Characteristics and Development Processes of Wetlands on Large-scale Landslide in Ou Mountain Range, NE Japan

*Natsuki Sasaki[1], Toshihiko Sugai[1]

1.Graduate School of Frontier Science, The University of Tokyo

Quaternary volcanoes in the Ou Mountains, northeastern Japan, are occasionally dissected by large-scale landslides with their areas greater than 1 km^2. On these landslide bodies various-size wetlands have been formed in the landslide depressions and contribute to creating mosaic landscapes and biodiversity of landslide areas with the steep scarps and forests. Since establishment ages of wetlands on landslide bodies reflect the timing of landslide activities, simultaneity of wetland formation in a single active landslide is inferred. However a large landslide contains coexisting wetlands of various development stages, including ponds and peat bogs. This contributes to further diversity of their landscapes and biota. This study examines geomorphological controls on the distribution and development of wetlands on large-scale landslides in the Ou Mountains.
We mapped in detail the microtopography of the landslides and identified ponds using color aerial photographs (1 : 18,000 and 1 : 15,000 scale) taken by the Geographical Survey Institute in 1976. We then calculated the slope inclination and the curvature, and mapped the drainage system from the GSI (the Geospatial Information Authority of Japan) 5-m or 10-m digital elevation models (DEM) using ArcGIS.
We selected 3 landslides in the Hachimantai Volcanic Groups and 2 in the Funagata Volcanic groups. These landslides have degraded caprock structure of the soft Neogene tuff covered with lava flows. The landslides on the Hachimantai are rotational ones that feature arcshaped scarps and stepped terrain in their upper parts. They have more fragmentary structures in their middle and lower parts. The secondary landslides commonly deform the feet of main landslides and contribute further to the undulating surface. Whereas these on the Funagata Mountain are translational landslides that feature rectilinear shaped scarps and constant height of block structures due to tensile stress.
Wetland distributions are controlled by microtopography of landslide bodies, and the wetland area is determined by the size of the depressions. The wetlands are mostly elliptical shape with long axes parallel to the linear depressions. On the Hachimantai, the wetlands in the middle and lower part of the landslide bodies tend to be smaller due to fragmentary topography. On the secondary landslides, a few wetlands stand only at the foot of the main scarps or in the depression between pressure ridges, because the soft material (earth flow) could not form depressions perpendicular to the slope direction. On the Funagata Mountain, the wetlands stand in the depressions between the scarps and in the cracks that are widely scattered over the landslide bodies.
All landslides in this study contain both ponds and peat bogs, different development stages. Sediment accumulation, connecting drainage channels and shortage of water recharge are considered to be major factors of wetland development from ponds to forests via peat bogs. The superposition map of the wetland distribution and the drainage system draws that the greater part of wetlands are connected to drainages whether water constantly flows or not through them. The peat bogs or forests (the latter stage of wetland development) tend to connect to higher order deeper streams. Therefore the degree of fluvial dissection of landslide bodies controls wetland development stage on the landslides. Landslide dams, such as the Nagamuma on the Funagata Mountain, with abundant recharge water from the upstream area could continue to be pond for a longer time than the other wetlands.

Keywords: wetland distribution, landslide, development process, Ou mountains

