

Shallow landslides investigation in Kelara watershed, Indonesia

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1. Introduction

The most common natural disasters in South Sulawesi, Indonesia are floods and sediment disasters. The number of the disasters has increased from the last 10 years (BNPB, 2010). In the Kelara watershed of South Sulawesi, shallow landslides have been occurred every year in the last five years due to increase of rainfall intensity and human activities (Fig.1). As a result, the local people often suffer from the incidence of shallow landslides causing them loss of life and property. In Kelara watershed a total of 36 shallow landslides occurred from 2005 to 2010 with a total volume of shallow landslides of 37,510 m³ (Fig.2). This paper reports the results of shallow landslides based investigation of rainfall and human activities in Kelara watershed, Indonesia.

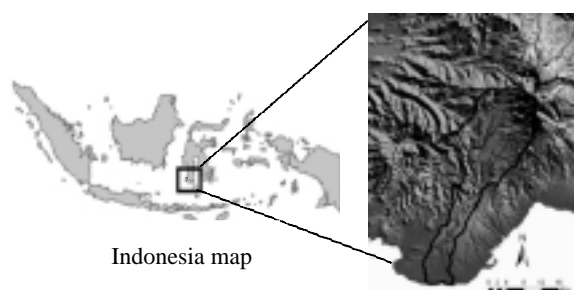


Fig.1 Kelara watershed in South Sulawesi, Indonesia

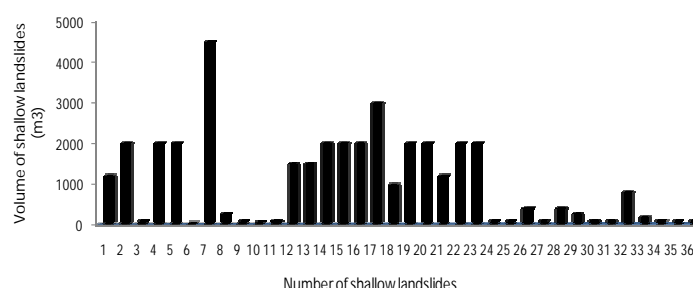


Fig.2 Volume of shallow landslides

2. Rainfall and shallow landslides

Shallow landslides triggered by rainfall occur mostly in mountainous landscape. Some of these shallow landslides occur suddenly and other shallow landslides respond slowly to rainfall. A series of shallow landslides occurred in Kelara watershed since 2005 to 2010 due to landuse change respond quickly to rainfall. High intensity rainfall usually occurs from December to April. In this area the upstream watershed have more high intensity of rainfall compare to downstream watershed (Fig.3 (A)). A total of 36 shallow landslides occurred in the study area with maximum duration of rainfall in 24 hours. The majority of shallow landslides happen on rainfall duration of less than 10 hours. The lower duration of the representing shallow landslides-triggering rainfall events was 1 hour with rainfall intensity of 31mm. The relationship between intensity (mm/hr) with duration (hr) triggering shallow landslides in Kelara watershed is shown in Fig. 3 (B).

3. Human activity and shallow landslides

Human activities in mountainous area such as agricultural practices on steep slope and the road construction contribute in great manner to shallow landslide occurrence. In Kelara watershed, the shallow landslide occurred on slope gradients ranging from 21° to 47° and 89% in dryland agriculture-mixed farm land of land use. An unsuitable landuse activity contributed to shallow landslide occurrence in Kelara watershed is shown in Fig.4. In addition, 36% of shallow landslides occurred along the roads (Fig.5). This indicates that slope

cutting for the road construction contributed to shallow landslides occurrence. It is well-known that the cutting of slope reduces the stability of the slope.

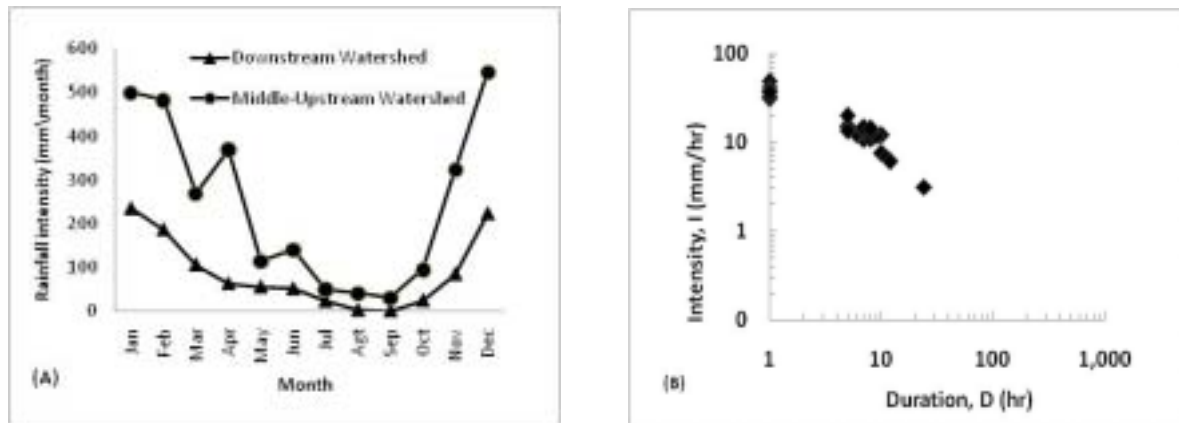


Fig.3 (A) Monthly rainfall intensity in the downstream and Middle-upstream Kelara watershed; (B) The relationship between intensity (mm/hr) with duration (hr) triggering shallow landslides in Kelara watershed, Indonesia



Fig.4 An unsuitable land use activity contributed to shallow landslide occurrence in Kelara watershed

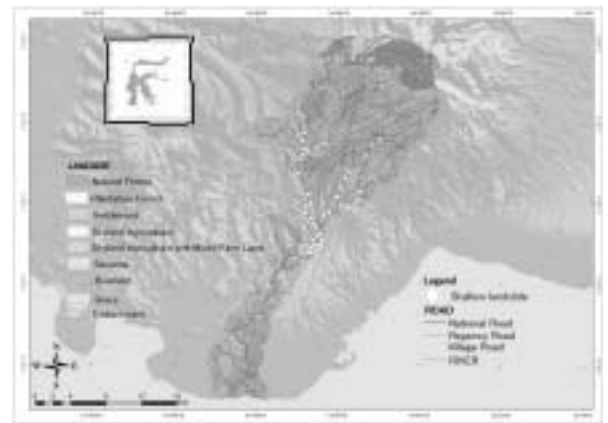


Fig.5 Land use map and distribution of shallow landslides in Kelara watershed

4. Conclusion and recommendations

- The investigation of shallow landslides revealed that rainfall and human activities contribute to shallow landslides occurrence in study area. The lower duration of the representing shallow landslides-triggering rainfall events is 1 hour with rainfall intensity of 31 mm.
- To reduce the incidence of shallow landslides in the Kelara watershed, it is necessary to change the pattern of land use; avoid indiscriminate land clearing, planting of appropriate plant species, technical engineering.
- Warning for people who work in agricultural fields when an episode of heavy rain occurs and warning for people who transit by forest roads during heavy rain.

Reference

BNPB, 2010. National Disaster Management Agency, Indonesia