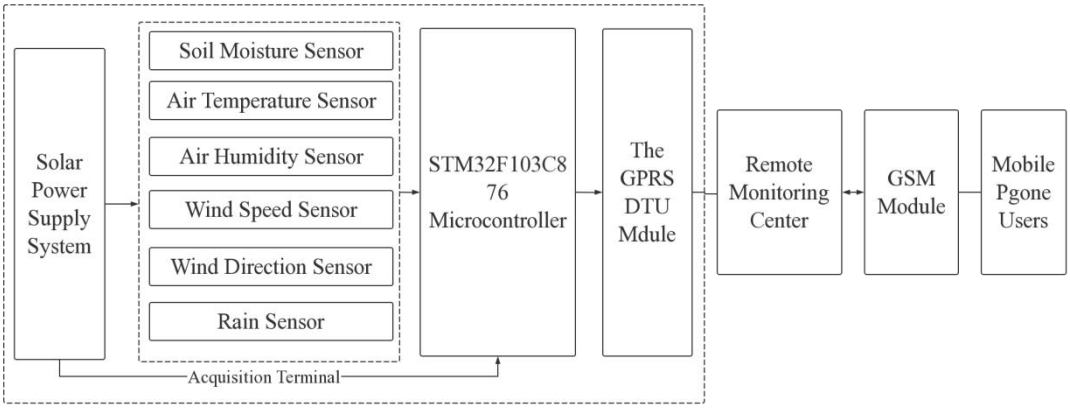

FIG. 1 Architecture diagram of online monitoring system

According to the above analysis, the overall system mainly includes four parts: first, it refers to the information collection terminal, second, it refers to the remote control center, third, it refers to the user's mobile phone, and finally, it refers to the wireless transmission module. In the process of system operation, the information acquisition terminal as an important module of information collection, will be under the control of the single chip microcomputer, the use of sensors to collect information, through the GPRS DTU module will be collected information sent to the remote control center, according to the solar energy supply system to the information acquisition terminal equipment to provide electrical energy. Since the design of this system will be based on the measurement accuracy index information of the sensor, the sensor model of the monitoring system should be reasonably selected on the basis of comprehensive consideration of cost expenditure. The specific scheme is shown in Table 1 below:[10-13]

Table 1 Sensor selection scheme

number	Sensor name	model	explain
1	Soil moisture sensor	PH-TS100	By measuring the dielectric constant of soil, the numerical value of soil moisture content is obtained by formula

			calculation.
2	Air temperature sensor	PHQW	The sensitive resistor is selected as the air temperature sensing component, and the temperature change value is obtained by measuring the resistance value.
3	Air humidity sensor	PHQS	The film humidity sensitive capacitor is selected as the air humidity sensing component, and the humidity change value is obtained by measuring the dielectric constant.
4	Wind speed sensor	PHWS	Under the action of the optical coupler, the rotating cup of the movable shaft rotates and generates a frequency signal.

The system software uses C language as a program development tool to systematically write software running programs, clarify the operating process and basic requirements of information collection, and use data analysis terminals to read data, which is regarded as the monitoring result after verification.

2.2 Technical analysis of soil and water conservation

On the one hand, standardized development. The key technology of soil and water conservation should be selected based on typical ecologically fragile areas in western China, and the quality and safety of construction should be regarded as technical conditions, and the technical support should be paid attention to to improve the operation efficiency of the project. From the perspective of practical operation, the construction of soil and water conservation technical system for power transmission and transformation projects is mainly used to innovate soil and water conservation technical means, truly realize dynamic soil and water conservation monitoring and management, and scientifically solve the impact of engineering construction and operation on the ecological environment. Nowadays, China pays more attention to the standardization of key technologies when constructing the technical system of soil and water conservation in power transmission and transformation projects, which has become the main content of this study. With the continuous development of social economy and science and technology, soil and water conservation technology of power transmission and transformation engineering is becoming more and more mature. Combined with the soil and water conservation system based on the early warning of impact factors, as shown in Figure 2 below, it mainly includes three functional modules. First, it refers to the basic impact factors, including relative height difference, soil texture and vegetation cover. The second is the response factor, which includes soil water content, erosion intensity and disaster sensitivity. Finally, it refers to the induction factors, which include 24-hour rainfall and slope loose material.[14-15]

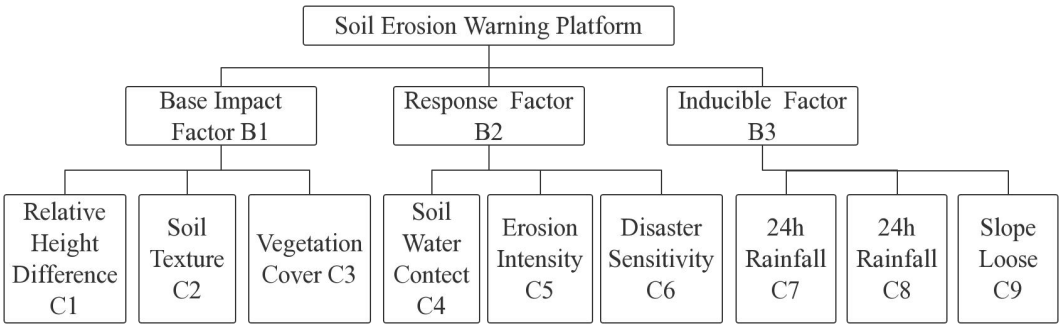

FIG. 2 Soil and water conservation system based on early warning of impact factors

On the other hand, the era of big data. In the rapid development of information technology, the construction of soil and water conservation technology system based on big data technology is an effective measure to solve the ecological environment problems of power transmission and transformation projects in typical ecologically fragile areas in western China. After importing the data model, the system will propose more accurate soil and water conservation measures. In dynamic real-time monitoring, this system can comprehensively monitor the basic information such as surface disturbance, temporary stacking of soil and rock, and provide an effective basis for soil and water conservation technology in each construction link. After summarizing the soil and water loss factors of power transmission and transformation projects, a mathematical model is built based on the geological conditions and data information of ecologically fragile areas in western China, and a soil and water conservation technical system is constructed through dynamic monitoring and analysis, which meets the requirements of ecological environment and soil and water conservation management of power transmission and transformation projects in the new era.

3. Result analysis

3.1 Case Analysis

Under the influence of geographical conditions, ecological environment and other factors, the possibility selection of industrial development in the western ecologically fragile areas is quite different from that in other areas. These areas have a common nature of extensive development of natural assets, and there are problems of different performance, uneven degree but essentially the same development. After entering a new stage of urban construction and development, the industries in the western ecologically fragile areas must promote industrial transformation and upgrading on the basis of efficient use of resources and high-tech reform if they want to achieve sustainable development goals. From the perspective of the development of the power industry, power transmission and transformation projects have a great impact on the ecological environment, and there are many potential soil and water conservation problems, which directly affect the efficiency and quality of the construction management of the project. The online monitoring system proposed in this paper is used to collect relevant information, carefully observe the data display of the computer operation interface of the monitoring center, and make a comparison and analysis with the field investigation data, if the accuracy of the monitoring data exceeds 90%. Then the monitoring results of the system can provide a reference for the application of soil and water conservation technology, and the specific results are shown in Table 2 below:

Table 2 Experimental results

Test number	statistical results	time	Moisture soil/（%）	Wind direction/°	Wind speed/（$m.s^{-1}$）	Air humidity/%RH	Air temperature/℃	Rainfall/（$mm.min^{-1}$）
1	monitor	08：23：10	22.5	263	0.212	81.5	11.23	0.0
	reality	08：23：10	22.1	260	0.209	80.9	11.33	0.0
	Accuracy/（%）	---	98.22	98.86	98.58	99.26	99.12	100
2	monitor	09：23：10	22.6	258	0.332	85.4	12.31	0.63
	reality	09：23：10	22.3	256	0.329	85.1	12.19	0.62
	Accuracy/（%）	---	98.67	99.22	99.09	99.65	99.03	98.41

Based on the analysis of the above table, it can be seen that the information collection accuracy of the research system in this paper has reached more than 98%, and the real-time monitoring data is strong, which meets the construction and management requirements of power transmission and transformation projects in typical ecologically fragile areas in western China.

3.2 Maintenance Measures

When solving the problem of soil erosion in power transmission and transformation projects in ecologically fragile areas in western China, the basic principles of prevention first, protection first, comprehensive planning, comprehensive treatment, local conditions, scientific management and attention to education should be strictly followed. The actual operation system is shown in Figure 3 below:

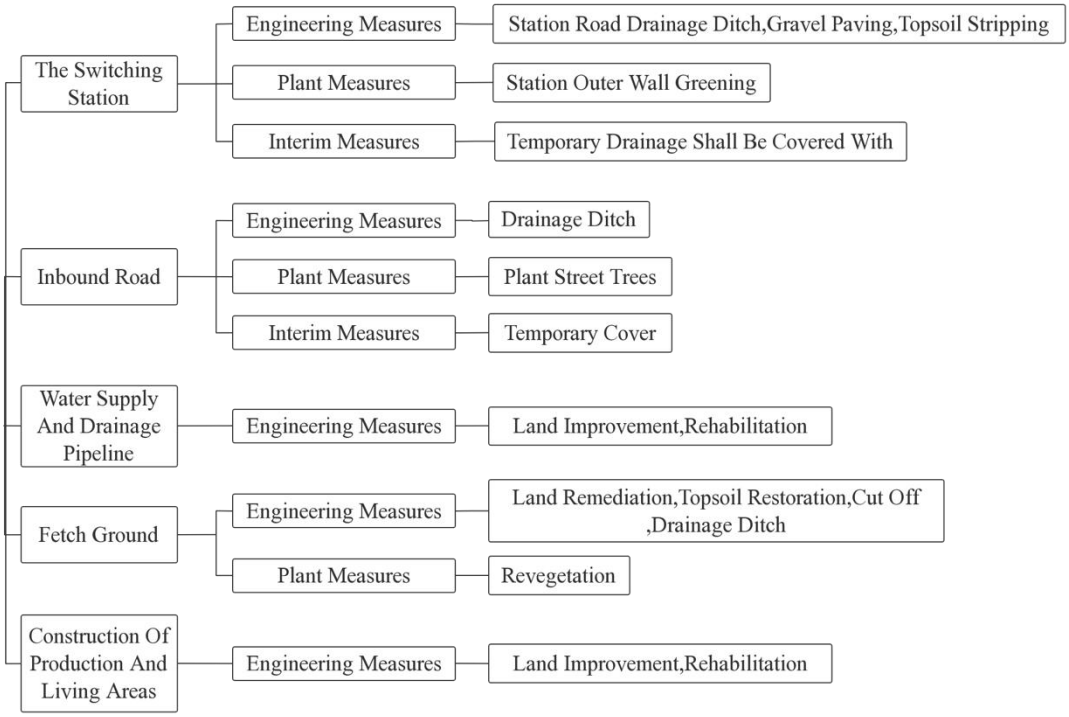

FIG. 3 Implementation system of soil and water conservation

For power transmission and transformation projects, construction personnel can choose engineering measures, plant measures and temporary measures and other technical means to solve the problem of soil and water conservation, the specific content is divided into the following points: first, switch station. In the Station Road design gutter, the use of gravel paving, topsoil stripping, can also be implemented in the station outside the wall greening treatment; Second, the pit road. Designing drainage ditches or planting street trees; Third, water supply and drainage pipeline. In this area, the engineering measures of land consolidation and rehabilitation should be selected; Fourth, the earth field. In this area, soil erosion can be alleviated by land regulation, topsoil restoration, drainage ditch design and vegetation restoration. Fifth, the construction of production and living areas. This area can only choose the engineering measures of land consolidation and rehabilitation.

Conclusion

In summary, after defining the environmental characteristics and construction needs of typical ecological areas in western China, starting from the impact of power transmission and transformation projects on the ecological environment, and according to the construction and operation of power enterprises in recent years, the soil and water conservation problems and application technologies of power transmission and transformation projects are mainly studied. In order to obtain more perfect information of soil and water environment of the project, this paper defines the technical system of soil and water conservation of the power transmission and transformation project while constructing an online monitoring system, and chooses two methods of obtaining information, namely remote monitoring and mobile phone monitoring, to provide technical support for the construction management of the power transmission and transformation project in the new era. The final experimental results show that the on-line monitoring system can

not only grasp more perfect soil and water loss information, but also provide an effective basis for selecting suitable soil and water conservation technology.

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