Seasonal and Diurnal Variations of Net Ecosystem CO_2 Exchange over Songnen Meadow Steppe in Northeastern China

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Key words : *Leymus chinensis* , Songnen meadow steppe , eddy covariance , carbon flux , net ecosystem CO_2 exchange

Introduction Carbon dioxide is the key factor to determine the degree of global climate change . In China , the studies on the role of terrestrial ecosystems in the sequestration of carbon have been limited to the typical steppe located in central Mongolia and Inner Mongolia , whereas for the meadow steppe , is still vacant . This paper is the first time to present results of continuous measurements of net ecosystem CO_2 exchange (NEE) above the Songnen meadow steppe in northeastern China using the eddy covariance technique . Our specific objectives were to : (1) to describe the characteristics in variations of net ecosystem CO_2 exchange (NEE) on diurnal and seasonal scales ; (2) to quantify the magnitude of a source or sink for atmospheric CO_2 .

Materials and methods The measurements were performed in the Pasture Ecology Research Station of Northeast Normal University , which located in Changling , Jilin Province of China (123°44'E , 44°40'N , 167m a . s . l .) . To evaluate the carbon sequestration of Songnen meadow steppe , which characterized by a large-scale pattern of meadow and alkali-saline patches , an open-path EC flux measurement tower was established in May 2007 as a member of the US-China Carbon Consortium (USCCC) for a long-term monitoring of turbulent fluxes of CO_2 , water vapor and energy (123°30'E , 44°35'N , 171m a . s . l .) .

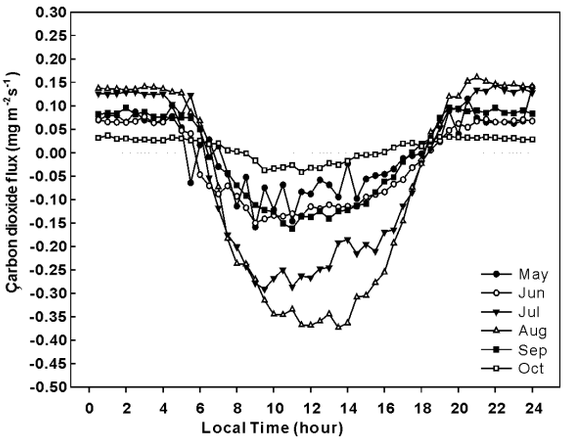

Figure 1 *The monthly-average diurnal variations of CO_2 fluxes over Songnen meadow steppe during the growing season in 2007 .*

Results and discussion Apparently in Figure 1 , the carbon assimilation was lower in the initial phase of growing season , which caused NEE in the daytime near the size of NEE at night . The rapidly growth of *Leymus chinensis* was respect to rising temperature and soil moisture . From June , NEE in the daytime started to increase and maintained a fairly higher than that at night for a long time until back to balance in September subsequently . An average CO_2 uptake reached a maximum of -0 .37 mg CO_2 $m^{-2} s^{-1}$, which can be seen in August when aboveground biomass peaked and higher than the steppe in Inner Mongolia (-0 . 29 mg CO_2 $m^{-2} s^{-1}$, Zhang et al . , 2007) . The Songnen meadow steppe acted as a net sink of atmospheric CO_2 and sequestered-87 .73 g C m^{-2} during the growing season in 2007 .

Conclusions The diurnal amplitude of net ecosystem CO_2 exchange (NEE) over Songnen meadow steppe varied substantially within the peak growing season , and there was a marked seasonal trend that NEE was regulated by the temperature and amount of precipitation . Firstly given the importance of Songnen meadow steppe as a terrestrial carbon store and argument concerning its carbon sink strength , this study will help to reduce uncertainties in carbon accounting for eastern Eurasia steppe .

References

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