学 位 論 文 内 容 の 要 旨

博士（環境科学）　　氏　名　Avirmed Dashtseren

学 位 論 文 題 名

Study on the ground thermal regimes under a forest-steppe mosaic in the area of discontinuous permafrost, Mongolia
（モンゴル不連続永久凍土帯の草原森林混在域における地温動態に関する研究）

In continental scales the areas with the active layer underlined by permafrost are overlapped with tundra and boreal forest, while seasonally frozen ground with steppe. In the northeastern Eurasia, transitions from the Siberian boreal forest to the steppe are clearly seen in the central Mongolia, where the general landscapes are characterized by a mosaic-likely distribution of forest and steppe. This mosaic also lies the southern edge of the Siberian continuous permafrost zone. These situations would reflect complicated distribution of active layer and seasonally frozen ground, and their symbiotic features with local geographic settings such as topographic relief, vegetation and micro-climate. However, the interplays between the ground thermal regime, vegetation cover, and climate are not understood clearly in such a mosaic region. To better understand these interplays, it is necessary to use the intensive field observation in various locations within the mosaic. This study aims to understand physically the interactive manners between the ground temperatures and site-specific factors, using four years hydro-meteorological records obtained from permafrost-underlying forested slopes and its adjacent permafrost-free steppe slopes.

The local topography together with the forest cover was found to be the most important factors that control the different amount of solar radiation on the ground surface at each site. During the winter, the topographic effect on the solar radiation seems to be very important for

the forested north-facing slopes, as it strongly reduces potential solar radiation (PSR) compared with south-facing slopes. Inversely, the topography effect on solar radiation at each slope is less and the differences in PSRs among the sites is identical during the summer. However, large differences in solar radiation at the ground surface between the sites were observed.

This indicates that the considerable differences in observed solar radiation at the ground surface between the sites were caused mostly by forest cover, rather than the topography effect during the summer. Significant reduction of the amount of solar radiation and air temperature to the ground surface, probably causing higher air temperature than the surface temperature at the forested north-facing slopes. In contrast, the mountain steppe on a dry south-facing slope receives a large amount of solar radiation, and therefore the surface temperature exceeds air temperature during the summer, leading to a warm soil profile.

The thick organic layer within the forested slope impedes the effects of air temperature to the deep ground during summer, and this is confirmed by the lower thawing ratios observed within active layer at the forested north-facing slope. Consequently, the active layer thaws slowly, although the active layer thickness (ALT) was determined during the summer warmth. In winter, the surface temperature is warmer on the forested slopes than on the steppe slopes, owing to the greater amount of accumulated snow cover and its low heat conductivity. However, the thick organic layer beneath the snow cover and the ice-rich substrate at forested site greatly enhances the freezing rate, which leads to rapid refreezing of the active layer. The duration and thickness of snow cover at the mountain steppe have a considerable influence on the seasonal development of seasonally frozen ground, and is inversely related to the thickness of seasonally frozen ground. Furthermore, despite of similar geographical conditions and soil textures at the sites, there was a later onset of soil thawing in the forested area than in the adjacent mountain steppe, even though soil freezing began simultaneously in both areas. These results exhibit that forested slope and the underlying thick organic layer at the edge of the Siberian forest are both important factors contributing to the ground cool and the existence of permafrost in this region, which appears only beneath the forested north-facing slopes.