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ОТРАЖЕНИЕ БИО-, ГЕО-, АНТРОПОСФЕРНЫХ ВЗАИМОДЕЙСТВИЙ В ПОЧВАХ И ПОЧВЕННОМ ПОКРОВЕ

Сборник материалов V Международной научной конференции, посвященной 85-летию кафедры почвоведения и экологии почв ТГУ

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which describes processes and events that occur in natural landscapes under the influence of fire. Basing on the study of the patterns on geographical distribution, development of properties and composition of pyrogenically transformed cryogenic soils with a polycyclic profile in Central and South Yakutia their geographic-genetic traits have been found.

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Influence of snow cover on nitrogen dynamics in soils of South West Siberia

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Climate models predict an amplification indicate that the huge territory of western Siberian plains will become suitable for agriculture. However, these projections do not consider soil fertility – a key issue for agricultural sustainability. Litter decomposition is an important nutrient recycling process that influences primary production. The objective of our study is to characterize the influence of snow cover on pedoclimate and N release from decaying litter. We performed snow manipulation, monitor temperature and soil moisture, and trace N release from decaying litter. In forest, ^{15}N release from litter was reduced by snow addition. In grassland, ^{15}N release in topsoil was stimulated by the snow treatment.

Keywords: *climate change, snow manipulation, N, litter decomposition, Western Siberia.*

Introduction

In all scenarios of the future climate changes associated with anthropogenic greenhouse warming, contemporary climate models project an increase in the cold sea-

son precipitation in high latitudes and in the southern part of Western Siberia [1, 2]. In Western Siberia, this will obviously increase the snow cover in winter and prevent soil from freezing. We assume that it will significantly increase the rate of decomposition and mineralization of soil organic matter, which in its turn, change the dynamics of the major nutrients. This will have a significant effect on the balance of carbon and mineral nutrients in the ecosystem, as well as the stability of ecosystems and biodiversity.

To test our assumption we artificially increased the snow cover, monitored soil temperature and moisture, and followed the dynamics N release from decaying litter.

Material and methods

Site description

Investigations were performed in South Western Siberia in forest and grassland close to Barnaul, in the steppe-forest zone (N 53.41.390, E 83.47.717), and close to Tomsk, in the subtaiga zone (N 56.30.583, E 085.43.671). Average temperature in Barnaul and Tomsk are 2.6˚C and 0.9˚C and amount of precipitation are 495 mm and 568 mm respectively.

Snow manipulation

A pair plot experiment was conducted in winter 2013–2014. Snow thickness was increased using snow machine. Snow addition was done twice, at the beginning and in the middle of winter. Treated area was 200–300 m^2. Snow manipulation increased the snow layer by 25 to 50 cm.

T°C and moisture recording

Measurements of soil temperature were performed every 4 hours (at 0, 4, 8, 12, 16, 20 hours) continuously during the year with the temperature sensors Thermochron iButton DS1921G-F5 #, which are able to record temperature from -40°C to 85°C with an accuracy of 0.5°C. Sensors installed at depths of 5, 15 and 60 cm. Soil moisture was measured by the sensors Decagon Em50, installed at a depth of 15 cm and 60 cm.

Trace N release from litter

To trace N release from decaying litter we setup ^{15}N experiment. The labeled litter was obtain by foliar application of labeled urea to young tree or to grass [3]. Tree and grass were sprayed with a 50-mM aqueous solution of ^{15}N urea (99.5 % ^{15}N) (pH 6.2) using a hand-sprayer. At all sites, the litter was replaced with ^{15}N-labeled litter in fall 2013 before snow manipulation. We sampled vegetation and soil layers 2 time per year (fall and spring).

We compare delta ^{15}N values of treatment with control. ^{15}N enrichment of soil was expressed as $\Delta^{15}N$:

$$\delta^{15}\mathrm{N}\left(\boldsymbol{\Delta}^{15}\mathrm{N}\right) = \frac{\left(\mathrm{R_{sample}} - \mathrm{R_{str}}\right)}{\mathrm{R_{str}}} \times 1000$$

where

$$R = \frac{^{15}\mathrm{N}}{^{14}\mathrm{N} + {}^{15}\mathrm{N}}$$

Results and discussion

Permanent snow cover settled down on late December 2013. It reached its maximum value of about 50 cm in control plots at Barnaul, and 75 cm at Tomsk. Snowmelt started at the 3rd of March.

In Barnaul, the first snow manipulation occurred on frozen soil. Soil temperature was ≤0°C during the whole winter season. Soil moisture after snow melt was higher for the plot submitted to snow addition. We had higher snow cover it means we have more water. We observe that the increase in moisture on +snow plot is delayed compare to control for joint and correlated reasons: snow cover was ticker and slower to melt. It kept soil temperature in +snow plot was negative over al longer period, what prevents infiltration of snowmelt in soil. In grassland, the thickness of snow after manipulation was lower than in forest. Snow manipulation had no clear effect on soil moisture.

In Tomsk, soil temperature was ≥0°C during the whole winter season. Snow manipulation had impact no on soil temperature. Data on soil moisture were too sparse to make interpretations.

In Barnaul, forest delta ^{15}N in soil was higher in control plot compared to +snow, it means that this plot got more ^{15}N released from decaying litter. In Barnaul, forest ^{15}N release from litter was reduced by snow addition. High soil moisture reduce microbial activity. In Grassland ^{15}N release in topsoil was stimulated by snow treatment. At Tomsk, in forest, ^{15}N release from litter was reduced by snow addition. In grassland, ^{15}N release in topsoil was stimulated by the snow treatment. We have no explanation of this because of lack of data.

Conclusion

These results highlight the importance of snow cover in controlling soil temperature, moisture content, microbial activity and nutrient cycling. This study is still going on. A second snow manipulation was set up in winter 2014–2015, monitoring of ^{15}N release and regular measurement of enzyme activities involved in the release of litter N will be performed in 2015.

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