

Characteristics and Development Processes of Wetlands on Landslide Masses in Hachimantai Volcanic Group, NE Japan

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Wetlands are widely distributed in the mountainous regions in Japan, and are subject to protection and conservation because of their beautiful landscapes and their peculiar biota. Considering not only their climate and hydrological conditions but also their geomorphological conditions is necessary to characterize development processes and environmental responses of wetlands. In tectonically active and warm humid regions like Japan, landslides are one of the most important factors for mountain development. Recently the role of landslides creating biodiversity and landscape diversity has been much attracted attention in the field of ecology and geomorphology (Geertsema *et al.*, 2007). This study focuses on wetlands as one of the representative landform units composing landslides and presents their characteristics and development processes in Hachimantai volcanic groups which have been deformed by many landslides. 'Wetlands' generally includes various types of water-rich conditions. In this study, as their primary components we focus on 'bogs' and 'ponds', and define 'bogs' as grasslands in moisture conditions.

Hachimantai volcanic group stands in Ohu backbone range and is composed of some Quaternary complex basaltic or andesitic stratovolcanoes. Their bodies are being collapsed by landslides characterized by a variety of body size and structures: some have deformed into several numbers of sliding blocks. Wetlands occur in almost all large scale landslide bodies. Its climate is categorized in Japan Sea side climate pattern as heavy-snow.

We investigated the characteristics of wetlands using remote sensing images and digital elevation models and analyzed the relationship with landforms by GIS. Then we reconstructed the development process of typical wetlands located both in and out of the landslide masses by the analyses of the sediment including ¹⁴C dating, tephra identification, carbon content measuring and grain size analysis.

On landslide masses 33.2 % (185 of the 599 in total) wetlands stood and area rate was 63.7 %. Most wetlands out of landslides stood on the volcanic original surface along the ridge line of Ohu mountain range or some were in the craters of Hachimantai volcano. The formers are the small bogs formed by meteoric-water (snow) cultivation in the nivation hollows. On the other hand, those on the landslide masses scattered widely. Large landslide masses frequently had ponds cultivated by ground water in the large and deep depressions along the scarps and in the small ones among pressure ridges.

In Oyachi, a wetland in a landslide, black mud and organic sand and silt (representing for bog and forest), sand and gravel (disturbance), clay and silt (pond) and peat (bog) deposited from their bottoms. Wetlands typically develop under the stable circumstance from ponds to bogs, and finally to forests. In the case of Oyachi, at BC 4000-3500 the bog changed to the pond, the former developmental stage, probably because the landslide activity formed the dam, and then it developed to the bog with stabilization of the slopes and the water discharge. On the other hand, the development process of Okuno-maki, a wetland out of landslides, were probably directly affected by climate changes. Diminishing erosion along with decreasing snow accumulation in the nivation hollow and warming of melt season climate toward the Medieval Warm Period enabled to be the bog. In contrast, landslide activities and denudation of landslide masses control the developmental stages of wetlands. Consequently, various ages and types of wetlands are presumed to coexist in humid mountains with large landslide masses.

Reference

Geertsema *et al.* (2007): Influence of landslides on biophysical diversity -A perspective from British Columbia. *Geomorphology* 89, 55-69.

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