Character of canopy apparent photosynthesis and transpiration in *Seriphidium* semidesert under different degradation gradient

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Introduction *Seriphidium* is generally the dominant native plant in semidesert and is extensively distributed in arid regions , especially on the northern slopes of the Tianshan Mountains . It plays an important role in stockbreeding and ecosystems . Photosynthesis and transpiration , which are two of the primary metabolic processes determining plants growth . But research reports about this semi-desert vegetation CAP and TR are relatively few . The objectives of this study were to determine : 1) what changes under different vegetation CAP and TR in different gradient of degradation in a day ? 2) What relationships between CAP .TR and environmental factors ?

Material and methods The study area is the spring autumn pastures of Sangong village , located on the northern side of the Tianshan Mountains , in Xinjiang , China . The dominant vegetation on the study sites is Seriphidium . , the companion species are , Petrosimonia and Ceratocarpus , but many degraded areas are inhabited by Petrosimonia . We divided grassland into three types according to degree of degradation , moderate , serious and exceeding (MD , SD , and ED) and built fence in all types (inside of fence : IF , outside of fence : OF) , with each plot measuring $40\times40 m^2$. Photosynthesis was measured using Beijing Siaidi company's CB-1101 photosynthetic detector within an assimilation box measuring $60\times60\times60$ cm^3 from an aluminum alloy frame and cover of film that allowed light transmittance greater than 85% , within the assimilation box two 12V fans were installed for blending air . Measurements were made from 10 :00am to 18 :00pm , at one hour intervals , three replications were set according fence×degree of degradation . Photosynthetic and transpiration rate were calculated using the apparatus software package . We inspected the relationships between all the variables by means of correlation analysis . All statistical analyses were performed using the statistical software package SPSS 12 .0 .

Results On moderate degraded grassland , with *Seriphidium* as the main vegetation , CAP from 10 :00 to 14 :00 increased slowly . The CAP was 8 $\mu molm^{-2} s^{-1}$ ~9 $\mu molm^{-2} s^{-1}$, and declined rapidly to the minimum from 15 :00~16 :00 , suggesting an obvious siesta phenomenon" , then rose slowly from 16 :00 to 18 :00 . From 10 :00 to 14 :00 , CAP (IF>OF) , but then both have similar trend in CAP after 14 :00 . When *Petrosimonia* was the main vegetation of severe and exceeding degradation of grassland , both inside and outside of fence CAP changed similarly with an obvious single peak curve with a maximum at 14 :00 . Inside of fence the highest average CAP was with severe degradation ,14 .8194 $molm^{-2} s^{-1}$, and the lowest CAP occurred with exceeding degradation outside of fence , only 1.9639 $molm^{-2} s^{-1}$. This result occurred mainly because with the conditions of exceeding degradation , vegetation is damaged and bare soil increases(Figure 1) . TR value of all vegetation types are a single peak curve , related closely to temperature changes . In all vegetation types TR increased significantly at 12 :00 , both its peak appeared in the afternoon at 15 :00 . This result occurred mainly because the transpiration is closely related to change of temperature , which on average TR is the highest on SDIF , followed by EDIF , and the TR changes are smallest on EDOF as the vegetation is very sparse(Figure 2) .

PAR and temperature changes are typical single-peak curves , the changes of temperature lags behind PAR , the peak of PAR appears at noon 14 :00 , but the temperature in the afternoon at 15 :00 . Inside and outside of the fence (Moderate Degradation) CAP decreased and TR increased with increasing PAR . CAP increased significantly with the rise in temperature in serious and exceeding degradated grassland , changes were consistent with temperature and PAR changes , correlation coefficients are 0.95** (P<0 .01) and 0 .96** (P<0 .01) and 0 .82** (P<0 .01) , 0 .34(P>0 .05) , respectively , except with extreme degradation . Due to sparse vegetation CAP did not change significantly with increasing temperature and PAR . Changes of transpiration are closely related to temperature , in the other five cases , the transpiration rate and temperature showed a significant correlation except for extreme degradation , correlation is not significant ; correlation coefficients were 0 .80** (P< 0 .01) , 0 .68* (P<0 .05) , 0 .87** (P<0 .01) , 0 .62* (P<0 .05) , and 0 .94** (P<0 .01) , respectively .

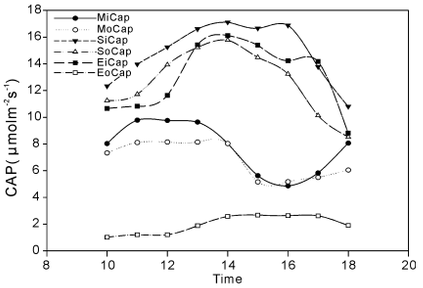

Figure 1 *Variation of CAP .*

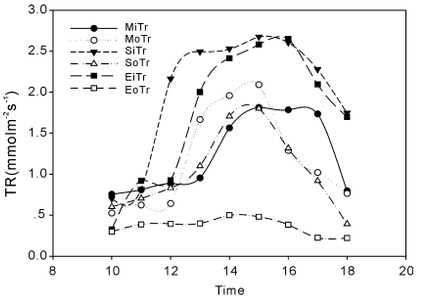

Figure 2 *Variation of Transpiration .*