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# Plant and soil features of different degradation grades in the Inner Mongolia steppe, China

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As a result of climate change and human activities over the past century, the community species composition, ecosystem productivity and biomass have undergone significant transformations due to grassland degradation, which has a profound impact on the carbon storage process. We aimed to research the dynamics of plant and soil features along different grassland degradation gradients and examine the effects of grassland degradation on plant productivity, soil fertility and soil respiration rate, as well as the relationships between these variables. To provide a comprehensive assessment of grassland degradation and potential restoration methods.We conducted an experiment in Xilingol League, Inner Mongolia, China. To investigate plant biomass, SLA (specific leaf area), carbon content and community productivity. We also measured the soil bulk density and water content, soil organic carbon, soil total carbon content and soil respiration rate in different degradation grades. Plant biomass decreased significantly, while the fraction of root biomass and SLA increased with degradation grade. The carbon content decreased in the leaves but increased in the roots as the degradation gradient increased. Gross ecosystem productivity decreased from 15.51 $\mu$mol.m-2.s-1 in LD (light degradation) grassland to 9.7 $\mu$mol.m-2.s-1 in MD (moderate degradation) grassland and to 5.8 $\mu$mol.m-2.s-1 in SD (severe degradation) grassland. The net ecosystem exchange was -8.29 $\mu$mol.m-2.s-1, -3.14 $\mu$mol.m-2.s-1 and -1.57 $\mu$mol.m-2.s-1 in LD, MD and SD grassland, respectively. The community respiration rate (7.22, 6.56 and 4.22 $\mu$mol.m-2.s-1) decreased significantly as the degradation grade increased. The soil bulk density increased as the level of degradation and the depth of soil growth. Soil water content were significantly lower in SD grassland than in LD and MD grasslands. In general, the soil organic carbon content decreased dramatically with degradation gradient, and the soil respiration rate decreased significantly with degradation grade under different grass coverage. Grassland degradation directly caused significant changes in plant biomass, SLA, root carbon content, community productivity, soil bulk density and nutrients. The relationship between biomass and vegetation coverage was influenced by degradation. Deterioration directly decreased ecosystem productivity and carbon sequestration ability. The soil respiration rate exhibited a significant positive correlation with soil temperature at 0-10 cm and above-ground biomass. Demonstrating an increase in temperature enhanced the soil respiration rate by promoting above-ground biomass.