

Review Article

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Landslides in Ghoin Valley District Poonch AJK

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Abstract

A number of landslide occurred in Ghoin valley when huge flood in 1992 hit the area. These landslides were complex and very sever and caused number of damages to house, land use and peoples of the area. There were number of slides reported each year in the Ghoin valley but among them two very important slides are discussing in this paper. Ghoin is an important valley eroded by Ghoin nala tributary of the Jhelum river. Geologically it is composed of Siwalik formation. In the valley the two main slides have been selected for study, Nariola-Androt and Soon slide.

Keywords: Natural resources; Streams and rivers

Introduction

Landslides are common phenomena in the geodynamically active terrain of the Himalaya. Their magnitude and frequency, however, depend on their cause of concern where these interfere with human interest, causing immense loss to human life, infrastructure, and natural resources. Global experience shows that human suffering can be minimized through timely, and effective mitigative measures that can cut down the burden upon the public exchequer by curtailing the expenses involved in the aftermath of a tragedy. Himalaya represents a highly sensitive ecosystem that is naturally poised for disaster. Although triggered by a wide variety of factors, mass movements in this terrain are controlled mainly by the geotectonic set-up of the rocks [1]. The Precambrian sedimentary and metamorphic rocks of the Higher and Lesser Himalaya have experienced severe folding, faulting and shattering during successive deformational phases of the Himalayan orogeny. These highly deformed rocks are deeply dissected by streams and rivers.

Ghoin Valley

Ghoin valley with the stream of the same name is one of the important valleys of the Poonch district, as it is one of the shortest routes from Rawalpindi to Rawalakot and other parts of Azad Kashmir. Ghoin stream has its origin at Dokhaddi near Rawalakot at a height of 975.meter from Jhelum river, and flowing about 35 kilometers from northeast to southwest drains into the Jhelum river at Azad Pattan. The mountain ranges are high, with an average height of about 3000 meter, and the highest points of Topa (2010 m), and Rehara (1559 m). The slopes of the mountains are very steep, with forest on the high slopes, while large parts of the lower slopes have been cleared of vegetation and occupied by the human settlements, where they practice agriculture and graze their sheep and goats. Marked and conspicuous terraces have developed in the bedrock as well as loose material, at different height, usually in the inaccessible parts, that can be observed with the help of binocular or telescope [2]. The steep slopes and terraces reveal that the valley has a highly complicated geomorphic history of its development during the Pleistocene period. Weak rock formation, steep slopes devoid of natural vegetation and plenty of water from monsoon rainfall and melting snow cover made the valley an ideal place for all the types of mass movements, which are often have hazardous to human life, property and infrastructure (Figure 1) [3].

Geology

The area of district Poonch and district Bagh constitutes part of Himalayas. The Himalayas are known as young fold mountains, because they have been formed during the tertiary era of the earth's geological history, as compared to old mountain ranges like Appalachians in USA Around 200 million years ago (also known as the Middle Permian Period), an extensive sea stretched along the latitudinal area presently occupied by the Himalayas. This sea was named as the Tethys. Around this period, the super continent Pangea began to gradually split into different land masses and move apart in different directions the Indian plate moved towards the Asian plate. Himalayas are the result of the collision of the Indian plate with Asian plate. Later, about 25 million years ago (Middle Miocene Period) came another mountain building period which led to the formation of the low Siwalik ranges [4]. Subsequently, periodic mountain building phases occurred as the Indian plate pushed against the Eurasian plates which led to the Himalayan ranges rising further. The last major phase occurred around 600,000 years ago.

Although the phase of major upheaval of the Himalayas has passed, the Himalayas are still rising, at a much slower rate. The Indian plate is continuously moving north at the rate of about 2 cm per years and because of this, the Himalayas are rising at the rate of



Figure 1: A view of Ghoin Valley.

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about 5 millimeter annually. This means that the Himalayas are still geologically active and structurally unstable. On the basis of geology and structure, the area of Poonch and Bagh districts falls into two broad zones, i.e. Central Himalaya Zone and Sub Himalaya Zone [5]. The northeastern part of district Bagh falls in the central Himalayas. The rock formation is directly in contact with Panjal Formations and is separated from oldest rocks by a thrust fault. Among the oldest rock units are included Salkhala formation, Dogra formation, Panjal volcanic series and Godwana formation. The younger rocks comprise Margala hill limestone, the Murree formation and the Siwalik (Figure 2).

Study site

The slide has occurred in the Murree Formation near the village of Nariola- Androt on GR 73° 42'44"E, 33°44'N in Ghoin valley. The sliding of a huge mass of bedrock of the Siwalik /Murree Formation began slowly in 1986, and the sliding continued intermittently for seven years up to 1992. In the rainy season of 1992, it slid down the slope and due to downward movement, the huge mass of the bedrock shattered into huge boulders and small fragments of the order of gravels and cobbles. The length of the slide from the bottom of the valley to top has been, measured as 1500 meters. Due to the sliding, a step like topography has developed in the bedrock with three very enspiceous scarps at the top. The lengths of the scarps are 30 m, 40 m and 25 m from top to bottom [6]. The slope angle varies from 50° to 85° in the different sections of the slide, while the width of the slide has been measured as 200 meter. Though the material has remained stable after 1990, due to the earthquake of 2005, a considerable part of debris moved downward, causing a lot of damage to the road and houses. Due to the steep slope and lack of vegetation cover the material may slide or creep during heavy precipitation or earthquake in future [7].

Nariola-Androt slide

The slide has occurred in the weak Siwalik Formation where the rock strata are inclined steeply with a lot of joints, fractures and weathered surface material. It seems that the rainfall and melting of snow lubricated the underlying strata to the point that friction was no longer sufficient to hold the rock units in place. Weak rock structure, steep slope, sparse vegetation, heavy precipitation and earthquake have played their role in the Nariola-Androt slide [8]. The slopes in the proximity are also vulnerable to the mass movement and the same is the situation in almost all the Ghoin valley. The slopes where there exist vegetation cover and forest are less vulnerable as compared to the exposed slopes. Though no historical record is available about the landslides in the Poonch Himalayas, field work carried out in the area reveals that the sliding of various magnitude and intensity is recurring phenomenon in the region. There are geomorphic evidences of the rock sliding in the past [9]. This varies in magnitude from a slide of a few meters to a slide like Androt, about two kilometers, extending from the top to the bottom.

Damages caused by the landslide

During the slide, hundreds of pine trees were destroyed, that further worsen the situation. The rock and debris were exposed to the precipitation, and during the monsoon season the processes of creep, slide and flow were noted to be more intensive as compared to dry season. During the survey of the area in October 2010, the sparse regrowth of the vegetation cover particularly pine trees, has began on the material. The area is known for fruit trees and crops. The fruit grown in the area include apple, apricot, plumps, pears, etc. where the crops included wheat and maize [10]. During the slide 32 kanal of fertile land with all the crops, washed away, while about 400 fruit trees were destroyed. About 200 meter long section of the road and a number of houses of the local people were fully or partially damaged. According to the effectees of nearby villages, the surveys of the damages were carried out by several government departments, and promises of the compensation were made, but no practical steps were taken in this regard (Figures 3-5).



Figure 3: Debris of the Nariola-Androt slide, where huge boulders can be seen along with the fine material.



Figure 2: The collision of India and Asia about 45 million years ago produce the majestic Himalayas.



Figure 4: Debris of Nariola-Androt Slide, moved downslope.



Type of damages

Landholding: 32 kanal

Pine Trees: Hundred of trees

Fruit Trees: 400

Houses: 25

Road: 200 m long

Slide No 2

Soon slide.

Soon valley forms part of Ghoin Drainage Basin, where a huge slide had occurred in 1992, on GR 73° 42′55″E, 33°48′57″N.It is a narrow and deep valley with a V-shaped cross profile, in the Siwalik Formation. The valley was covered by thick forests of pine and chir, till 1977/78. Due to demographic pressure in the surrounding area, forest was cut from a huge terrace in the valley and the land was cleared for the construction of houses and agriculture. In the monsoon period of 1992, rain fall continuously for three days. It resulted in a huge slide over a large area, and thousand metric tons of the bedrock and soil slid over a very steep slope of about 80°, to the valley bottom, about 500 meter deep, that shook the area, with a big bang. The huge block of bedrock shattered into rubbles during the sliding and the course of stream remained blocked for long time. The scar of the slide was still very fresh at the time of fieldwork, in October 2010.

The entire Ghoin drainage basin, due to the Siwalik Rock Formation, steep slopes and heavy rainfall, is vulnerable to natural hazards. A variety of mass movement types, like landslide, earth flow, rock fall and debris fall etc occur continuously, throughout the year, but in rainy seasons, the rate is accelerated [11]. The forest provides a cover that mitigates the chances of these processes. In Soon area, the slide seems to have been triggered by the cutting of forest from a terrace on the steep slope. The bedrock and soil was exposed, where the houses were constructed and agriculture was practiced. Heavy monsoon and winter precipitation seems to have reduced the strength and cohesion of the rock and unconsolidated material, which caused slope instability, that ultimately resulted in slope failure, and the material slid down the slope in form of landslide. Man induced mass movements due to deforestation are common in the area.

Damages

The Soon Slide washed away forty kanal of fertile land along with the crops, while a number of houses were destroyed along with all the belongings, including cattles etc. The people had already left the houses, as they have perceived that, slide may occur due to the continuous rainfall. Along with the houses and agriculture land, hundreds of chir and pine trees, were also uprooted and slid down along with the rock debris. To reduce the chances of mass movement in future, afforestation campaign was carried out by the local people of the area.

Apart from the cutting of trees, another very important factor that triggered the mass-wasting processes is the construction of new roads or the widening of the already existing roads in the area. The newly constructed 35 kilometer long Azad Pattan-Rawalakot road in Ghoin valley, has initiated a phase of mass-wasting processes including landslide and accelerated soil erosion, in the valley. Along the road a number of sites were examined where the sliding, rockfall, debris fall etc. have taken place. They are particularly frequent in the monsoon period when Rawalpindi-Rawalakot road through Ghoin valley remains blocked for days, due to the sliding of the material. They not only damage the road, bridges and retaining walls, but the trees, agricultural land and houses are also destroyed. Following are the few selected sites where mass-wasting processes have occurred, along the road (Figures 6 and 7).

Conclusion

Of the most common natural hazards in the Poonch, landslides cause most damage to the natural and manmade environment every year, particularly during the monsoon period. In 1992 monsoon caused two major catastrophic mass movements in this region; one along Ghoin nala, nariola Androt and other is in Soon Valley.

Figure 6: Soon slide, material in the Soon valley, regrowth of the vegetation can be seen on the material.



Figure 7: View of Soon Landside, Ghoin Valley, Poonch district.

Physiography of the Poonch 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 worst year for the slides in the district was 1992, when there was heavy monsoon rainfall, for eighteen days continuously that caused a lot of damage to life, property and infrastructure in the entire Azad Kashmir. Another very important impact of the rainfalls is the heavy floods in the valleys, which are responsible for undercuts in the bedrocks making it unstable, and as a result huge block of the bedrock is detached slides down slope to the bottom of the valley. Slides because of floods and undercuts are common in all the valleys of Poonch districts, and most of the slopes are vulnerable to slides because of this. In the natural environment of Poonch district, after rainfalls, earthquake is very important agent that makes the huge blocks of bedrock detached from the mountains, and move downward, in form of landslides. The earthquake of October, 2005 is responsible for numerous slides in the western Himalayas, and a number of important slides including, Androt and Soon slides.

Man's activities have played a key role in accelerating the frequency of the landslides by cutting forests for different purposes i.e. the construction of the houses, clearing of land for agriculture and building of the roads etc on the mountain slopes. The removal of forests leaves the mountain slopes exposed for soil erosion and landsliding. As it has already been mentioned, the physical environment is susceptible to mass-movement but natural vegetation provides a cover and reduces the chances of landsliding. Apart from the removal of the vegetation the road cuttings are vulnerable to the landsliding. Whenever, there is monsoon rainfall, winter precipitation or an earthquake, the weathered material and the huge blocks of rocks are detached and slide downward on the steep slopes. Those parts of the district are at high risk of landsliding wherefrom the forests have been removed or where the roads have been constructed on the slopes.

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