

Landslides in Rawalakot-Arja Valley: A Review

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Abstract

Landslides, mass movements of rock, debris or earth down slopes are worldwide phenomena which cause significant damage and an estimated 5000 fatalities each year. They are caused by the interplay of various natural and anthropogenic factors and may occur under diverse geo environmental conditions. Goal of this research is to gain a deeper insight into the causes and precursors of landslides, which will facilitate more accurate identification of landslide prone locations and, enable early detection of landslide events. As catastrophic events, landslides can cause human injury, loss of life and economic devastation, and destroy construction works and cultural and natural heritage. A number of landslides occurred in Rawalakot-Arja valley. These landslides were complex and very severe and caused number of damages to house, land use and peoples of the area. There were number of slides reported each year in the Rawalakot-Arja valley but among them some important slides are discussing in this paper. Geologically it is composed of Siwalik formation. In this valley the six main slides have been selected for study. These are Mujahidabad Slide, Mudflow at Sanadi, Khadd Bazar Landslide, Bosa Gala Landslide, Narh-Gran Landslide and Sokkini-na-par Landslide.

Keywords: Creep; Slumping; Overgrazing cultivation; Agriculture; Phenomenon

Introduction

Rawalakot Arja valley is located at Latitude 33°51'32.18"N, Longitude 73° 45'34.93"E and an elevation of 5374 feet. In Rawalakot Arja valley landslide is caused by a number physical and anthropogenic factor. They include water, rock type, slope gradient and vegetation cover. Moreover, earthquake and heavy precipitation also trigger off the processes. Anthropogenic factors include deforestation, overgrazing, cultivation on slopes and infrastructure development.

Landslides in Rawalakot-Arja Valley

Like Ghoin valley, Rawalakot-Arja valley is also vulnerable to a number of geological, geomorphological, biological and climatic hazards. They include soil creep, slumping, soil erosion, mudflow, rock fall and landslides. The processes have also been observed in Parat valley, near Rawalakot, Paniola, and Sanadi and in the vicinity of Arja, in the main Bagh-Nala valley [1].

Mujahidabad Slide

This slide has been studied at Mujahidabad, occurred in 2001. It has a length of about 35 meter from top to bottom, and a width of almost 50 meter, with a slope angle of 65 degrees. Along with the steep slope, weak lithological formation and sparse vegetation, one of the main causes is the quarrying activities in the area since 2001 that made the slope unstable. The bedrock is composed of the alternating beds of sandstone and siltstone. Heavy rainfall during summer and snowfall in winter caused mass movement and damaged the infrastructure in the area [2].

According to the local people the area was covered with thick vegetation in 1980, but at the time of field survey in October, 2010 there was sparse vegetation cover on the slopes. The slide has damaged about one kilometer of road section. The road section has been reconstructed and retaining wall has also been constructed to control the fall of loose material on the road. Houses at the top of the sliding area are also at risk as shown in Figures 1 to 3.

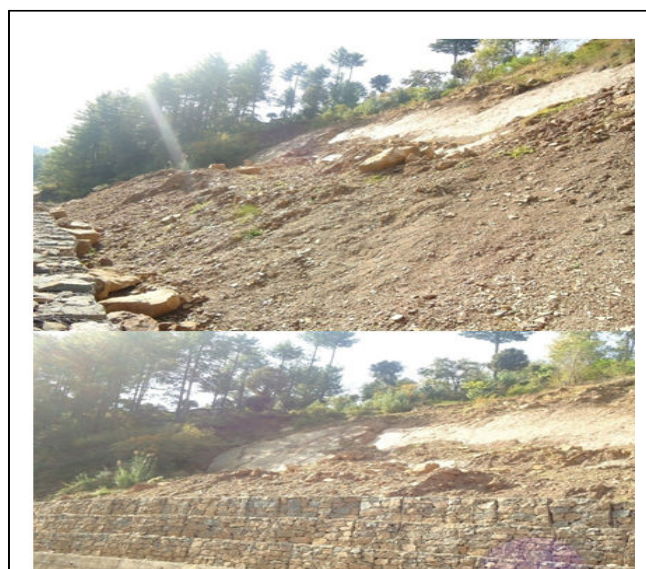


Figure 1: View of Mujahidabad landslide and retaining wall.

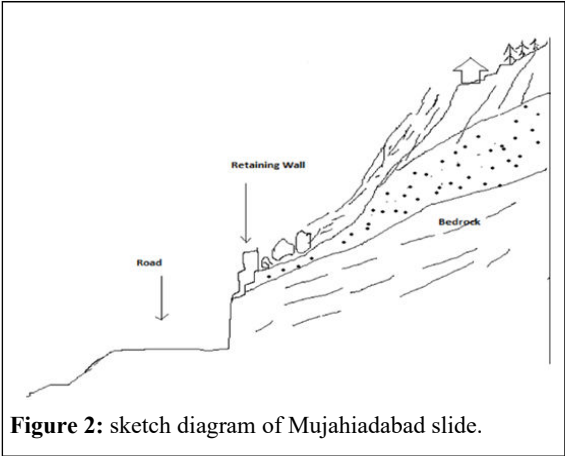


Figure 2: sketch diagram of Mujahiadabad slide.

Mudflow at Sanadi

A huge mudflow has been examined at Sanadi on, GR 33°53'59"N parallel, and 73°41'52" E meridian, occurred on 24th of February 2007, 15km away from Rawalakot in Sanadi Area locally known as Sanadi Rakh. This seems to be a huge mudflow, having its origin on the top of the mountain range 3500 meter high with thick forest. Sanadi, a perennial stream (nala) has carved a wide and deep channel on the slope of the mountain range, from top to the bottom, with a width that varies from ten meters at the top to about seventy meters at the base in the main valley. The slope of range is steep, ranging 65° to 80°. Sanadi nala is flooded during the monsoon period. In July, 2007 huge boulder hit a vane in which seventeen people were died [3]. The forest has partially been cut by the people to clear the land for agriculture as well as for the construction of houses. Occasional mass wasting phenomenon, particularly, landsliding and mudflow are common in the area. The material of the flow was composed of huge boulder, gravels and clay. The reconstruction of the road was still in progress, during the field work in October, 2010 as shown in Figures 4 to 8.



Figure 3: View of broken retaining wall due to landslide at Sanadi area.



Figure 4: View of eroded material due to landslide at Sanadi area.



Figure 5: Different views of mudflow at Sanadi.



Figure 6: View of newly constructed retaining wall in Sanadi area.



Figure 7: View of cracks in Sanadi area formed during earthquake.

Khadd Bazar Land Slide

Khadd Bazar is located on the old Rawalakot-Thorar-Mang Road, about 15 kilometers from Rawalakot. It is mountainous area with high mountain ranges and very steep gradients, between 70 degrees to 80 degrees. Geologically, the rocks are weak sandstone of enormous thickness, and severely deformed by tectonic movements. The forests cover the slopes of the mountains, but they are not due to the steep slopes and cutting for the construction purpose [4]. The mountains have been severely eroded by streams with narrow and steep gorges and valleys. In the earthquake 2005, a huge slide occurred, a part of the mountain slid downslope that destroyed the Khadd Bazar, with a large number of shops, houses, agriculture land and almost one kilometer of the Rawalakot-Thorar road. A fresh almost vertical scar can still be examined very high on the mountain slope, from where the boulder of the rock detached and slipped downward. Currently a large part of destroyed market is covered with bushes and gives a destroyed look. Each year, during the monsoon period, material saturated with

water slid downslope and due to this situation new construction is not possible as shown in Figures 9 and 10.



Figure 8: A view of damaged market in Khadd Bazar.



Figure 9: A view of damaged house near Khadd Bazar.

Bosa Gala Land Slide

The area is locally called Sarinagala, lying about three kilometers to the north of Thorar and falls in the UC Tain, sub division Thorar, District Poonch. In 1992, due to seventeen days continuous rainfall, a huge landslide occurred in the area. A high sandstone mountain slid downward with million tons of rock, because of the rainfall, weak sandstone rock formation steep slope of about 85°, and lack of natural vegetation. Due to dispersed houses, only eight houses washed away in the village and a large number of agriculture fields were destroyed [5,6]. Thousands of chir and pine trees were uprooted and destroyed. According to the respondents every year in monsoon period, sudden fall of loose material is a common phenomenon in the area as shown in Figures 11 and 12.



Figure 10: A view of Landslide in village Bosa Gala.

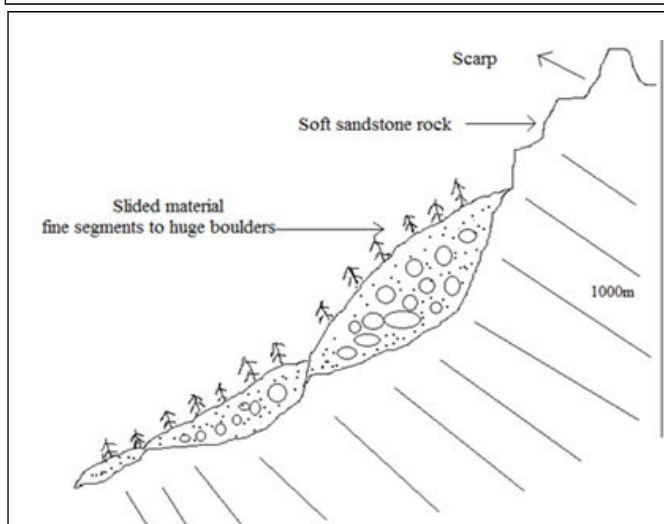


Figure 11: Sketch diagram of Bosa Gala slide.

Narh-Gran Land Slide

Narh-Gran is a well known village on the mountain slope in Tain area, main Jhelum valley about 10 kilometers from Thorar. It is comparatively large nucleated village of the area, with about three hundred houses, the land is fertile, due to the availability of water from the springs there are orchards with large number of fruit trees in the village, while people also practice agriculture on terraced fields. In this area ground moves downslope by one meter per year during rainy season for the past 50 years to 60 years. Due to this problem, the people of the area have started to migrate to safer places [7]. According to the local respondents, people of the area have started plantation to overcome the problem. After plantation the problem has been solved to some extent. The people have again reconstructed their houses in the area and have also practise agricultural activities. According to the respondents there were a large number of natural springs in the area in the past and it may be due to these water bodies that the material became saturated and slid down. A large number of springs have dried up with the passage of time, may be due to climatic change (Figure 13).



Figure 12: A view of Narh-Gran slide.

Sokkini-na-par Landslide

Another very important and huge landslide has been examined in Tain area known locally as Sokkini-na par slide, in main Jhelum valley. A huge block of bedrock, about 300 meter, (1000ft) has detached from almost vertical cliff in 2005 earthquake and moved downslope for hundred of meters. The bedrock i.e. Sandstone badly shattered and many large pine and chir trees were uprooted. Huge boulders and rock fragments have spread over a large area [8,9]. This slide has started after the earthquake, 2005 and is still active. As this slide is away from the residential area, no damage to houses and livestock has been observed but a large section of Thorar-Tain-Dhalkot road was destroyed, while a large number of agriculture fields were also destroyed and washed away with sliding material [10]. The slides mentioned are the important ones out of the hundred of the slides that have occurred in the past as shown in Figures 14 and 15.



Figure 13: Debris of Sokkini-na-par slide comprising of huge sandstone boulders.



Figure 14: Different views of landslide in the area of Sokkini-na-par.



Figure 15: Huge rock fragments in the area of Sokkini-na-par.

Discussion and Conclusion

This review is aimed to find out the causes of landslide hazards in Poonch district. For this purpose, a number of sites have been selected and studied, where slides had occurred in past and had inflicted damages to life, property and infrastructure. Physiography of the Rawalakot district plays a very important role in sliding. The entire district is mountainous, with high mountain ranges and very steep slopes, or almost vertical free faces, with very narrow and deep gorges and V-shaped valleys. The only exception is the highland of Rawalakot, ten kilometer long and about three kilometer broad plain surrounded by mountains. This type of physiographic setup of the district is most vulnerable to the sliding phenomenon; as compared to plain area. The study of slides reveals that due to physical and man-made environment, the entire district is susceptible to the mass-movement, particularly landsliding. Only vegetation cover reduces the chances of mass-movement processes. The elements of natural environment include physiography, geology, geomorphology, climate and natural vegetation. The removal of forests leaves the mountain slopes exposed for soil erosion and landslides. Apart from the removal of the vegetation the road cuttings are also vulnerable to the landslides in the area.

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