The enhancement of nitrification in the presence of herbivores

Mayumi Seto[1]; Tasuku Akagi[2]; Muneoki Yoh[3]

[1] Dept. Earth Planet. Sci, Kyushu Univ.; [2] Kyushu Univ.
; [3] Tokyo Univ. Agri. Tech.

http://www.tuat.ac.jp/˜akagilab/home.html

[Introduction]

The dynamics of nitrogen in terrestrial ecosystem have attracted wide interest in geochemical and agricultural assessments. Simulation studies of models help us understand the complex N dynamics, which depends on environmental conditions such as oxygen content, temperature and pH.

Yoh (2006) focused on an enhanced nitrate leaching in the presence of herbivores and suggested that herbivores may have a positive effect on nitrification reaction. Although many authors have suggested that N-accumulation through herbivory can have a positive effect on plants and their productivity (*grazing optimization and nutrient cycling hypothesis*) (McNaughton, 1976; Mazancourt et. al., 2007), the direct interaction between dynamics of soil N and herbivores has not been discussed. We examined this idea by using model simulation.

[Model]

We investigated soil N cycling-herbivore interaction in grassland systems by comparing two models. Model 2 was as the same as model 1 expect for the presence of herbivores. The qualitative differences between plants and herbivores lie in their prey-predator relationship (trophic level), C/N ratio and percent N of organic matter supplied from their detritus. These last two values reflect the N-accumulation effect by herbivory. We performed numerical simulations and mathematical analysis of this model to evaluate the presence of three nitrogen forms; ammonia, nitrate and organic nitrogen.

[Results]

The results of the simulations revealed that the total abundance of nitrate-N at steady state of model 2 (inhabited with herbivores) was one order of magnitude glater than that of model 1 (without herbivores). The increase of easily decomposable organic matter supplied from herbivores enhanced the nitrification reaction. Turnover rate of soil N in model 2 was also ten times more than that of model 1. The steady state analysis of the model also supported the enhancement of nitrification in the presence of herbivores.

[References]

Yoh, M. (2006) Japan geoscience union 2006
McNaughton, S. J. (1979) American Naturalist 113, 691-703
Mazancourt, C. (2007) Ecology, 79, 7, 2242-2252