

Changes of river water quality under the land-use changes in Teshio river watershed, northern Japan

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River water quality is one of the important environmental indicators for ecosystem function, services and environmental health associated with the drinking water for human, irrigation water for agriculture, nutrient and energy sources for freshwater and estuary ecosystems and so on. The watershed land-use changes often alter the structure and functioning of the terrestrial systems, possibly caused negative impacts on water quality. Therefore, understanding how the human activities through land-use changes affect the water quality is quite important to develop the sustainable society in future. In this study, we investigated the river water quality (nutrients and humic substances) from upstream forested region, middle to lower region utilized by agriculture and estuary in Teshio River watershed at northernmost of Hokkaido, northern Japan.

Teshio River was located cold and snowy region in northern most of Japan. This snowy climate is characterizes as high water discharge during the short melting season, causing the higher flux of nutrient and humic substances from terrestrial to estuary ecosystem compared to the other seasons. The gentle and moist topography at middle to lower basin made those lands available for agricultural field. The land-use change for agriculture increased the nitrogen leaching from soil to river as result of over-utilization of fertilizer, resulted to increase of nitrate concentration in river water from middle to lower basins. Dilution of the river water from upstream forested basin was important to maintain the low concentration of stream nitrate especially in upstream region. However, the decrease of water discharge by the water control of the upstream dam decreased those dilution process, caused to amplify the increase of the nitrate concentration as results of the land-use change for agriculture in downstream of the dam.

In lower region of Teshio River, natural wetland and pasture land at flat plain under cool climate contributed to deliver the humic substances and nutrient to the river water. The flat topography of river channel in the lower and estuary region produces the dynamic water exchange of freshwater and seawater where is important habitat for corbicula and other aquatic biota. The upward and downward dynamics of salt water in those region played important roles on carriers of nutrients and feed resources such as phytoplankton from terrestrial and inland freshwater to the downstream river water and estuaries.

Our results provided the basic characteristics of dynamics for nutrient and organic matter in the watershed based on the surrounding environmental features, and the human impact on these dynamics. The development of the adaptive basin management strategy would be important for the sustainable society under the global changes with consideration of watershed properties and spatial interactions of their function and services.