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A GEOGRAPHICAL STUDY OF LANDSLIDE: A CASE STUDY OF MALIN VILLAGE OF AMBEGAON TAHSIL IN PUNE DISTRICT, MAHARASHTRA

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Abstract

The downward and outward movements of the consolidated and unconsolidated soils and rock matter from any geomorphic features due to natural or manmade causes are termed as the landslide. Such movements or displacement occur under the influence of gravitational force presence of water greatly aids this phenomena as it makes the rocks and soil more weak and mobile. A land slide occurs when the part of natural slope is unable to support its own weight due to natural or anthropogenic reasons. Landslide is a general term for a wide variety of down slope movements of earth materials that results in the perceptible downward and outward movement of rock and soil materials under influence of gravity. Three year back there was landslide at Malin village. The study area is found very steep up to 850slope at some locations and the remaining slopes are with a minimum of 450 slopes which also responsible for happened landslide during rainfall seasons. This paper has been written on geographical study of landslide occurrence at hillside areas in Malin village. Many times the landslide occurs due to some natural and manmade reasons. The natural and manmade factors are responsible for occurrence of landslide. We have investigated the soil test results and find out the rainfall changes in last five years during monsoon season.

Keywords: *Landslide, Malin Village, Debris Flow, Slope, Rainfall, Mud Flow*

Introduction

Most of the area of Malin village having terrain region with steep slopes, located in valley side, these slopes are used for cultivation purpose. Most of the area is covered closer to these slopes, which are steeper in nature coming under high hazard zone. Debris flow involves down slope movements of enormous amount of viscous soils and boulders either separately or mixed together and occurs mostly along river valley sides. The difference between debris flow, earth flow and mud flow is related to size of particles and amount of water. The size of particle decreases from debris flow to mudflow. The three terms form a series of progressively higher water content (i.e. water content increases from debris flow through earth flow to mud flow) but are often used interchangeably. Debris flows have 20-80 percent particles coarser than sand sizes, whereas earth flows and mud flows are 80 percentage or more mud and sand. Mud flow is the most liquid "end member" of the series (A.L.Bloom, 1978). Debris flow occurs mostly due to availability of water, presence of loosely deposited soils and fine rock materials, lack of vegetation cover, clay minerals in the soils, unstable slope, undercutting of slope (valley sides) by streams, earth tremors etc. Disaster means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, Environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area; (The Disaster Management act, 2005)

A landslide occurred in the village of Malin in the AmbegaonTahsil of Pune district, Maharashtra. The landslide hit early in the morning on 30 July 2014, while residents were a sleep. This event has been caused by a burst of very heavy rainfall in the Malin village. In this natural calamity at least 151 people were killed in Malin landslide. The landslide was first noticed by a bus driver who drove by the area and saw that the village had been overturned with mud and earth. Those people dead in this calamity their 44 houses also buried in the landslide of Malin village. Debris flows

range in size from a few meters to over 1000 meters in width and may be tens of meters thick in places; more commonly they are 1 to 5 m thick (M.J. Selby, 1982). The water content is more in mud flow than in debris flow and earth flow. Mud flow is most common along valley sides of streams or river and debris (mud) so produced is transported by the rivers.

Study Area

The Malin village is located in AmbegaonTahsil of Pune district, Maharashtra. It is located in a North-Westerly direction of the Pune district. The place of Malin village that lies between Latitude 73º40' N to 73º45' N and Longitude 19º10' E to 19º5' E. This area surrounded by mountain terrain has an average altitude of 850 meters from mean sea level. The average temperature is 200 to 280 C and average annual precipitation is 1133.73 mm (Monsoon season). Area of Malin village has an irregular shape, mountains region having an area of 736 sq. / meter. The vegetation is mainly of dry deciduous type and scrub type. It is due to moderate and irregular rainfall.

Objective

The specific objectives of the present study are as follows

1. To understand rainfall variation in last five years during the monsoon or rainy season.
2. To analyze the soil texture and water holding capacity of the study area
3. To study the landslide on geographical base in Malin village.

Data Collection

The primary and secondary data have been used for this research paper. Primary data: In this study we collected three soil samples at local level in Malin village. This soil samples tested at District Soil Survey and Soil Test Department, Krushibhavan, Pune. Secondary data: Rainfall data of Malin village and native villages obtained from Dimbhe Rain gauge Weather station.

Methodology

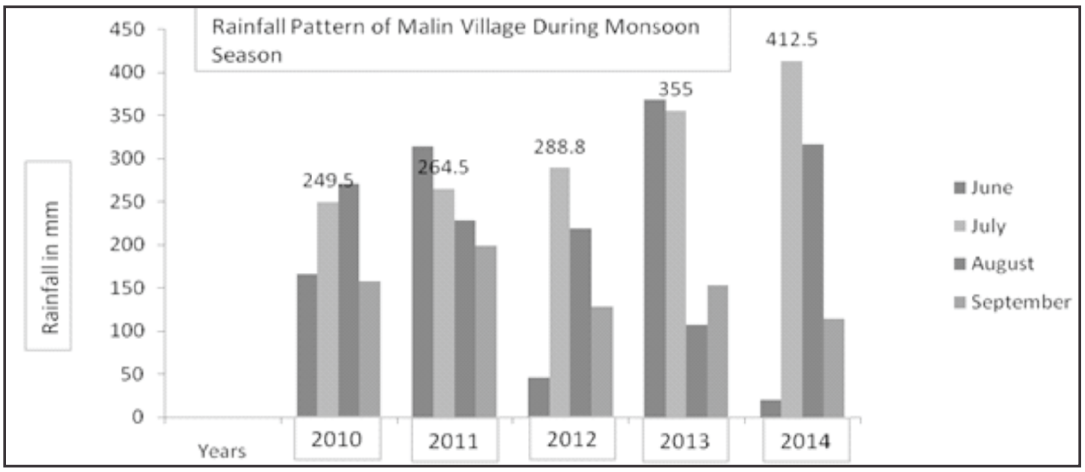
Following methodology used to investigate the different aspects mentioned above.

In this study a field survey soil samples was carried out on the various locations along the mountains slope of Malin village. The soil samples have been collected from three locations of hill first soil sample taken top of the hill, second soil sample taken middle of the hill and third soil sample taken bottom of the hill. All these collected soil samples were tested in laboratory at District Soil Survey and Soil Test Department, Krushibhavan, Pune. This soil samples tested as per standard norm government laboratory. On the basis of these results we find out soil texture and structure of Malin Village landslide. Field survey included thought of local people at actual location in Malin village. Also on the field some information obtained through local people regarding practices of shifting agriculture and land development scheme. This rainfall data collected for understanding rainfall trend last five years. On the basis of this rainfall data we analyzed excess rainfall trend. The cartographic technique has been used to represent the data.

Rainfall Pattern during Monsoon Season

Month / Year	June	July	August	September
	Rainfall in mm			
2010	165.8	249.5	270.8	157.8
2011	314.0	264.5	228.3	199.0
2012	45.8	288.8	218.5	128.5
2013	368.0	355.0	107.0	153.0
2014	20.5	**412.5**	316.0	114.0
Total Rainfall (mm)	914.1	**1570.3**	1140.6	752.3

(Source- Dimbhe Rain gauge Weather Station)



Rainfall Pattern

Rainfall pattern of Malin village observed during previous five years back to identifi the rainfall trend. During the 2010 year rainfall was 165.8 mm in the month of June, 249.5 mm in July, 270.8 mm in August and 157.8 mm rainfall recorded in the month of September. In the 2010 year highest rainfall recorded in August month. During the 2011 year rainfall registered 314 mm in the month of June, 264.5 mm in July, 228.3 mm in August and 199 mm rainfall recorded in the month of September. In the 2011 year highest rainfall recorded in June month. During the 2012 year rainfall recorded 45.8 mm in the month of June, 288.8 mm in July, 218.5 mm in August and 128.5 mm rainfall recorded in the month of September. In the 2012 year highest rainfall recorded in July month. Again highest rainfall recorded in June and July month of 2013 year.

In the year of 2014 if you compare this year rainfall to any other year we got highest rainfall amount in the month of July that is 421.5 mm rainfall. Total amount of rainfall was recorded 1570.3 mm in the month of July only, this is highest rainfall amount during the any other monsoon month. This is one of the main cause responsible for occur landslide in Malin village. In this whole rainfall data July month received more rainfall amount than any other month last five year. In the previous day Malin village received 108 mm rainfall within 24 hours (29 July 2014). Hence landslide was causes by excess rainfall. As the rainfall is very important factor in landslide concerned so it is very necessity to get the data of rainfall to concerned area so that to identify the spot and impact.During rainy season these loose soil masses when saturated with water causes sliding of the land.From the landslides investigations reports, it is shown that this area was affected by very strong monsoon rainfall in the two days prior to the landslide. A. K. Saha (Deputy Director General, Geological Survey of India) said that preliminary reports indicated the landslide occurred due to two days of non-stop rain.

Soil Sample of Malin Village

The soil samples have been collected from three locations of hill first soil sample taken top of the hill, second soil sample taken middle of the hill and third soil sample taken bottom of the hill.

Sr. No.	Properties	Sample No. 01		Sample No. 02		Sample No. 03	
		Reading	Remark	Reading	Remark	Reading	Remark
01	pH	7.24 pH	Slightly Alkali	7.39 pH	Slightly Alkali	7.12 pH	Slightly Alkali
02	EC	0.14 mS/cm	Normal	0.28 mS/cm	Normal	0.43 mS/cm	Normal
03	Organic Carbon	0.63 %	High	0.15 %	Very Low	0.72 %	Very High
04	Phosphorus	13.60 Kg/ha	Low	13.82 Kg/ha	Low	13.60 Kg/ha	Low
05	Potassium	99.13 Kg/ha	Very High	254.53 Kg/ha	Very High	178.49 Kg/ha	Medium
06	CaCo3	3.38 %	Medium	3.00 %	Medium	3.25 %	Medium
07	Texture	9.0 Soil Tex.	Sandy Silt Clay	6.0 Soil Tex.	Silt Clay Loam	10.0Soil Tex.	Sandy Clay
08	Magnesium	11.81 meq %	High	13.84 meq %	High	13.03 meq %	High
09	Sodium	0.98 meq %	Low	0.80 meq %	Low	0.68 meq %	Low
10	W H C	57.05 %	-	55.57 %	-	43.02 %	-
11	App. Density	1.17 gm/cc	App. Density	1.23 gm/cc	App. Density	1.40 gm/cc	App. Density
12	Specific Density	2.21 gm/cc	-	2.04 gm/cc	-	2.16 gm/cc	-
13	Pore Space	60.01 %	-	57.04 %	-	51.96 %	-
14	Moisture	13.11%	Moisture	17.11%	Moisture	6.59 %	Moisture
15	Coarse Sand	21.62 %	-	16.31 %	-	15.19 %	-
16	Clay	24.65 %	-	31.60 %	-	7.50 %	-
17	Silt	24.32 %	-	33.52 %	-	34.64 %	-
18	Fine Sand	29.35 %	-	22.84 %	-	40.24 %	-
19	Calcium	23.48 meq %	High	23.01 meq %	High	21.24 meq %	High

(Source- Soil Sample Tested By District Soil Survey and Soil Test Department, Krushibhavan, Pune)

Soil Analysis Results

In this study above table is shown the result of soil samples. That is tested in soil laboratory. Test involve to crumble the dry soil by fingers, soil analyses at side was done it shows that no need of more pressure required to crumble the soil, the soil was very loose and easy to crumble. So we visited Malin village, we observed ground conditions and collected soil sample for identified the soil texture, soil structure, water holding capacity, pore space and calcium properties of the soil. For that we planned to conduct soil test on samples to be collected from landslide affected site, samples to be collected were from 3 different levels, top, middle, and bottom level of the landslide hill.

Soil texture of Malin village found Sandy Silt Clay, Silt Clay Loam and Sandy Clayat top hill, middle hill and bottom of hill respectively. On the top part of the hill Sandy silt clay soil found which was more responsible fo water penetrate inside the ground quickly. Coarse Sand found 21.62 %, 16.31 % and 15.19 % Clay 24.65 %, 31.60 % and 7.50 %, Silt 24.32 %, 33.52 % and 34.64 %, Fine Sand 29.35 %, 22.84 % and 40.24 % at top hill, middle hill and bottom of hill respectively. Calcium properties of soil are remarkably high at top, middle and bottom level of landslide hill. Water Holding Capacity of the soil is 57.05 % at the top of hill, 57 % water holding capacity found at middle stage of hill and 43.02 % water holding capacity found at base or foothill of the landslide. In this study pH value of the soil Slightly Alkali found at all level of hill. Sodium properties are found low percentage. Electric conductivity found normal range. Also the soil condition getting there is very loose containing non- cohesive soil with small pebbles, and other loose material which is very prone to landslide. Soils are reddish brown in color and rich in sandy sediment and it is fine to course in size.

Causes of Malin Landslide

1. Malin village received 108 mm rainfall within 24 hours (29 July 2014). The downpour was continuing throughout the whole day. The landslides were caused by heavy rainfall that had begun the previous day.
2. The environmental destruction that the resulted landslide occurred due to government scheme Padakai Yojana implemented under Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) in this area that led to the landslide. It was implemented in the upper part of the Malin village.

3. Flattening of the ground the halfway mark of the hill for cultivation is the cause for the landslide in Malin village. Use of heavy machinery over the past two years to the land for cultivation contributed to the crumbling of the hilltop
4. Some cause cited as contributing to the landslide was tree cutting or excessive deforestation in this hilly area. Malin farmers were changed agricultural practices like shifting cultivation is more dominant in this area.
5. Major cracks in the ground in many places where soil had eroded and washed downhill. This was an important indicator of a landslide, which the villagers had failed to grasp.
6. The hill slope of Malin village is more than 50degree, that is major cause of landslide occurred. The instability of the hills slope was due to the manmade construction activities, which are often done any without careful analysis of environmental consequences.

Conclusion

After the studying rainfall and soil test parameters and investigating the sites we measurably found that some anthropogenic and natural Phenomenons are the reason for landslide in Malin village. The study area is found very steep up to 850slope at some locations and the remaining slopes are with a minimum of 450 slopes which also responsible for happened landslide during rainfall seasons.

The heavy rainfall has been occurring for last two to three days, and water was accumulated at the top of the hill. The accumulated rainwater percolates through either interface of weathered material and sand silt clay at the surface of the hill. Heavy rainfall in the month of July 2014, that is 412.5 mm rainfall recorded before the incident of Malin landslide found main reason.

Soil texture of Malin village found Sandy Silt Clay, Silt Clay Loam and Sandy Clayat top hill, middle hill and bottom of hill respectively. Soil analyses at side was done it shows that no need of more pressure required to crumble the soil, the soil was very loose and easy to crumble.

Deforestation was dominant in the Malin village; most of the farmers cut the vegetation cover along the hill slope. Soil was turned out to be free. Because of leakage of water and the water holding limit is less here.This study shows that the hill slope was unstable prone to failure. It was triggered by various man-made and natural factors like heavy rainfall, unscientific farming activities at the top of the hill and along the hill, unplanned cultivations.

References

1. A Geomorphic study of south Kankan (Karlekar S.N.1981)
2. Bawaskar Akshaykumar, Jagtap Akash, and Pranit Bansod, “Rehabilitation of Malin Village”. International Journal of Research in Advent Technology (E-ISSN: 2321-6937).
3. Doke Arjun (June 2017), “Malin Village Landslide: A Geological Hazard”. Indian Streams Research Journal, ISSN: 2230-7850 Volume 7, Issue -5.
4. Geomorphic Analysis of upper Bhima River (Jog S.R.1985)
5. Gujarathi Pooja, Mane S. J, (19 March 2016), “Landslide Zones of Nearby Areas of Malin Village, Pune District, Maharashtra Using GIS Techniques”. International Journal of Science and Research (USR) ISSN (online) 2319-7064 Index Copernicus Value (2013) 6.14.
6. Indurkari G. D, Saharkar U. R, Ahire H. H, and Kulkarni D. D, “Study and Suggestive Measures of Landslides on Pune Mumbai Route”. IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e-ISSN: 2278-1684, p-ISSN:2320-334X, pp 50-59, www.iosrjournals.org
7. Introduction to Geomorphology (V.S. Kale and Avijit Gupta) page no. 83 to 85.
8. Jadhav Atesh, Bhagat Pankaj, Patil Rahul, Bhir Anil and Shevale Samriddi,(April 2016) “Stydy of Ladslide Hazard and Mitigation Methods” International Journal on Recent and Innovation Trends in Computing ISSN:2321-8169 Volume:4 Issue: 4 293-295, http://www.ijritcc.org

9. Sable P.D, Shinde S.B, Mule S.S, and Tamboli J.K, " Landslide Investigation in Bhor Tahsil: A Case Study of Mahadevwadi". Research Article Volume 6 Issue No. 4, ISSN 2321-3361.
10. Sable Pandurang, Gawande Sagar, Bangar Laxmikant, Wanare Pavan, and Sagar Amit,
11. Savindra Singh. "Physical Geography".
12. Shaikh A.F, Gunjal P.K, Chaple N.V, (April 2015) "Report on Landslide in Malin Village in Pune". International Joural of Engineering Sciences and Research Technilogy (111), ISSN:2277-9655. http://www.ijesrt.com
13. Singh T. N, Singh Rajbal, Singh Bhoop, Sharma L. K, Singh Rajesh, and Ansari M.K. (14 January 2016) "Investigations and Stability Analyses of Malin Village landslide of Pune District, Maharashtra, India". Published online, Nat Hazards (2016) 81:2019-2030.
14. The study of rainfall infiltration runoff and source characteristics in the source Region of Krishna Basin (Ghole S.P.1984).

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