T-FACE Experiment in the Qinghai-Tibet Plateau

Shiping Wang
Chinese Academy of Sciences, China

Jinhui Wang
Chinese Academy of Sciences, China

Caiyun Luo
Chinese Academy of Sciences, China

Xingwu Lin
Chinese Academy of Sciences, China

Yingnian Li
Chinese Academy of Sciences, China

See next page for additional authors

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Shiping Wang, Jinhui Wang, Caiyun Luo, Xingwu Lin, Yingnian Li, Xinquan Zhao, and Bruce A. Kimball

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Shiping Wang[1*] , *Jinhui Wang*[1] , *Caiyun Luo*[1] , *Xingwu Lin*[1] , *Yingnian Li*[1] , *Xinquan Zhao*[1] , *Bruce A . Kimball*[2]
[1] *Key Laboratory of Adaptation and Evolution of Plateau Biota , Northwest Institute of Plateau Biology , Chinese Academy of Sciences , Xining 810008 , China . Corresponding author's E-mail : wangship@yahoo .com*
[2] *U .S . Arid-Land Agricultural Research Center , USDA , Agricultural Research Service , Arizona , 85238 , USA .*

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Introduction Scientists have used both passive and active experimental designs to simulate climate warming . However , for many of the designs the conditions are so unnatural that quantitative extrapolation to field conditions is questionable (Kimball 2005) . Here , our aims are to : (1) describe warming effect of the temperature free-air controlled enhancement (T-FACE) system on the microclimate and (2) assess the applicability and suitability for longer-term studies of climate warming on the ecology of an alpine meadow at Haibei , Qinghai-Tibet plateau , China .

Materials and methods The experimental site is located at the Haibei Alpine Meadow Ecosystem Research Station (HBAMERS) , Chinese Academy of Sciences . In May , 2006 eight hexagonal arrays of Mor FTE (1000W , 240V) infrared heaters were built over grass along with eight dummy arrays over reference plots (Kimball *et al* . , 2007) . The experimental design included two factors (warming and grazing) with each of the resultant 4 treatment combinations replicated 4 times to total 16 plots in a completely randomized block distribution in the field . Air temperature and relative humidity at the 30 cm height of the soil surface , soil temperatures (at 0 , 5 , 10 , 20 and 40 cm soil depths) and moisture (at 10 , 20 , 30 and 40 cm soil depths) were measured and then 15-min averages were analyzed . The grazing treatment was imposed just once on August 16 in 2006 , and there was no significant difference between grazing and no-grazing treatments by the end of growing season . Therefore , the grazing treatment plots were regarded as additional replicates , so that the results of the warming treatment were analyzed using 8 replications .

Results The degrees of vegetation warming during daytime averaged 1 .18℃ and at nighttime averaged 1 .69℃) , which closely matched our set points of 1 .2℃ and 1 .7℃ , respectively . The T-FACE system had little effect on daily air temperature at 30 cm above the ground surface in the growing season (15～20 cm above canopy in August) . Average values of soil temperature at 0 , 5 , 10 , 20 and 40 cm were significantly increased by 1 .3～1 .5℃ (0～20 cm) and 0 .5℃ (40 cm) , and warming only increased the diurnal soil temperature range at 5 cm . Although warming caused decreases of approximately 3～13% of relative value of soil water content from 10～40 cm on the volumetric basis , these differences were not significant ($P > 0.05$) between warmed and no warmed plots at the different time scales (hourly , daily , monthly and seasonal) for 10～40 cm soil depths . Therefore , the T-FACE system simulated the changes in vegetation and microclimate well that are expected with future global warming .

References

Kimball , B .A . , 2005 . Theory and performance of an infrared heater for ecosystem warming . *Global Change Biology* 11 : 2041-2056 .

Kimball , B .A . , Conley , M .M . , Shiping Wang , Xingwu Lin , Caiyun Luo , Morgan , J . , Smith , D . , 2008 . Infrared heater arrays for warming ecosystem field plots . Global Change Biology (in press)

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