THE FACTORS ANALYSIS ON THE DEVELOPMENT OF PERMAFROST IN CENTRAL AND EASTERN OF QILIAN MOUNTAINS IN WESTERN CHINA

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The Qilian Mountains, which is composed of a series of mountains with the elevation ranged from lower than 2000m to high than 5000m, are located at the north-eastern edge of Qinghai-Tibetan Plateau and the western part of China. The Qilian Mountains have important geographic meanings in that it's the boundary mountain of two provinces of Qinghai and Gansu and the headstream of three continental rivers in China. The study area (99.5-100.5N, 37.5-38E) is concentrated in the central-eastern part of the Mountains, in which the altitudes range from 3500 m to 4600 m and the mean altitude of the whole area is 3850 m. The high altitude formed the cold climate settings which contributed to the development of permafrost; therefore, altitude is the major factor controlling the development of permafrost.

In addition, because of the highly varied topographic and microclimatic conditions, the distribution patterns of permafrost are characteristic by sporadic and discontinuous in the mountainous areas. Such influencing factors as latitude, slope, aspect, vegetation, soil wetness etc., as well as their interactions have great impacts on the development and distribution of permafrost in different spatial scales. To evaluate quantitatively the effects of influencing factors in different spatial scales, a statistical method was used and the relationship between permafrost existence and the regional or local factors was analyzed. The basis data in this case are the boreholes drilled in 2004 to investigate the distribution patterns of permafrost along the main roads in this area to serve for their maintains. In order to finish the task of evaluation, a binary variable of permafrost existence or not was presented based on the boreholes, and the potential direct solar radiation monthly and annually, the curvatures which included the profile curvature and the plan curvature, as well as the soil wetness index was calculated based on a 90m-resolution DEM using the Solar Analyst program within the software of ESRI's ArcView 3.2 and the System for Automated Geoscientific Analyses Version 2.0 (SAGA) software, on the basis of which the correlation analysis was carried out within the SPSS13.0 software.

The primary analysis results showed that longitude, elevation and latitude were the major

factors in the regionally permafrost distribution scales with their correlation coefficients were -0.682, 0.621 and 0.573at the 0.01 level, respectively. With the exception of the macro-factors of longitude and latitude, the analysis results proved that the most significant relations were found between the binomial existence of permafrost and the elevation and the potential direct short-wave incoming radiation (PSR) with their correlation coefficients of 0.621 and 0.504. Next came the slope and aspect factors with correlation coefficients of -0.252 and -0.249 at the 0.05 level. However, the micro-topographic factors of curvature, plan curvature and profile curvature were proved to have no significant relations with the permafrost existence in this area (Sig. >0.05). Similarly, the topographic wetness index had no obvious relation with the permafrost. Furthermore, the relationship between solar radiation and permafrost occurrence was analyzed by calculating the potential seasonal and monthly solar radiation values and testing their correlations with the binary existence of permafrost. The results showed that both the monthly and seasonal solar radiations had significant relations with permafrost occurrence, and especially the summer PSR and June PSR had the strongest correlations with correlation coefficients were 0.646 and 0.666, respectively. Accordingly, on the basis of the correlation analysis, elevation and June PSR were main controlling factors for the development of permafrost in the study area, followed by aspect and slope factors.

Lack of vegetation cover data is a big drawback of this research. In this area, alpine meadow is the main vegetation type. The favorable ground surface water conditions allow the surface vegetation to grow well and the interaction between vegetation cover and soil water content is so intense that it is difficult to distinguish clearly the individual functions in the process of permafrost development. The interaction between vegetation and soil water content, as well as their effects on the mechanism of the development of permafrost should be studied further. Owing to the drier continental climate, the duration of the snow cover on the ground surface is short and the snow cover is thin. Seasonal snow cover has a great effect on the development of permafrost in this area. The influence of snow covers on the development of permafrost could not be considered in this case.