Estimation of water quality improvement function of an abandoned meadow adjacent to mire area

*Toshikazu Kizuka[1], Hidetoshi Mikami[1], Satoshi Kameyama[2], Satoru Ono[1]

1.Institute of Environmental Sciences, Hokkaido Research Organization, 2.Center for Environmental Biology and Ecosystem Studies, National Institute for Environmental Studies

Konsen region, eastern Hokkaido, is one of the largest dairy farming area in Japan. In dairy farming basins, nutrients loading often cause eutrophication at downstream mires and lakes. Negative impacts of eutrophication have been concern for biodiversity and fisheries. On the other hand, recently, meadows which are not suitable for cultivation have become evident due to their poor drainage and wet condition especially in the margins of mires and rivers. Thus, reduction of pollution loads and effective utilization of abandoned meadows are important issues for dairy farming basins of eastern Hokkaido. Focusing on the nutrients retention processes in wetlands, we are considering about the role of abandoned meadows as buffer zone with water quality improvement function. In this study, we examined the nutrients dynamics in an abandoned meadow based on the observation of nitrogen and phosphorous concentrations in groundwater and surface water and the hydrological condition.

We investigated at an abandoned meadow in Tsurui Village, Akan District, which was located upstream of Kushiro-shitsugen National Park. We set a plot of approximately 100 m×175 m surrounded by open drainage ditches. The field was abandoned and covered by weeds including hygrophyte except for some areas where grass were cultivated during low water table period. We surveyed the ground elevation of 68 points in the plot. We comparted the plot into 28 cells of each 25 m×25 m. A well and three piezometers (30, 80, and 130 cm depths) were installed at the center of each cell. Water table was manually measured in the wells and piezometers in August and October of 2015. In addition, water level was automatically recorded from August to November at a continuously waterlogged point in the plot and drainage ditches on the north and south sides of the plot. Hydraulic conductivities were measured using piezometers at four points in the plot. Groundwater was sampled at each piezometer in August and October. Total nitrogen, total phosphorous, and ionic nitrogen and phosphorous were analyzed after filtration.

The ground surface in the plot gently down from the north to the south with an approximately 1/200 gradient. And the ground surface slightly down along the east and west drainage ditches. Continuous water level measurement in the plot showed about 52 cm change during investigation period. Almost the entire plot was considered to be flooded for the highest water level. Lower area on the east and west sides of the plot was continuously flooded and water depth reached a maximum of 64 cm at the lowest point. These indicated the study plot had similar hydrology with flood wetlands and groundwater level varied spatially according to the variation of ground surface. Similarly to the ground surface, groundwater level in October lowered from the north to the south and from the center to the east and west sides of the plot. Hydraulic conductivity represented the order of 10^{-8} -10^{-5} m s^{-1}, which was lower than those of peat in Kushiro Mire. Lower permeability of shallower layer implied the effects of tread pressure with farming vehicles. Because hard soil layer interrupts rain infiltration, surface water runoff would be likely to occur. Groundwater showed high nutrients concentration locally in the plot. The highest concentration of nitrogen was appeared at 30 cm depth in the center of the plot. The concentration decreased with depth and the peak moved toward the east drainage ditch. This implies nitrogen moved from some nutrients sources near the surface ground to the drainage ditch by advection and diffusion. Spatial distribution of nitrogen concentration was similar between August and October, though the concentration slightly

decreased across the plot. Therefore nitrogen export might occur throughout the investigation period. We plan to estimate nutrients retention in the abandoned meadow by the calculation of nutrients fluxes in the plot.

Keywords: Hydraulic conductivity, Nutrient, Peatland, Spatial distribution, Water level change, Waterlogging

