



# Natural Hazards and Degradation of Landforms in Eastern Ramganga Basin of Kumaun Himalaya

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## Abstract

*Natural hazards are extreme weather and climate events that occur naturally in all parts of the world. Some regions are more vulnerable to certain hazards than others. Hazards become disasters when there is loss of people's lives and properties. Typically, a natural hazard can be defined as the probability of occurrence within a specified period of time and within a given area of potentially damaging phenomenon. In the present study an environmentally sensitive area suffering from natural hazards and degradation of landforms is selected. A detailed field investigation was conducted in the study area to find out the impact of processes causing environmental degradation. In the recent past these natural processes are rapidly increasing due to increasing phase of human activities; causing damage to life and property in the Eastern Ramganga basin specifically and the Himalayan region in general. In the study area Kwiti, La, Jhekala, Nachani, Tejam, Dor, Bansbagad, Ruisapata, Simtola and many more villages were severally affected due to the natural hazards in the past few years. Eastern Ramganga catchment is highly vulnerable to the risk of several kinds of natural hazards. Disasters in the region cause great loss to life and property and pose serious threat to the process of development which has impact on economic and social well-being of the people living here. Thus, the impacts of natural hazards caused by different geomorphic processes including extreme events are multidimensional affecting environmental, social and economic systems.*

## Keywords

*Hazards, Degradation, Tectonic, Extreme Events*



## 1. Introduction

The processes which cause an accident or extreme event, or danger are called Hazards, whereas disaster is a sudden adverse or unfortunate extreme event which causes great damage to human life as well as plants and animals. Natural hazards are combinations of natural phenomena such as earthquakes, mass movement, floods, volcanic eruption, tsunamis and many more that may cause loss of lives and damage to the property. Though it may not be feasible to control natural events and to stop the progress of natural phenomena, an effort could be made to alleviate their effects on human lives, infrastructure and property. The natural hazards are the outcome of natural processes operating on the surface of the earth as well as under it. Anthropogenic processes trigger these natural hazards up to some extent in the Upper Ramganga (Eastern) Basin. The main factors causing natural hazards in the region are uneven topography, drainage basin and steep and irregular slope of the region. In spite of the efforts done by central and state governments at ground level there is a need to improve management strategy in a geodynamic region like the Himalayas. Some of the suggestions, if particularly implemented, can improve the condition of the local inhabitants who are facing the consequences of the extreme geomorphic processes changing into disasters. Though some studies in the Higher Himalaya have been conducted with the G.I.S. techniques lack of field studies and on the spot measurements, these studies have limited scope to save the vulnerable areas.

Young and dynamic Himalayan mountainous are highly vulnerable to landslides and other mass wasting processes. The study area is a part of sparsely populated region due to steep slopes and inaccessible remote terrain. Every time, the slopes of the Himalayan mountainous region are at risk. The risk is higher where anthropogenic activities take place in an irresponsible way. Example- the material output of slope cutting down the slopes in a mismanaged way in the Higher Himalayan terrain. This material is responsible for road accidents along the Thal Munsyari road in the study area. During the monsoon rains the hill roads are fraught with danger. The damaging hazards triggering by earthquakes or heavy rainstorms are, somehow responsible for loss of lives and properties in these areas. In the Himalayan region landslides during heavy rainfall are very common either it is Garhwal or Kumaun Himalaya in Uttarakhand. The hill regions of North-eastern part of our country are facing problems of landslide because of heavy rainstorms.

## 2. Study Area

The study area (Eastern Ramganga basin) lies in the part of the hill state of Uttarakhand has a total geographic area of 53,483 km<sup>2</sup>, of which 93% is mountainous and 64% is covered by forest. The Ramganga Basin has been divided into two parts. First one is the Northern basin which is located Northward Thal. The Southern part of the Eastern Ramganga Basin has not been included in the present study. The Upper Ramganga (Eastern) watershed has been further divided into various micro watersheds which can be seen in map. The area of the selected upper catchment of the Eastern Ramganga Watershed includes 722 km.<sup>2</sup> areas which can be seen in the location map of the study area (fig-1). The Ramganga River flows in N-S direction for about 78.6 km. The basin lies between 29°31'23" and 30°14'11" N latitudes and 80°06'12" and 80°06'49" E longitudes and is 26.5 km at its widest.

## 3. Methodology

The study has included both primary and secondary data collection. Detailed information has been collected through different sources (governmental, non- governmental and personal contacts with local people and other) and detailed field study of the area. Severely affected villages in Eastern Ramganga Basin are selected for the study. Preliminary data collection was completed through field survey and personal interviews by using schedule method. Secondary data collected from block development office and tehsil headquarter books, websites and articles etc.

## 4. Result and Discussion

The degradation of environment is combined effect of natural and cultural forces but the exponentially increasing intervention of cultural forces accelerated the pace of degradation unbearably. The degradation of slopes of Kumaun Himalaya is linked with the various socio- economic activities. anthropogenic and technogenic activities are making instable the hill slopes of the Himalaya.

The Upper Ramganga (Eastern) area is highly prone to high intensity rainfall events including cloudbursts, flash floods and landslides. Climate change will increase the frequency of extreme weather events including heavy rainfall. The impact on the steep slopes in the higher Himalayan region of Uttarakhand will be even greater because the Himalayas are warming at least twice as fast as the globe. Rapidly melting glaciers in the higher Himalayan region will release large quantities of water into river systems. The Eastern Ramganga Watershed is severely affected by a number of natural hazards such as: landslides, flashflood, cloudbursts, erosion, earthquakes etc. (1). (See table 1)

**Table 1.** Major Landslides affected area of Eastern Ramganga Basin.

S.N.	Area	Effected Area
1	Haradiya Nala	Haradhiya Nala and Eastern Ramganga River
2	Dor village	Agricultural land
4	Ruisapata	Agricultural Land and Jakula River
5	Jhekala	Road and agricultural land
6	Kwiti	Jakula River Flow and hillslope
7	Bansbagadh	Bhujgadh River Flow
8	Near Nachani	Mehargadh River Flow

**Source a:** Primary Data

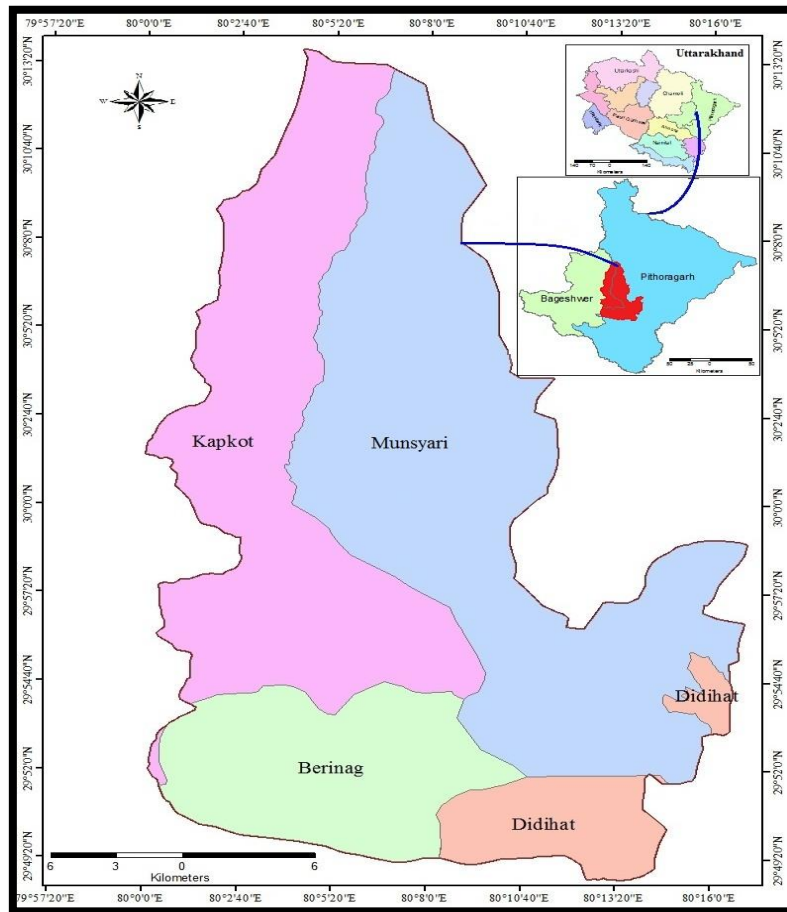
The degradation of environment is combined effect of natural and cultural forces but the exponentially increasing intervention of cultural forces accelerated the pace of degradation unbearably. The degradation of slopes of Kumaun Himalaya is linked with the various socio- economic activities. Demand for wood is one of the major factors of deforestation (2). The rocks are decomposed, water flows in a minimized way and forest resources have been deteriorated due to frequency occurrence of mass wasting in the Himalayan region. Some other factors responsible for the degradation of landforms are overgrazing, quarrying and above all, blasting for construction of roads, canals and dams in the Himalayan region. The construction of a road through a mountain terrain results in the generation of land slides.

The largest landslide is located in the mid-eastern part of the drainage basin. The material moves down the slopes and joins the main stream. The area of this landslide is increasing every year. Another major landslide is responsible for degrading the agricultural land near Dor village. A large landslide which mobilizes the material, carries it down slope and joins Jakula stream (a tributary of Eastern Ramganga River) has caused severe damage in Ruisapata and surrounding areas. Jhekala village landslide damaged the road and agricultural land. Twelve people died in the disaster caused by this landslide and cloud burst in 2009. Near Bansbagadh village a slide has its impact in the flow of Bhujgadh stream. Landslides near Nachani village occurred because of road construction which has blocked flow of Mehargadh.

On the whole, land degradation has its impact on the total geographical area of Bhandarigaon, Laa, Jhekala, Girgaon, Bansbagadh, Timtiya, Talla- Bhainskot, Ruisapata and Gini which have been affected due to the process. These villages are severally affected by degradation of land. Among these villages, 5 villages are in northern part and 3 villages are located in

southern part of the study area.

The selected villages for the study are Bhandarigaon, Laa-Jhekla, Girgaon, Bansbagadh, Timtiya, TallaBhainskot, Gini, and Ruisapata. The total geographical land of these villages was 1694.5 hectare including forest land (515.258 hec.), agricultural



**Figure 1.** Location Map

**Source.** Google Earth and Arc GIS Software, NRDMS Centre, Department of Geography, S.S.J. Campus Almora

land (256.303 hec.) and NAP (non-agricultural purpose) land (922.939 hec.). The total damaged land was 9.34 % of the total area in these villages. Among these selected villages, Bhandarigaon is most affected one. This village located on the slopes above the Jakula river bed and land is sliding towards the river. In 2013 and 2014 31.92% of the forested land, 26.37 % of the agricultural land and 17.41 % of the NAP land has been damaged by disaster. More than fifty percent of the families of the villages have been rehabilitated after the disasters of 2013. Laa- Jhekla villages are located along ThalMunsyari road and bank of Jakula river. Cloudburst in the Laa- Jhekla village in 2009 was responsible for the untimely death 26 people of Laa village and 12 of Jhekla village who were buried alive in the debris. Laavillage was totally demolished due to the disasters. Houses and agricultural land of the villages were converted in the barren land. 15.14 % of the forested land, 19.12 % of the agricultural land and 21.82 % of NAP land was again devastated in the year 2013-2014. In Jhekla village several debris channels flowed down slopes, changing a large part of the village area into ruins and damaged mainly agricultural land.

Girgaon was also one of the villages which were devastated due to disasters in recent past, 10.09 % of the total forested land, 5.46 % of the agriculture land and 9.22 % of the NAP land was damaged because of the disasters in the village. Forested and NAP land of Girgaon was damaged by debris flow. Similarly, in Bansbagadh 3.73 % forested land, 4.22 % agricultural land

**Table 2.** Land Distributions of Selected Villages in Eastern Ramganga Basin.

Village name	Total geographical Land (hectare)	Forest Land (hectare)	Agricultural Land (hectare)	NAP(hectare)
Bhandarigaon	64.734	11.151	22.747	30.836
Laa- Jhekla	48.218	8.849	10.822	28.547
Girgaon	526.024	217.841	57.061	251.122
Bansbagadh	238.683	54.067	25.783	158.833
Timtiya	123.125	12.000	7.715	103.410
Talla-Bhainskot	195.895	64.800	14.034	117.061
Gini	200.158	86.550	51.119	62.489
Ruisapata	297.663	60.000	67.022	170.641

**Source.** Block Development Office (Munsiyari)

and 3.84 % NAP land; in Timtiya village 7.16 % forested, 13.09 % agricultural and 12.62 % NAP land; in TallaBainskot village 4.81 % forested, 8.40 % agricultural and 10.27 % NAP land; in Gini village 2.46 % forested land, 2.03 % agricultural land and 17.74 % NAP land and in Bansbagadh village 6.9 % forested land, 10.96 % agricultural land and 11.20 % NAP land was ruined due to disaster (table 3). Major agricultural land area was damaged by road construction in some villages. Timtiya and TallaBhainskot were affected by river band erosion. Most of the agricultural and forestland of Gini village affected by debris flow. Ruisapata was totally damaged, and the terraced agricultural fields were flattened.

**Table 3.** Land Degradation in hectares in Some Villages of Eastern Ramganga Basin.

Name Villages	Damaged Land		
	Forest land Land (hec.)	Agricultural Land (hec.)	NAP (hec.)
Bhandarigaon	3.56	6.000	5.37
Laa- Jhekla	1.34	2.07	6.23
Girgaon	22.00	3.12	23.17
Bansbagadh	2.02	1.09	6.11
Timtiya	0.86	1.01	13.06
Talla-Bhainskot	3.12	1.18	12.03
Ruisapata	2.13	7.35	19.12
Gini	4.14	1.04	11.09

**Source b:** Block Development Office, Munsiyari

## 5. Conclusion

In the present study, there are a large part of the forested land was damaged in Bhandarigaon and Girgaon where the rate of 31.92 % and 10.09 %. In the village Laa- Jhekla, TallaBhainskot, Gini and Ruisapata the percentage of damage is higher in the agricultural area. The area including forested land and village area of Bhandarigaon and Girgaon is prone to mass wasting processes. Thus, damage was caused due to landslides and cloudbursts both. Ramganga along with its tributaries has worked

out the bed and banks along its path and worked away the agricultural terraces of Timtiya and Bansbagadh. All the selected villages (Bhandarigaon, Laa- Jhekla, Girgaon, Bansbagadh, Timtiya, TallaBhainskot, Gini, Ruisapata), 7.60 % of total forested land, 8.91 % of total agricultural land and 10.42 % of total NAP land damaged by environmental hazards. The hazards and disaster play their different role in different environmental conditions. The effect of these events in various landforms varies with the geological setting and anthropogenic activities in the area. If the people of the Himalayas were more aware of the geological vulnerability and ecological fragility, they would surely force more compliance of laws and regulations to protect it. Prevention and mitigation measures play an important role in minimizing the damage caused by disasters which occur due to the active geomorphic processes. We cannot stop these natural processes but mitigate the harmful effect of hazards by identified the sensitive areas. So, the study may help environmentalists to analyze the impact of hazards in every aspect of human life (4).

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