

The Movement of Sediment and Development of Gullies Inside of Landslide area

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There are many researches focusing on gully network. Distinguishing these researches into some groups, two major approaches are found. One is inductive approach. This approach of study makes the theory based on the specific observation of current terrains. From this approach, some famous theories, such as Horton's Law, are led and discussions based on natural condition are realized. However this type of survey has a limitation in researching the formation of gully network in short time scale. Other one is deductive approach. This approach researches the formation of gully network by doing slope experiments. This kind of research invokes some theories led by inductive approach. By doing experiments, the formation of gully network in short time scale is discussed. But because the experiments have to equalize conditions of soil, rainfall, slope angle, etc. The result based on natural conditions cannot be observed. For these reasons the researches connecting two approaches are required. To meet this condition, researching formation of gully network in short time scale, analyze based on the real terrain is ideal. One of the study areas meeting the condition is a landslide area. This study researched newly formed landslide area located in Kanazawa city, Japan. This landslide had few gullies when the observation was begun. Research was done for five months, from July 2018 to November 2018. In this research, by using an Unmanned Ariel Vehicle (UAV), observation of gully network was done. From the images taken by the UAV, Digital Surface Models (DSMs) are made. Comparing these DSMs, in drainage systems expansion of gully network was measured. At the same time, to understand the movement of sediment was measured by using pins and bricks. Also the profile of each gully was taken.

In five months, gully network extended to the top of the landslide. Analyzing the gully network, the tendency of network matched Horton's 1st law. But the gully network's tendency did not match Horton's 2nd law. On the landslide surface and inside of gullies, erosion and sedimentation occurred. This can be said to the small gravels to big ones. The erosion and sedimentation occurs intermittently not continuity. Gullies became deeper by downward erosion, and they became wider by lateral erosion. However sedimentation inside of gullies was also observed. By sedimentation, small scale of channel changes happened. Small scale of sedimentation is ignored or omitted in experiments of gully network. But in reality, small-scale sedimentation can play an important role in forming gully network. Small sedimentation can interrupt the formation of gully network. Adding to this, landslide's original terrains controlled the gully formation. For these reasons, to gully network in landslide area it can be said that the gullies adopted Horton's 1st law but by the small sedimentation and the terrain of landslide, gully network did not adopt Horton's 2nd law. From the result of the observation, slope experiment and the real terrain have both common points and different points. This survey is primitive research of gully network in real terrain. To make the data for sure, more researches are required.

Keywords: Gully Erosion, Landslide, Mass Movement