

Community Based Disaster Management Planning: Case Studies From Uttarakhand, India

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ABSTRACT: *This paper deals with the concept of community based disaster management (CBDM) and explains causes and effects of different disasters and their risk assessment in Baliya nala catchment of Uttarakhand. For the data collection author has used PRA (Participatory Rural Appraisal) tools and secondary data. This paper captures disaster assessment, vulnerability assessment, capacity assessment and risk assessment and interpretations of the variations in various disasters attributes on the basis of risk assessment.*

Keywords—Community participation, Disasters, PRA tools, Case study, Hazard Assessment, Vulnerability Assessment, Management Assessment, Risk assessment, Uttarakhand.

I. INTRODUCTION

In case of disasters, the people at the community level have more to lose because they are the ones directly hit by disasters, whether major or minor. They are the first ones to become vulnerable to the effects of such hazardous events. On the other hand, they have the most to gain if they can reduce the impact of disasters on their community. This concept gave rise to the idea of community-based disaster management where communities are put at the forefront. Through the CBDM, the people's capacity to respond to emergencies can be increased by providing them more access and control over resources and basic social services. Using a community-based approach to manage disasters certainly has its advantages. Through CBDM, it is hoped that communities will be strengthened to enable them undertake any programmes of development including disaster preparedness and mitigation.

II. OBJECTIVE

1. To study the region in reference to different disasters.
2. To find the exposure, vulnerability, disaster, capacity management and risk assessment with the help of PRA (Participatory Rural Appraisal) tools.
3. To investigate the maximum risk assessed in the area and,
4. Finally suggesting a management plan for the region.

III. RESEARCH METHODOLOGY

1. Collection of primary data by using PRA tools and conducting interviews for ground reality.
2. Study the region and assess different disasters.
3. Collection of secondary data for analyzing, explaining, and combining the information from the primary source with additional information.

VI. BALIYA NALA (UTTRAKHAND) AND DISASTERS

The Study area is a natural unit of catchment of the Baliya nala stream which is a tributary of the Gola River that drains a major portion of Nainital town of Uttarakhand. The total area of Baliya catchment is 76.79 sq.km .The total length of Baliya river is 14.84km from Nainital to Ranibagh where it confluences with the Gola river. It lies between Lesser Himalaya and lower Shiwalik, between 29° 16' 10" N to 29° 24' 11" N latitudes and 79° 41' 21" to 79° 48' 13" E longitudes.

GENERAL INFORMATION
a. GEOMORPHOLOGY & LANDUSE

GROUND ZONE	LAND USE
ZONE OF RIDGES AND STEEP SLOPE	Forest and grazing
MODERATE ZONE	Agriculture, grazing land
ZONE OF MINIMUM ELEVATION	Agriculture

The zone of ridges and steep slope includes major portion in north of the river. It lies in altitudinal zone of 1400 m. thus subjected to high erosion. It covers 45% area of the total area of the basin. The zone of moderate slope lies between altitude of 900mts to 1200mts, thus erosion is also comparatively less. This zone also characterised by fault and a dissected topography. This zone involves maximum anthropogenic interference thus contributes in maximum silt discharge to the principal stream. This zone covers 35% area of the total area of river. The zone of minimum elevation varies from 545mts to 1400mts thus erosion is low. The soil is enriched with silt and thus it is potentially fertile, this covers roughly 20% area of total river basin.

b. MORPHOLOGY(ROCKS):

Krol Formation	Dolomite and limestone
Blaini Formation	Bleached and grey slate
Naghat Formation	purple and white quartzite with volcanic green and purple slate Salari Thrust
Amritpur Granite	granite and quartz porphyry
Main Boundary Faulty(Lower Shiwalik)	sandstone ,Shale and clay

The terrain to the south of Baliya River, constituted of sandstone, clay stone and shales of lower shiwalik belt, exhibits a youthful morphology characterised by sharp, jagged peaks and Steep slopes. The Shiwalik has been thrust over by a huge synclinal fold succession of Palaeozoic sediments of Nagthat Blaini and Krol formation constituting, known as Krol nappe. The synclinal thrust sheet has been truncated by the main boundary fault.

C. CLIMATE:

Amount of rainfall is high towards north and west in thickly forested area. Further northward increase in altitude has marked effect in lowering the temperature. Climate data for the Balia nala could be available only for two recording stations maintained by the forest department.

D. VEGETATION:

In a large measure, the natural vegetation is an index of such basic physical conditions in any area, as rainfall, altitude, temperature and soils.

The principal vegetation is Chir (Pinus roxbughii) while Oak (Quercus lceucotrichophora) is also a prominent species but relatively a smaller area in Ranibagh and Jeolikot area. We find an area of dense mixed forest of Sal (Shorea robusta), Chir (Pinus roxbughii), Khair (Acacia catechu) and grass but in Jeolikot and Nainital, the principal species is Pine. The main shrubs that occur in this area include Ghingarau, Kilmora (Berberis vulgaris) and Hishalu (Rubus ellipticus). There are few patches of deciduous forest also.

**CASE STUDY OF VILLAGES:
Table -1. General Information of Selected Village**

NAME OF VILLAGE	NO. OF FAMILY	TOTAL POPULATION	POPULATION LIVES TOCK	NO. OF SCHOOL	NO. PANCHAYAT MEMBERS	NO. OF SOCIAL ORGANIZATION	MEDIUM OF COMMUNICATION	MAIN DISASTER	NO.OF BANK
SURYAJALA	140	800	250	02 (Primary)	03(01 MEN and 02 Female)	02	Radio, Television, Telephone, Newspaper	Flood, Landslide, Forest Fire, Heavy Rain	NIL
DAUGAR A	30	254	52	NIL	NIL	NIL	Radio, Television, Telephone, Newspaper	Flood, Landslide, Heavy Rain	NIL
BHAURJALA	12	95	45	NIL	NIL	NIL	Radio, Television, Telephone, Newspaper	Flood, Landslide, Heavy Rain	NIL
LAMJALA	25	150	85	NIL	NIL	NIL	Radio, Television, Telephone, Newspaper	Flood, Landslide, Heavy Rain	NIL
RUSIMALLA	45	175	66	01	NIL	NIL	Radio, Television, Telephone, Newspaper	Flood, Landslide, Heavy Rain	NIL
RANIBAGH	60	320	125	02 (1Primary and 1High School)	NIL	NIL	Radio, Television, Telephone, Newspaper	Heavy Rain	01 (State Bank of India)

The village Suryajala has the highest population. The main livestock are buffalos, cows, bulls, goats, hens, and dogs. The main occupation of villagers is agriculture and other occupations are poultry farming, dairy farming and bee-keeping. There are no means of education except Suryajala and Ranibagh. The means of villages are good in all these villages. The banking facility is only in Ranibagh. The main disasters in these villages are flood, landslide, forest fire, and heavy rain.

V. RESULTS

Table-2.Hazard Assessment

NAME OF VILLAGE	NAME OF DISASTER	HAZARD									AVERAGE
		FREQUENCY			EFFECT			RANKING			
		DEFINITE	CHANCE	NO CHANCE	HIGH	MEDIUM	LOW	HIGH	MEDIUM	LOW	
SURYAJALA	FLOOD	3	-	-	3	-	-	3	-	-	9/3=3
	FORESTFIRE	3	-	-	-	2	-	-	-	1	6/3=2
	LANDSLIDE	3	-	-	3	-	-	-	2	-	8/3=2.7
DAUGARA	FLOOD	3	-	-	3	-	-	3	-	-	9/3=3
	LANDSLIDE	3	-	-	3	-	-	-	2	-	8/3=2.7
BHAURJALA	FLOOD	3	-	-	3	-	-	3	-	-	9/3=3
	FORESTFIRE	-	2	-	-	-	1	-	2	-	5/3=1.7
	LANDSLIDE	3	-	-	-	2	-	-	2	-	7/3=2.3
LAMJALA	FLOOD	3	-	-	3	-	-	3	-	-	9/3=3
	FORESTFIRE	3	-	-	-	-	1	-	-	1	5/3=1.7
	LANDSLIDE	3	-	-	3	-	-	-	2	-	8/3=2.6
RUSI MALLA	HEAVY RAINFALL	3	-	-	3	-	-	3	-	-	9/3=3
	LANDSLIDE	3	-	-	3	-	-	-	2	-	8/3=2.7
RANIBAGH	HEAVY RAINFALL	3	-	-	-	-	1	-	-	1	5/3=1.7

The average of frequency, effect and ranking of flood in Suryajala, Daugara, Bhaurjala and Lamjala is 3 and forestfire registers 2, 1.7 and 1.7 respectively Suryajala, Bhaurjala and Lamjala villages. Landslide in Suryajala, Daugara and Rusi Malla records 2.7, while in Bhaurjala and Lamjala, it is respectively 2.3 and 2.6. From it, this is clear that the effect of landslide in Suryajala, Lamjala and Russi Malla is very high. The average of rainfall disaster in Rusi Malla and Ranibagh is 3 and 1.7. Thus we see that the chances of flood disaster in first 4 villages is very frequent and effective while landslide is very much effective and frequent disaster in all six villages along Baliya nala.

Table-3.Vulnerability Assessment

NAME OF VILLAGE	DISASTER	POPULATION			BUILDING			INFRASTRUCTURE			RESOURCE			ECONOMY			AVERAGE
		HIGH	MEDIUM	LOW	HIGH	MEDIUM	LOW	HIGH	MEDIUM	LOW	HIGH	MEDIUM	LOW	HIGH	MEDIUM	LOW	
SURYAJALA	FLOOD	-	2	-	-	2	-	-	2	-	3	-	-	3	-	-	12/5=2.4
	FOREST FIRE	-	-	1	-	-	1	-	-	1	3	-	-	-	2	-	8/5=1.6
	LANDSLIDE	-	2	-	-	2	-	3	-	-	3	-	-	3	-	-	13/5=2.6
DAUGARA	FLOOD	-	2	-	-	2	-	-	2	-	-	2	-	-	2	-	10/5=2
	LANDSLIDE	-	2	-	-	2	-	3	-	-	-	2	-	-	2	-	11/5=2.2
BHAURJALA	FLOOD	3	-	-	3	-	-	3	-	-	-	-	1	-	-	1	11/5=2.2
	FOREST FIRE	-	-	1	-	-	1	-	-	1	-	-	1	-	-	1	5/5=1

	LANDSLIDE	-	2	-	3	-	-	-	-	1	-	-	1	-	-	1	8/5=1.6
LAMJALA	FLOOD	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-	15/5=3
	FOREST FIRE	-	-	1	-	-	1	-	-	1	3	-	-	3	-	-	9/5=1.8
	LANDSLIDE	-	-	1	-	-	1	3	-	-	3	-	-	3	-	-	11/5=2.2
RUSIMALLA	HEAVY RAINFALL	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-	15/5=3
	LANDSLIDE	3	-	-	-	-	1	-	-	1	-	2	-	-	-	1	9/5=1.8
RANIBAGH	HEAVY RAINFALL	-	-	1	-	2	-	-	-	1	-	-	1	-	-	1	6/5=1.2

In Suryajala the vulnerability of landslide of population, building, infrastructure, resource, and economy is 2.6 in average. It also records highest frequency of forest fire is 1.6 and of flood is 2.4, thus we see that major disaster at this village is landslide. In Daugara the vulnerability by landslide is 2.2 and by floods 2 in averages. While in Bhaurjala flood is major disaster which is 2.2 in average and forest fire is 1 and of landslide is 1.6 in average. In Lamjala the vulnerability of flood is 3 in average and of landslide are 2.2 and of forest fire is 1.8 in average. In Rusi Malla major disaster is heavy rainfall and its average is 3 while landslide is 1.8. In Ranibagh heavy rainfall is major disaster and its average is 1.2.

Table-4(A).Management Assessment

NAME OF VILLAGE	DISASTER	LEVEL OF AWARENESS : Government and community			According to act level of provision for management of disaster			EFFECT OF REGULATIONS for disaster			REACTION OF GOVERNMENT :after disaster occurs			FORECASTING: effective level by Government		
		LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH	LOW	MEDIUM	HIGH
SURYAJALA	FLOOD	3	-	-	-	2	-	-	2	-	3	-	-	3	-	-
	FOREST FIRE	3	-	-	3	-	-	-	-	1	3	-	-	3	-	-
	LANDSLIDE	3	-	-	-	2	-	3	-	-	3	-	-	-	2	-
DAUGARA	FLOOD	-	-	1	-	-	1	3	-	-	-	2	-	3	-	-
	LANDSLIDE	-	-	1	-	-	1	3	-	-	-	2	-	3	-	-
BHAURJALA	FLOOD	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-
	FOREST FIRE	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-
	LANDSLIDE	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-
LAMJALA	FLOOD	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-
	FOREST FIRE	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-
	LANDSLIDE	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-
RUSI	HEAVY RAINFALL	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-

MALLA	Y RAINF ALL																
	LANDS LIDE	-	2	-	3	-	-	3	-	-	-	-	1	-	-	1	
RANIBAGH	HEAVY RAINF ALL	-	-	1	-	-	1	-	-	1	-	-	1	-	-	1	

The level of awareness in Daugara and Ranibagh is very high while in other villages it is very low and the provision for management of disaster in Daugara and Ranibagh is very high but at other villages it is very low or medium. The effect of regulation in Suryajala for forestfire and in Ranibagh for heavy rainfall is very high while at other places it is very low. The reaction of government is very low except Ranibagh for rainfall and Rusi Malla for landslide. The forecasting of landslide in Russi Malla and heavy rainfall in Ranibagh is highly effective while at other villages it is very low or medium.

Table-4(B).Management Assessment

NAME OF VILLAGE	DISASTER	LEVEL OF WARNING : before occurring disaster			PREVENTION & MITIGATION OF DISASTER			LEVEL PARTICIPATION: of community disaster management			LEVEL OF PARTICIPATION: of non-governmental in disaster management			LEVEL OF PARTICIPATION: Government in disaster management			AVERAGE
		L O W	M E D I U M	H I G H	L O W	M E D I U M	H I G H	L O W	M E D I U M	H I G H	L O W	M E D I U M	H I G H	L O W	M E D I U M	H I G H	
SURYAJALA	FLOOD	-	2	-	-	-	1	3	-	-	-	2	-	-	2	-	23/10=2.3
	FOREST FIRE	-	2	-	-	-	1	3	-	-	-	2	-	-	2	-	25/10=2.5
	LANDSLIDE	-	2	-	-	-	1	3	-	-	-	2	-	-	2	-	22/10=2.2
DAUGARA	FLOOD	-	-	1	-	-	1	3	-	-	-	2	-	3	-	-	20/10=2
	LANDSLIDE	-	-	1	-	-	1	3	-	-	-	2	-	3	-	-	20/10=2
BHOURJALA	FLOOD	3	-	-	-	2	-	-	1	3	-	-	-	2	-	-	26/10=2.6
	FOREST FIRE	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-	30/10=3
	LANDSLIDE	3	-	-	-	2	-	-	1	3	-	-	-	2	-	-	26/10=2.6
LAMJALA	FLOOD	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-	30/10=3
	FOREST FIRE	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-	30/10=3
	LANDSLIDE	3	-	-	-	2	-	3	-	-	3	-	-	3	-	-	29/10=2.9
RUSI	HEAVY	3	-	-	3	-	-	3	-	-	3	-	-	3	-	-	30/10=

MALLA	RAINFALL																3
	LANDSLIDE	-	-	1	-	2	-	-	2	-	3	-	-	-	2	-	20/10=2
RANIBAGH	HEAVY RAINFALL	-	-	1	-	-	1	-	-	1	-	-	1	-	-	1	10/10=1

The level of warning (before occurring disaster) is low in Bhaurjala , Lamjala , Russi Malla while medium in Suryajala and high in Daugara and Ranibagh. Prevention and mitigation of disaster is high in Suryajala , Daugara and Ranibagh , and low to medium in Bhaurjala , Lamjala and Russi Malla. The level of participation of community in disaster management is low in Suryajala , Daugara , Lamjala regarding all disaster while in Ranibagh it is low in case of heavy rainfall and in Ranibagh it is low in case o heavy rainfall and medium in landslide. In Ranibagh level of community participation in disaster management is high. The level of participation of non-governmental organizations in Bhaurjala , Lamjala , Russimalla and Ranibagh is medium while,high in Ranibagh. The level of participation of government is low in Daugara, Lamjala , Bhaurjala (medium in flood and forest fire) and in Russi Malla (medium in landslide). In case of Ranibagh level of participation of government is high.

Table -5. Risk assessment

NAME OF VILLAGE	DISASTER	HAZARD ASSESSMENT	VANURABILITY ASSESSMENT	MANAGEMENT ASSESSMENT	RISK ASSESSMENT
SURYAJALA	FLOOD	3	2.4	2.3	3.13
	FORESTFIRE	2	1.6	2.5	1.28
	LANDSLIDE	2.67	2.6	2.2	3.16
DAUGARA	FLOOD	3	2	2	3
	LANDSLIDE	3	2.2	2	3.3
BHAURJALA	FLOOD	3	2.2	2.5	2.64
	FORESTFIRE	1.67	1	3	0.557
	LANDSLIDE	2.33	1.6	2.5	1.49
LAMJALA	FLOOD	3	3	3	3
	FOREST FIRE	1.67	1.8	3	1.002
	LANDSLIDE	2.67	2.2	2.9	2.025
RUSIMALLA	FLOOD	3	3	3	3
	LANDSLIDE	2.67	1.8	1.9	2.53
RANIBAGH	HEAVY RAINFALL	1.67	1	1	1.67

$$RISK\ ASSESSMENT = \frac{HAZARD\ ASSESSMENT \times VANURABILITY\ ASSESSMENT}{MANAGEMENT\ ASSESSMENT}$$

The risk assessment of disasters show, risk of landslide in Suryajala, Daugara, Bhaurjala, Lamjala and Russi Malla is respectively 3.16, 3.3, 1.49, 2.025 and 2.53 while of flood in Suryajala (3.13), Daugara (3), Bhaurjala (2.64), Lamjala (3) and Russimall (3).Risk assessment of forest fire in Suryajala , Bhaurjala and Lamjala is respectively 1.28, 0.557 and 1.002 and of heavy rainfall 1.67 in Ranibagh. Thus this table shows risk of Landslide and flood disasters are very high in all six villages along Baliya nala.

VI. CONCLUSION

Baliya stream region is very susceptible for disasters (Figs A to J). As per case studies it is proved that disaster occurs frequently in this area. Most occurring disasters in this area are: landslide, flood and in some areas forest.



Fig. A. Show's landslide process along Baliya Nala.



Fig. B. Presents soil creeping through crack in roads.



Fig. C. Shows bad condition of retaining walls.



Fig. D. Garbage dumping is the main reason for bad condition of retaining wall

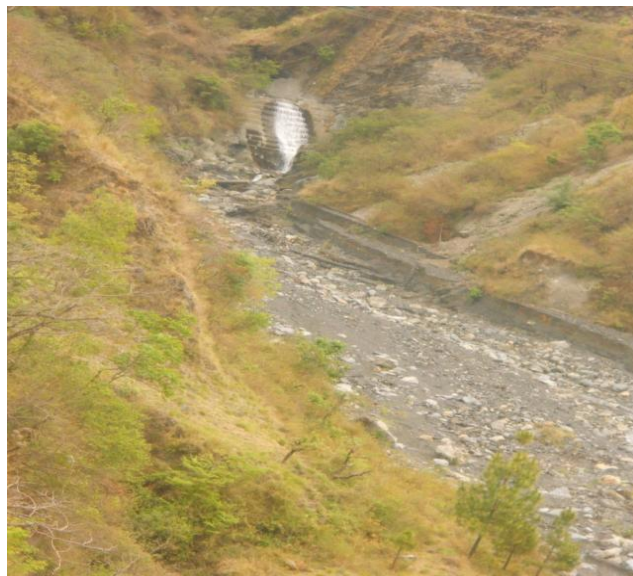


Fig.E. Photograph of Baliya Nala from bridge of Veerbhatti



Fig. F. shows sedimentation by Baliya Nala which demarcates rate of soil erosion



Fig. G. Show's contribution of government to reduces rate of landslide.



Fig. H. shows plantation of Ram Bass which Protect Baliya Nala.



Fig. I. Method of protecting roof of houses from heavy rainfall by communit



Fig. J. Here Baliya Nala conflues to Gola river.

About 320.72 hector of the Baliya catchment is found environmentally highly sensitive and fragile. Due to the presence of Main Boundary Thrust (MBT) and others fault this zone is geotectonically very instable and thus consequently vulnerable to the process of mass movement and surface removal. Besides anthropogenic process of resource development, specifically construction of road along sensitive slopes, expansion of settlement zone and agriculture on forests and upslope areas, overgrazing etc. have further rendered this entire zone prone to frequent and widespread land sliding and excessive erosion.(Bartarya, S.K. and Valdiya, K.S. (1989).

The role of community is very insignificant to mitigate and manage disasters in Baliya nala catchment area, as well the role of Government authorities is also less. Although by the efforts of government, in some areas retaining wall to prevent landslides have been erected, but these means are not helpful to that extent due to lack of maintenance.

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