

Physicochemical properties and carbon density of alpine sod layer with their variation across habitat gradients in the Zoige Plateau

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Abstract: The alpine sod layer is a soft, tough and resistant to shifting surface soil layer under the formation of the natural vegetation in the plateau cold region, understanding its ecological function is a prerequisite to promote grass and animal husbandry production for recuperation and protection, and the active use of project construction. Based on the extensive investigation on the alpine vegetation of the Zoige Plateau in the Eastern Qinghai-Tibetan Plateau of China, set up moisture gradient community sample plots: swamp, degraded swamp, swampy meadow, wet meadow, dry meadow and degraded meadow, and the elevation gradient community sample plots: subalpine meadow, subalpine shrub meadow, alpine shrub meadow and alpine meadow were set up. The sod layer bulk density, soil particle composition and soil organic carbon (SOC) content of different types of community plots were analyzed and to compare its carbon sequestration capacity on the moisture and elevation gradients. The results showed that the average thickness of the sod layer was 30 cm, the bulk density of the swamp was the smallest, and the SOC content was above 300 g/kg. The bulk density of degraded meadow was the highest while its SOC content was decreased significantly. The SOC density of sod layer in different communities was between 10 and 24 kg C/m², and decreased with the decreasing of soil water availability, and meadow degradation significantly decreased the soil organic carbon storage in sod layer. The sod layer SOC density of alpine shrub meadow was 15% higher than that of meadow on the altitudinal gradient. It was concluded that the mass water content threshold value for maintaining the sod layer stable is 30%. In the degraded succession of alpine vegetation from swamp to meadow, the bulk density and compactness of sod layer became larger, while the organic carbon content, carbon density and carbon storage decreased. The higher the gravel content of swamp, the more easily degraded, and the higher the sand content of the meadow, the more easily degraded. Shrub meadow had higher carbon sequestration capacity than that of meadow, but the productive function of shrub meadow was lower. Keeping the sustainable development of grassland productivity and maintaining the carbon sequestration ecological function, it is necessary to prevent the degradation of the sod layer, and restrain the succession from meadow to scrub meadow.

Key Words: surface soil layer, soil organic carbon, carbon density, alpine vegetation, Zoige Plateau