Large-scale sediment disasters caused by Typhoon No.12 in the Kii Mountains

OKAMOTO Atsushi, Head
UCHIDA Taro, Senior Researcher

Research Center for Disaster Risk Management, Erosion and Sediment Control Division

(Key words) Deep-seated landslide, river course blockage (natural dam), landslide soil volume

1. Introduction

Typhoon No.12 approached and made landfall on the Japanese Archipelago in early September 2011, causingd a severe disaster on the Kii Peninsula. Rain was long-term relatively intensive rainfall, which began to fall on August 31 and continued for 5 days, ending on September 4. In the village of Kamikitayama in Nara prefecture, although the maximum hourly rainfall was less than 50 mm/h, the total rainfall reached 1,800 mm.

Based on a report by the Erosion and Sediment Control Department, Ministry of Land, Infrastructure, Transport and Tourism of October 26, the rainfall resulted in a total of 100 sediment disasters occurred in the three prefectures of Nara, Wakayama, and Mie, resulting in 56 dead and missing persons.

2. Outline of the sediment disasters

This typhoon caused many deep-seated landslides, forming river course blockages (landslide dams) at 17 locations (Photo 1). At five of these locations where the height of landslide dam was 20 m or higher, and where there are about 10 or more buildings with habitable rooms downstream from the landslide dam, emergency surveys were performed by the Ministry of Land, Infrastructure, Transport and Tourism under the Law for Partial Revision of the Act on Sediment Disaster Countermeasures for Sediment Disaster Prone Areas, which was enacted on May 1, 2011[1].

Photo 1. River Course Blockage at Nagadono Valley in Totsukawa Mura in Nara Prefecture

3. Landslide ground distribution

The spatial distribution of the landslide was surveyed by performing an in-situ survey and using aerial photographs and satellite images. The surveyed area was 4,800km^2. The landslide volumes at each landslide were calculated using an empirical equation concerning landslide area and landslide volume[1].

Table 1. Results of Interpreting Landslide Ground and Estimating Landslide Soil Volume

	All landslides	Large-scale landslide*
Number of landslides	3,077	76
Landslide areas (m^2)	Approx. 10 million	Approx. 5 million
Landslide volume (m^3)	Approx. 100 million	Approx. 80 million

* Landslide producing sediment volume of approximately 100,000m^3 or more

It was estimated that landslides occurred at 3,077 places in the survey range, the landslide area (only scar, excluding runout and deposited area) reached approximately 10 million m^2, and the landslide volume was approximately 100 million m^3.

The Public Works Research Institute has surveyed inventories of large-scale deep-seated landslides (volume larger than 100,000m^3) caused by torrential rain or melting snow since the beginning of the Meiji Period (1867-1912), and confirmed 188 cases. In contrast, Typhoon No.12 caused 76 large scale deep-seated landslides with landslide volume of approximately 100,000m^3 or more. This fact shows that although there were differences in survey methods, Typhoon No.12 caused more deep-seated landslides than past disasters. Landslide area shows that large-scale deep-seated landslides accounted for about 50% of total landslide area, and that about 80% of landslide volume was produced by large-scale landslides. This suggests that large-scale deep-seated landslides have an extremely great impact on sediment production.

[Reference]
1) Civil Engineering Journal, Vol. 53, No. 12, p. 4-7, 2011