Carbon and nitrogen characteristic in plants and soils of the degraded alpine *Kobresia pygmaea* meadow in the Tibetan Plateau

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Introduction Grassland in the Tibetan Plateau occupies an area of about 1 .5 million km^2 , or two thirds of the total plateau area (Sun & Zheng 1998) . For a long time , grasslands were thought to be inexhaustible , but overgrazing has resulted in serious degradation . Cryoturbation and climate change have also accelerated the deterioration of alpine meadow . Ecosystem alterations cause changes in C and N cycling by altering plant production , rates of soil organic matter accumulation and decomposition , and subsequent C storage in the soils . The objective of the study was to evaluate the influence of land degradation on plant and soil C and N content in degraded alpine meadow .

Materials and methods This work was conducted on alpine meadow in Gande county , Qinghai Province (34°08′N , 100°11′E) located 4060 m asl . Three plots (200m×200m) for each lightly degraded meadow (LD) and severely degraded meadow (SD) were chosen for study . Total vegetation ground cover , and aboveground biomass for grasses , sedges and forbs were evaluated . Total organic carbon and total nitrogen for aboveground plant tissue , the root tissues and soil in the 0～20 cm and 20～40 cm depths were analyzed by dry combustion in a VarioEL® elemental analyzer . Tests for significant differences between treatments were conducted using analysis of variance with least significant difference .

Results The biomasses of grasses , forbs and the root biomasses in the 0～20 cm , 20～40cm and in 0～40m depths in LD were significantly higher than those in SD , respectively , except the biomass of sedges . The total aboveground plant tissue C and root C and N contents were higher for LD than SD , although , there were no significant difference for plant N and soil C and N between LD and SD .

Discussion With grassland degradation , vegetation cover and plant productivity decreased , which resulted in soil degradation , even loss of economical and ecological function . In the degraded succession of alpine meadow , sedges and grasses with dense-short rootstalk were replaced by dicotyledons with taproots , and the belowground biomasses were changed . The change of the community structure and functional groups resulted in the loss of plant tissue and soil C and N (Wang et al 2005) . Compared with the lightly degraded meadow , C content is lower in the severely degraded meadow . The decline was primarily attributed to decline in vegetative cover and productivity . In addition , since the carbon dioxide which was removed by photosynthesis from the atmosphere was reduced , there may be a decrease of organic matter input into the soil .

Table 1 *The biomass (±standard error) of plant groups and root in different degraded land .*

	LD	SD
Grasses (g m^{-2})	73 .24 (13 .32) a	7 .91 (3 .59) b
Forbs (g m^{-2})	76 .03 (10 .92)a	137 .02 (16 .19) b
Sedges (g m^{-2})	18 .42 (4 .47) b	3 .90 (2 .09)a
Total	167 .69 (24 .27)a	148 .88 (21 .54)a
Root 0-20 cm (g m^{-2})	2266 .81 (187 .41) a	942 .02 (168 .70) b
Root 20—40 cm (g m^{-2})	284 .89 (116 .18) a	28 .34 (5 .85) b
Root 0—40 cm (g m^{-2})	2551 .69 (204 .53) a	970 .39 (172 .35) b

Mean with the same latter are not significantly different at 5% level .

Table 2 *Mean (±standard error) content of C , N for plant , root and soil in 0-40cm in different degraded land .*

	LD	SD
Plant C (g m^{-2})	70 .67 (10 .23) a	57 .79 (8 .49) b
Plant N (g m^{-2})	3 .30 (0 .33)a	2 .04 (0 .29)a
Root C (g m^{-2})	905 .67 (78 .14) a	358 .10 (62 .32)b
Root N	15 .33 (2 .04)a	6 .57 (1 .88)b
Soil C	13692 .7 (1211 .4) a	13131 .9(1032 .3) a
Soil N	3633 .4 (160 .0) a	3772 .3 (210 .0) a

Mean with the same latter are not significantly different at 5% level .