RIGHT AND AUTHENTIC INFORMATION: A MUST FOR THE CORRECTIVE ACTION

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Monsoon season is particularly notorious for landslides when enhanced pore water pressure facilitates downslope movement of rock mass and debris. Despite being spared by major landslides (akin to Okhimath and Malpa of 1998) the State of Uttarakhand has significant human toll during the monsoon season. In the monsoon season of 2007 (between 1st June and 30th September, 2007) as many as 83 persons were reported dead besides massive loss of dwelling units, infrastructure, private property, animal stock and agriculture and forest land.In the year 2007 significant slides took place at Panjana, Devpuri, and Baram in Rudraprayag, Chamoli, and Pithoragarh districts respectively. Though the most spectacular and massive former did not have loss of human lives. Landslides are often debated to have distinct structural control but the same was not observed at all the three places where concentrated rainfall was observed to be the main culprit. In all the three situations the *insitu* rocks are not involved in the initiation of the slide. These slides are observed to be primarily restricted to the top soil surface. Initiating at a higher elevation amid forest (as in Panjana and Baram) or amid agricultural terraces (as in Devpuri) the slides took place amid heavy rains and the rolling down debris gathered enough momentum to wash off infrastructure that came in its way. The slide at Malla Sain *tok* of Baram is initiated less that 60 meters above the habitation along the colluvial slope that had stabilized and had good vegetative cover. Soil mass together with the embedded boulders broke loose amid heavy rains in the midnight of 5th September, 2007 and the thick mudflow ravaged four houses taking toll of 10 human lives. There is similar story to be narrated at Panjana and Devpuri though at both these places the slide initiated at a much higher elevation. (Figure 1,2,3&4)

Figure 1. *View of the Agricultural fields of Panjan village (district Rudraprayag) devastated by flow along Kagwa Gadhera.*

Figure 2. *Ground fissures in Panjan village. These secondary fissures have developed due to the toe erosion by landslide debris.*

Despite being located in remote areas, the local administration responded promptly but the same is often being criticized for lack of action prior to the incidence. The scientific community has been often putting forth strong arguments in favour of carrying out detailed landslide hazard zonation related exercises for ascertaining the threat of landslides in the hilly areas so as to undertake timely mitigative action. Experiences of the implementing agencies in the areas covered by similar exercises are, however, not very encouraging. This is largely attributed to the scale of the final output as also the certainty of conclusions in time and space (highest hazard classes are often not the first to be affected by the event).One has also to review the basis of these hazard and risk maps. Various input layers often being utilized for ascertaining landslide hazard include geology, slope, aspect, relief, land use / land cover, soil, lineament and structure (mostly the trace of the major structures) and most researchers have made it a general practice to rely largely upon remote sensing data (thanks to the advances made by the India Space Programme) and relegating minor field details (bedding joint relations / attitude, joint spacing / continuity) to the back seat. Lack of standard and tested methodology leaves the space open for the innovativeness of the researcher and the end user is given to speculate upon a variety of outputs tendered. Moreover the trend of putting forth generalized remedial measures is really not serving any purpose. To add to it, the most important causative factor

(precipitation) is mostly not being accorded its due share of importance in finalizing the hazard maps.Geological Survey of India, being the nodal agency for landslides, should take this issue seriously and formulate a strategy whereby the outputs available to the end user are authentic and reliable and are supplemented by implementable technical solutions. Some points for action to be considered to make a dent in this direction include, i) formulation of standard methodology for landslide hazard zonation ensuring incorporation of adequate quantum of field data in the same, ii) standardizing slope stability thresholds for different litho-units, iii) standardizing precipitation thresholds for different slope and lithounits, iv) establishing database of meteorological parameters, and if possible v) ensuring real time online precipitation data access facility to the State Emergency Operations Centres. Besides the above mentioned points, one needs to understand that making a hazard and risk map is a technical issue and its efficacy is a function of the competence and experience of the person undertaking the job. A system driven approach (where the output is based upon the input of a certain layers) is not really going to fetch results and such an attitude towards hazard zonation needs to be discouraged or restricted to academic pursuits. Being an issue related to the public welfare and sensitivity, the formulation of hazard and risk maps certainly needs to be regulated.It may be carried out by licensing a few qualified persons as is, normally, being done in case of Mine Plan preparation. This would reduce a lot of ambiguity and bring forth positive action for the welfare of the masses.

Figure 3. *View of the house devasted by deffrential ground movement along fissures shown in fig. 2.*

Figure 4. *View of the Devpuri slide in Chamoli district that took tall of 08 lives.*

The State of Uttarakhand has significant human toll during the monsoon season. Details of the losses during the monsoon season of the previous three years for the 04 months extending between 1st June and 30th September are as given below :

Sl. No.	District	Human beings dead			Animal loss			Loss of dwelling units						Loss of agricultural land (in hectare)		
								Partial			Complete					
		'07	'06	'05	'07	'06	'05	'07	'06	'05	'07	'06	'05	'07	'06	'05
1.	Almora	2	0	8	17	10	21	166	89	324	33	12	32	100.00	0	0
2.	Bageshwar	3	5	3	15	22	55	239	130	151	25	31	18	3.46	2	0.60
3.	Champawat	2	0	8	0	1	0	14	7	12	4	8	0	0	0	0
4.	Pithoragarh	26	6	13	81	78	132	98	9	2	75	27	22	1.20	2	0
5.	Nainital	1	1	16	12	0	3	97	58	63	6	23	7	0	0	11.349
6.	Udhamsingh Nagar	10	5	4	0	0	0	0	0	0	0	0	0	0	0	0
7.	Haridwar	5	2	4	19	0	1	5	6	879	4	0	0	0	70	0
8.	Pauri Garhwal	6	2	2	0	0	30	1	0	6	6	0	0	0	0	2
9.	Dehradun	0	0	0	2	0	8	11	0	0	6	0	4	0	0	3.00
10.	Rudraprayag	0	4	13	1	20	0	0	0	38	2	14	20	0	0	0
11.	Uttarkashi	4	6	3	0	2	15	7	10	24	8	2	28	0	0	182.202
12.	Chamoli	20	6	26	115	23	2	163	215	61	31	40	10	0	0	0
13.	Tehri Garhwal	4	5	11	11	12	10	54	47	5	17	12	10	6.3	0	1.00
Total		83	42	111	273	168	277	855	571	1565	217	169	151	110.96	74	200.151

Based upon the reports received from the districts