Wetland landscape in mountain region created by landslides

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Wetlands are widely distributed from coastal lowlands to mountain districts and from northern to southern Japan. Although the area density of wetlands at each altitude is high not only in the lowlands but also in the altitudes around 1600 m to 1800 m, wetlands are one of the representative landscapes of mountainous areas. The origins of mountain wetlands are as diverse as volcanic crater lakes, glacier lakes, and peatlands in nivation hollows on gentle slopes with snow accumulation and wetlands in depressions created by gravitational slope deformations, including landslides. In particular, many mountain wetlands coincide with areas of landslides with the snowiest regions of northeastern Japan facing the Japan Sea, and it is important to interpret the wetland landscape of the mountain region from a geomorphological perspective. This presentation introduces the role of landslides in the formation and development of mountain wetlands on Quaternary volcanoes in the Ou Mountains, northeastern Japan.

In the Sengan, Kurikoma, and Funagata volcanic regions, which are composed of multiple Quaternary stratovolcanoes, the area density of wetlands is high in the landslide and on original volcanic surfaces. Landslide wetlands are distributed over a relatively wide range of altitudes and do not depend on the amount of snow. The size and distribution of wetlands in a large-scale landslide, typically seen in the Quaternay volcanoes, are controlled by their micro-topographical arrangement. In the case of the rotational landslides in the Sengan volcanic area, larger wetlands are formed at the foot of the scarps in the upper blocky part of the landslide body, and smaller ones tend to be in the well-deformed lower part. In a translational landslide of the Funagata volcanic area, since it is recognized that the landslide body moves in multiple blocks, large-scale wetlands are formed in grabens at the block boundaries, and small-scale wetlands are in linear depressions on the blocks.

Another characteristic of wetlands in a large-scale landslide is that wetlands in various states, such as lakes and peatlands, coexist in the same landslide. Lake Naganuma in the Komonomori landslide in the Sengan volcanic area was formed in a closed depression before approximately 7000 cal BP and gradually developed into the marsh by slowly shrinking in the water area. On the other hand, the evidence from the Oyachi wetland shows that its transition from peatland to forest was interrupted at about 5500 cal BP by slope movement, leading to the development of a lake that was drained by streams at about 3300 cal BP, after which a peatland environment has persisted until the present. We suggest that the landslide wetland is primarily influenced by landslide movements, local topographic deformation, and stream dissection, and there may be continuously existing wetlands during the long term, repeating a cycle of emergence, development, and disappearance.

The importance of wetlands in mountainous regions is often underestimated owing to their small area, but large-scale landslides with densely distributed wetlands have a mosaic landscape of cliffs, forests, and wetlands, which are considered to be ecologically important as places which provide various kinds of habitat for a long time. In addition, landslide wetlands, which are independent of snow accumulation, could be more resilient to climate change and may play a role as a refugia for biological diversity. Little is known about the impact of future climate change on mountain wetlands and their ecosystems, and further research is required from a variety of perspectives.

Keywords: landslide wetland, development process, large-scale landslide, Quaternary volcano

