Chapter VII

CASE STUDIES

The case studies are primarily based on primary data collected by personal survey of the areas. A detailed questionnaire was prepared relating to landslide information — their possible causes according to the residents, the property affected, people’s attitude towards these hazards, preventive measures adopted by them, and various adjustments made by them.

From each site 11 to 16 families were selected at random and each family was subjected to a detailed interview. Several common features of all the four sites could be identified:

1. Landslides had occurred mainly during the post-independence period,
2. Landslides had occurred during the summer monsoon period,
3. A vast majority of landslides had occurred in the slope category of 50° and more.

It has been observed that when a reporter reports any landslide he sometimes could not mention the exact place where it had occurred; but instead he gives the name of the nearest possible prominent place. For this reason nearby areas of the case study sites are also included in the text. For example, interviews with the people of Chamnau, situated at 30° 24′N latitude and 79° 19′E longitude on the right bank of Alaknanda...
and 9 kilometre from Chamoli, revealed that the village had experienced about 3 major landslides during 1979 and 1980 devastating all the cultivated fields. Each landslide was flashed in the newspaper but everytime the reporter mentioned that it had occurred near or north or south of Chamoli.

Chamoli Sites

It is situated at 30° 24'N latitude and 79° 20'E longitude on Rishikesh-Badrinath highway. It lies on the left bank of the Alaknanda, 8 kilometres north of Nandprayag. The pilgrim road to Kedarnath by Okhimath and Gopeshwar begin from here. The entire settlement is situated between the altitude of 1400 and 1600 metres.

Of a total of 21 landslides that had occurred on this highway, 6 had occurred at or near Chamoli.

The area provides a natural slope for weathering and erosion. The rocks are generally weak and permeable which can easily be eroded and modified by human interference. The area consists of loose boulders of shale and slate, which are generally faulted. There are many local faults, which had made the zone weak and unstable. The quartzite of the area at the mouth of Birahi river is partly crushed and crumbled.

Terracing the slopes for agriculture has changed the ecological balance of the area. Deforestation has laid bare the slopes. During rains water penetrates the rocks thereby further aiding soil erosion.
One of the important factors for the devastating landslides occurring in Chamoli is that here the graziers had completely destroyed the trees by cutting their main branches and twigs for fodder. Close browsing by goat and sheep is another villain of this tragic drama since it loosens the soil cover of the slope.

Quarrying is another human activity which triggers off landslides frequently. About 3 kilometres downhill from Chamoli near Maithana the quarrying of marble has generated many landslides. Here the beds are dipping inside the slope. Extensive quarrying has left the rock to overhang the road thereby increasing the possibility of landslides. A crack had already developed in the strata which can fall at any time. (Fig. 15)

Despite the government's efforts in restricting the construction of markets in the landslide prone areas new market centres are emerging very rapidly. New shops and hotels have been constructed despite the government's warning regarding the instability of the slope. Many multi-storeyed buildings have been built - all of which entail the use of large amount of explosives for the excavation of their foundations which in its turn disintegrate the rocks resulting in massive landslides.

Since all the landslides had occurred during the summer season, consequently most of the damages by these hazards also occur in this period. Heavy damages have been caused to agricultural lands. The whole of the village named Daduwa near
Chamoli was buried in 1982 landslide. All the terraced fields of the village had disappeared. The total loss of crops, property, and cattle was estimated at 1,20,000 rupees. Field enquiries revealed that the damages caused anxiety and worry and prompted many farmers to leave the village for other areas.

Shogi Sites

It is situated at 31° 2'N latitude and 77° 7' E longitude at an elevation of 1300 metres on Kalka-Rampur highway, 11 kilometres from Simla.

Of a total of 250 landslides which had occurred on this highway from 1935 to 1984, 35 had occurred at Shogi. Most of them have occurred during the summer season. Of the 14 people interviewed by the author 9 had stated that landslides mostly occur during heavy summer monsoon rains.

The ground area slopes at an angle of about 50°. On this steep slope terraced fields have been made. All the fields slope inside the terraces. This results in the accumulation of water on the terrace for a considerable time. The presence of cracks in the fields allow the water to percolate. This results in enormous sinking of the area. At many places in the village such sinking was noticed by the author. At some places, it appears, that there is an impermeable clay layer in the sub-soil. Water percolating
through the upper layers of soil can no more pass through this impermeable layer. If and when this sub-soil water can find a way out through toe-erosion the whole upper landmass collapses. For the villagers this land-sinking problem is quite a common thing. Since most of the sinking takes place in small patches, the villagers either fill that sunken place or just leave that place. The latter practice is not common as yet, because rodents burrow their shelters in them and create other problems.

Shogi village has 18 kuhls. All have been constructed without any cementing material. This also accelerates sinking through large percolation of water.

Another factor triggering off landslides is the construction of approach paths to various places within a village and to other villages. The paths are usually made on steep slopes as a result of which toe cutting occurs frequently.

Springs are also present at some places whose water was not properly tapped. This also leads to sinking problem.

Since the residents have adopted themselves to these natural hazards, there are no major damages or loss of life in the area. Most of the farmers have accepted these hazards as a fait accompli and continue to live on the same land. The houses are built from the locally available material. Thus the inhabitants are not very much perturbed over the damages caused by landslides.
Most of the relief for various damages comes from the government agencies such as the Social Welfare Department and it comes promptly, usually within 4 to 7 days of the tragedy. But they give only 10 per cent of the total loss, for which the villagers are not satisfied. They think that the amount of compensation was not sufficient, as the loss is much greater than what was given to them.

Most of the rescue operations are conducted by the Public Works Department.

Some farmers who have stayed on their lands have made small attempts at afforestation so as to bind the soil. Retaining walls of locally available material have also been built to prevent the slide from recurring.

Aut Sites

It is situated at 31° 44'N latitude and 77° 12'E longitude at an elevation of 1200 metres on Mandi-Manali highway, 45 kilometres from Mandi.

The area has a ground slope of more than 60°.

Of the total 34 reported landslides that had occurred on this highway, 10 had occurred at and near Aut.

Of the many catastrophic events, two events, based on the residents responses and The Tribune reports attract our special attention.
Event 1

A landslide had occurred on the morning of 17th July 1963 in a residential section of village Chhatiaog, located on the right bank of river Beas at 31° 43' N latitude and 77° 13'E longitude. The tragedy caused an estimated damage of 75,000 rupees. Fortunately there was no loss of life. Most of the injured were women and children as male members were out in the fields.

Rumbling sounds, snapping of power lines and falling of power poles created panic among the residents. Many of them thought it was a thunderstorm.

The walls of many houses cracked. The daily utility services became inoperative. The landslide damaged four double-storeyed buildings. Of the 21 residential houses involved in sliding, 4 were entirely destroyed.

The landslide event came as a surprise to the village community, as no government agency had ever forewarned the people about any possible landsliding in this area. Surprisingly following the landslide the affected residential houses were not abandoned by the people. The author saw several families still living in damaged houses.

The landslide occurred within the Larji-Shali formation of dolomite and limestone, which are highly fractured and faulted.
As in other cases, the most important generative factor of the landslide is the deforestation. Vegetation cover has depleted rapidly by local people for meeting their fuel, fodder, and timber requirements. A few trees of mango and jammun are standing here and there. According to the local people slope failures have been occurring for a long time, when due to increased population more wood is needed. Quite a different situation prevails to the east of Chhatiaog and on the left bank of the Beas near Bakari, where dense forest cover has checked the landslide occurrences to a great extent.

Event 2

According to The Tribune reports multiple landslides had occurred near Aut on June 11, 1958 killing 2 persons. Field observations revealed many more casualties and damages. Interviews with the eyewitnesses of this reported landslide revealed that the mishap occurred during the quarrying of limestone. According to S.K. Ahlawat, a retired sub-divisional officer, some workers were engaged in the quarrying operations on that day. He was supervising the operation when a huge boulder fell on the labourers. Three of them died on the spot and four succumbed to their injuries after 2 days. The landslide had also breached the highway at some places.
Limestone and sandstone are the dominant rock types of this area. They are heavily faulted and jointed. During rains water percolates through the joints and bedding planes resulting in the softening of the rocks. This decreases their compactness and results in landslides. Field observations indicated that the movement took place along tension cracks and joints through which surface water had percolated and caused a sudden rise in the pore-water pressure in the limestone. The fallen material covered a major part of the highway and caused partial blockade of traffic. Immediately after the occurrence of the landslide clean-up operation was carried out by the Border Road Organisation to keep the highway open for traffic.

The area has presently no trees. Deforestation, however, does not seem to have much effect in the generation of landslides here. In the last 2 decades all the trees have been cut and yet there was no landslide. It was only during the present quarrying operations that the tragedy occurred and that also due to the fact that quarrying had left the upper rocks to overhang the road thereby increasing the possibility of landslides.

Ramban Sites

It is situated at 33° 14' N latitude and 75° 14' longitude.
on the right bank of Chenab at an elevation of about 800 metres along Jammu-Srinagar highway.

Of the total 289 landslides that had occurred along this highway, 64 had occurred at Ramban.

Field survey indicated that although it is a weak lithological zone yet the unscientific activities of the people are the main causative factors for this problem.

Traditional agriculture harms the terrain. Agriculture is practised on steeper slopes than recommended. Usually less than 33° of slope of the land is recommended for agriculture with terracing. But unfortunately land is cultivated in this area even at a slope of 60° as observed to the north-north-east of Ramban near Jhalibas. These terraced fields on higher slopes can not fulfil the purpose of bench terracing. All the terraces slope towards the outer edges allowing rainwater to rush down the slopes. The top soil and the manures used in these fields are washed away along with water.

Almost all the slopes of the area are cultivated for wheat and millets. Conventionally both crops induce erosion. Soil layer is thin and stoney. The demand for staple food compels the people to practice agriculture even on such poor soil.

Underground water emerging on the surface at some places is also an important factor in the generation of landslides.
here. It soaks the unconsolidated material and leads to landslide.

Though the landslides are not an annual feature, interviews with the farmers indicated that these are associated with the years of heavy rainfall. It appears that landslides occur approximately at 4 to 6 years interval, though it is difficult to recapitulate their occurrences from the memory of old farmers. The local inhabitants still, however, remember that the landslide of 1974 was due to very heavy rainfall. It was ascertained from The Tribune report that it must be June 25, 1974 landslide of which the villagers were talking about. Interviews with the people revealed that in this landslide one residential house was completely damaged. There was no loss of life. This damage was not reported in the newspaper.

References
2. See ref. 1, p. 51.