Soil respiration and grazing in Renchinlhumbe soum of Hovsgol aimag

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Soils in the northern boreal zone contain large amount of carbon. The major carbon pathway from soil to the atmosphere consists of soil respiration and the process greatly depends on climatic conditions. Northern Mongolia (Hovsgol aimag) has warmed by almost 2˚C and soils have become drier. One of the major threats to soil moisture and temperature is grazing practices.

Mongolians have a nomadic style of grazing which is known as most suitable form of the pasture use in harsh continental conditions of Mongolia. However, this nomadic style was altered in during the middle of the last century, which affected vegetation cover and soil. Remnants of the nomadic grazing still exist but during the last one and half decades, the number of livestock heave increased dramatically and accelerated the impact from livestock to soil and vegetation cover.

As livestock remove vegetation cover, soils become warmer and drier. This condition has the potential to accelerate (because of the high soil temperature) or reduce (because of the lower soil moisture) soil microbial activity in northern cool regions where there is high amount of soil organic matter.

In order to assess how livestock grazing influences soil temperature and affects soil respiration in the southern border of the Siberian taiga forest, we designed an experiment involving livestock grazing. This experiment takes place in Renchinlhumbe soum of Hovsgol aimag that is located in the Northern part of Mongolia.

Our study site consisted of three locations measuring 25 by 25 meters just outside Renchinlhumbe soum. We selected random points within each quadrate to place enclosures 1 by 1 m in size. In the first location we selected 8 points and in 4 of them, we placed enclosures. The remaining 4 of the points were marked as comparative grazed plots. In the second and third locations we selected 6 points and placed 3 enclosures in each of the locations and marked 3 comparative grazed plots.

Soil temperature measurements were collected in each of the study plots at the same time of the day, (between 9.30-10.30 AM) with in the time period of June 12 to July 8. Soil respiration were measured 7 times during June 17- July 10 (always at the same time of the day-between 4.30-5.30 PM) period. At the end of the experiment we collected plant biomass and soil samples (0-10 cm depth) from each plot.

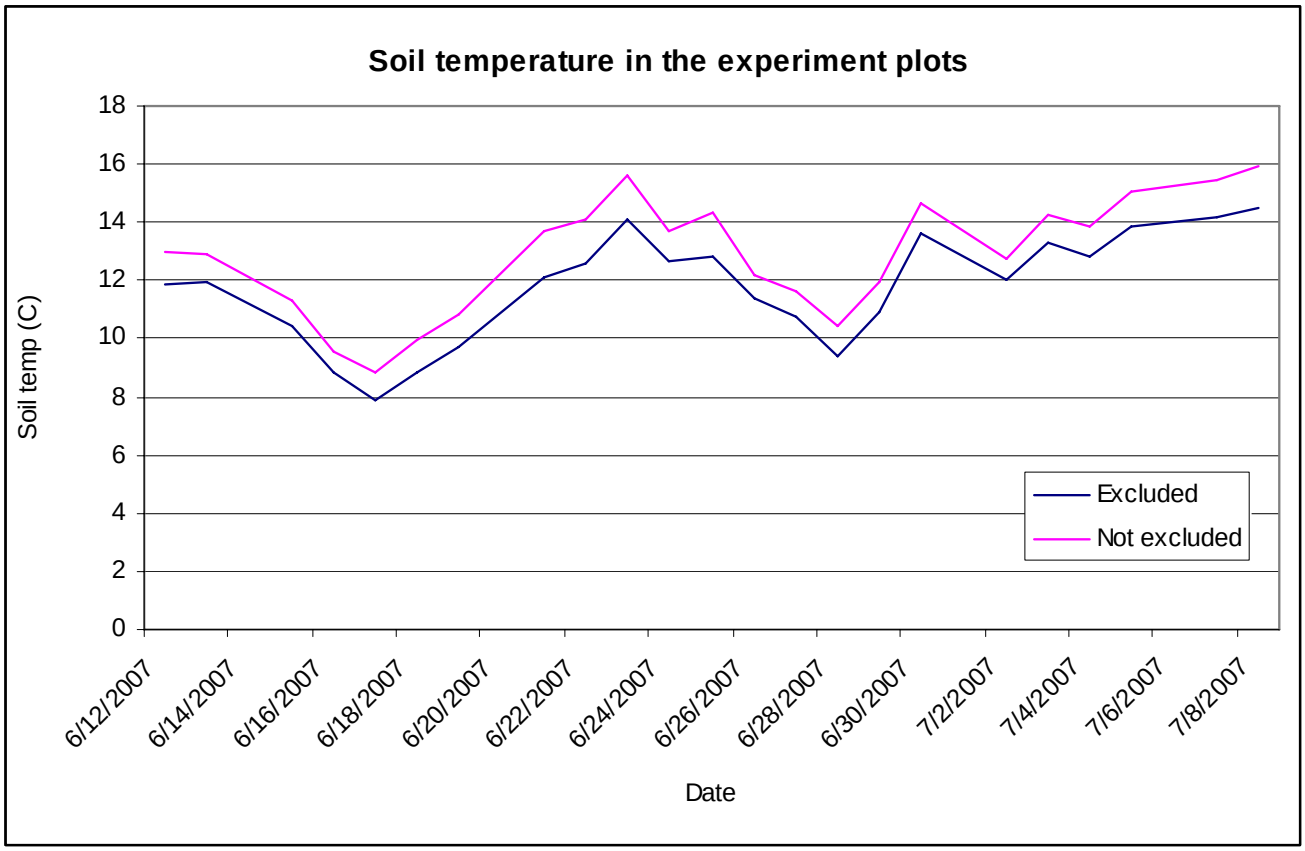
Soil temperatures in the excluded plots were significantly lower compare to grazed plots (Figure 1, Table 1). The average soil temperature in grazed plots was 12.9˚C while in excluded plots it was 11.8˚C. This difference is possibly induced by the shading effect of

the enclosure fences since the differences were consistent during the whole study period and possibly increased overall soil moisture and biomass.

Table 1. Results of the two-way ANOVA on soil temperature data

Source	DF	F Ratio	Prob > F
Grazing treatment	1	40.0806	<.0001
Date	22	498.1466	<.0001
Treatment*Date	22	2.0863	0.003

Figure 1. Soil temperature during in study plots



Results in soil respiration measurements shows that there are no significant differences between excluded and grazed plots. However, there are highly significant differences between the measurements from different days, which implies significant direct climatic effects on soil respiration processes but not grazing effects (Table 2).

Table 2. Results of the two-way ANOVA on soil respiration data

Source	DF	F Ratio	Prob > F
Grazing treatment	1	1.0846	0.2981
Date	6	73.2798	<.0001
Treatment*Date	6	12.2125	<.0001

We obtained air temperature and precipitation data from the local meteorological station. Even though it was not significant, correlation between air temperature (and soil temperature) and soil respiration was positive, meaning soil respiration was increasing as air temperature increased (Table 3). However, due to lack of data, we could not make a comparison between soil respiration and precipitation (only two of the days measured had rain).

Table 3. Correlation between soil temperature and soil respiration in different plots

Variable	Mean	Std Dev	Correlation	Signif. Prob	Number
Soil temp	11.93	2.378988	0.313855	0.3205	12
SR	0.542061	0.181264			

Initial results from this study suggest that grazing has a insignificant effect on soil respiration compared to soil/air temperature. However, the study needs to be expanded in terms of spatial and temporal dimensions in order to carefully explain interactions between soil carbon processes and grazing.