Response of Plant Species Diversity to Simulated Climate Change Nitrogen Supply in Desert Steppe

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Key words : species diversity , diversity index , desert steppe , warming , nitrogen supply

Introduction Species diversity plays an essential role in sustaining earth system processes and providing basic goods and services to human society . Stresses from human activities , however , are having a profound effect on the earth system , including loss of species diversity , which is proceeding at unprecedented rates . Such stress is climate alteration and deposition . We investigated the independent and combined effects of experimental warming and nitrogen supply on plant species diversity in Sizhiwang County , a located in Inner Mongolia , China .

Materials and methods The experiment used a paired , nested design with warming as the primary factor and nitrogen supply as the secondary factor . There were six paired of 3×4-m plots , one plot in each pair was assigned as the warming treatment and the other as the control . Each warming and control plot were divided into two subplots (2×3-m) .The subplots were randomly assigned to the nitrogen supply treatment . Nitrogen supply in the subplot is $10 g/m^2$. The warmed plots have been heated continuously since May 2006 using 165×15-cm MSR-2420 infrared radiators (Kalgo Electronics , Bethlethem , PA , USA) suspended 2 .25 m above the ground . In the unwarmed control plot , one dummy' heater with the same shape and size as the infrared radiator was suspended 2 .25 m high to simulate the shading effects of the heater . Thus , there were six replicates for each treatment(control , warming , nitrogen supply , warming plus nitrogen supply) . In each of 24 subplots , we laid out a 1× 1-matrix . We investigated species diversity , cover and height . Margalef (Ma) , Shannon-Winner (H) , Simpson (D) and Pielou (JP) diversity indexes were analyzed using SAS 9 .0 .

Results In the study , the main effect of warming plots for H , D , JP was larger than in the control plots both 2006 and 2007 , but Ma was decreased . Comparing 2006 and 2007 in warming and control plots , D index was similar , H and JP were both increasing , respectively 4 .1% and 4 .6% , but Ma decreased 1 .5% . Both 2006 and 2007 , D , H and JP's value in warming× nitrogen supply subplots is higher than other three kinds treatment plots (control , warming , nitrogen supply) . In the same year , these diversity indexes were no significant difference ($P>0.05$) . The reason could be attributable to warming time . If warming experimental was continuously done in the following year , the diversity index difference would be significant . These diversity indexes did not vary in nitrogen-supplied subplots . A similar result has been reported from the Tibetan Plateau (Klein et al , 2004) .

Table 1 *Diversity index (W : warming , N : nitrogen supply , C : control) .*

Treatment	Margalef		Shannon-Winner		Simpson		Pielou	
	2006	2007	2006	2007	2006	2007	2006	2007
W×N	1 .576a+0 .21	1 .453a+0 .14	1 .491a+0 .2	1 .586a+0 .2	0 .695a+0 .07	0 .736a+0 .07	0 .717a+0 .07	0 .772a+0 .1
W	1 .544a+0 .31	1 .437a+0 .14	1 .425a+0 .21	1 .613a+0 .16	0 .642a+0 .09	0 .756a+0 .05	0 .693a+0 .07	0 .784a+0 .06
N	1 .536a+0 .23	1 .477a+0 .24	1 .44a+0 .25	1 .524a+0 .26	0 .653a+0 .11	0 .749a+0 .05	0 .689a+0 .12	0 .716a+0 .08
C	1 .625a+0 .3	1 .495a+0 .22	1 .438a+0 .37	1 .511a+0 .26	0 .642a+0 .16	0 .701a+0 .1	0 .674a+0 .14	0 .716a+0 .13

Conclusions The study , which is the first to explicitly examine the independent and combined effects of experimental warming and nitrogen supply on the desert grassland , suggests that the future species in this region will depend on both climate change and nitrogen supply .

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