Chapter I

INTRODUCTION

A hazard may be defined as an unforeseen disaster. Almost every natural earth process may be taken as hazard at a certain time and under certain circumstances. Natural hazards comprise mainly floods, cyclones, mass-movements, volcanic eruptions, desert locusts, and earthquakes. They are extreme events, mostly beyond the experience, expectations, control, immediate adjustments and predictive power of man in terms of their extra-ordinary suddenness, enormous magnitude, restricted spatial occurrences, and heavy damages to life and property. (Fig. 1)

Landslide as a Natural and Culturally-Induced Hazard

The phenomenon of weathered surficial material moving down the slope by gravity is termed mass-movement. It comprises all gravity-induced movements, such as landslides, creep, rockfalls, mudflows, earthflows, avalanches, and even the falling of boulders. It does not include material which is carried directly by transporting agents such as water and wind in which case the process is termed mass-transport. Mass-movements are important in all climatic regions but their greatest frequencies are recorded in humid regions.
LANDSLIDE IN THE SCHEME OF NATURAL HAZARDS

Fig. 1
The rate of mass-movement may be rapid or extremely slow, almost imperceptible to human observations without the aid of sensitive and sophisticated instruments. Landslides, avalanches, and rockfalls illustrate the former while creep illustrates the latter.

The thesis deals primarily with the landslide events. They are some of the most universally experienced, dynamic, devastating, and recurrent natural hazards even though unlike the avalanches their spatial impact is limited.

Slope, climate, nature of rocks, and earthquakes are the principal natural factors which generate landslides. But with the increase in intensity and area of developmental activities of man in the mountains, landslides are becoming more anthropogenic than merely natural. With total disregard for ecology and the destruction caused to mankind by the decimation of nature, man has generated many landslides and has become their victim.

Landslide: An Expression of Man-Nature Interaction - A Hypothesis

Landslides constitute one of the environmental hazards. They are to a very large extent the result of human activities and constitute their landscape expression. Man has often been instrumental in abetting nature to set the stage for disaster.
LANDSLIDE AS AN ANTHROPOGENIC HAZARD

- Elaboration of Transport Network
- Deforestation
- Extension of Irrigation Network
- Minning and Quarrying
- Urban Growth
- Extension of Cultivation

Fig. 2
Throughout the twentieth century mountains all over the world have been experiencing an increasing intensification of man-nature interaction with devastating consequences. This interaction is expressed through the spread of settlements, elaboration of transport arteries, conversion of forests into cultivated lands, and construction of vast reservoirs for irrigation and hydro-electricity in the mountainous areas. Disregarding the dynamic stability in the ecological balance existing in nature, man through his rapid and unplanned activities has triggered a number of landslides. In the areas where and the time periods when intense human activities are witnessed larger number of landslides have been experienced. Of the various human activities those which are related to the developmental processes are the most potent in causing these hazards. The increasing momentum of these developmental activities enlarge the potential scale of damage to life and property and to ecological resources.

This man-nature interaction is brought out most dramatically along the mountain roads. It is here that humankind emerges as ecologically dominant through a relatively short span of time. To construct and then to subsequently widen the roads he mercilessly and unscientifically blasts the rocks without taking any care for the stability of the slope. Quarrying near the roadside slopes further weakens
and softens rockmasses which during the rainy season saturates with water and slides down in the form of a landslide.

Applying these higher levels of abstractions of the relationship between development and landslides to India and more particularly along the four highways, namely Rikesh-Badrinath, Kalka-Rampur, Mandi-Manali, and Jammu-Srinagar, it can be hypothesised that landslide occurrences are more numerous during post-independence period than during pre-independence period. Their occurrences are more numerous in the Lesser Himalayas than in the Greater and Trans-Himalayas. It is in this Himalayan range that the destructive effects of human activities are more pronounced. It is here that man through his developmental activities has weakened the hillslopes by cutting the rocks and felling the trees for a wide range of construction purposes. The problem of these hazards has been aggravated by high rainfall and by the presence of a lithology of permeable sandstone, limestone, and shales.

Empirical studies based on the extensive scrutiny of newspaper reports, field observations, and the interviews with the local people suggest that landslides along the highways have caused extensive damages to the physical and cultural landscape.

In spite of this bitter truth dangerously unstable slopes are being occupied and terraced, forests are being cut, and roads are being constructed with very little concern for the fragile environment. Thus man's role in the generation
of landslides along the four highways is more pronounced than that of the natural factors.

The Western Himalayas

The Western Himalayas comprise the states of Himachal Pradesh, Jammu and Kashmir, and the Uttarakhand region of Uttar Pradesh. Within this large area the present study is focussed on the four highways along which lie the landslide and avalanche sites reported in the newspapers. These highways are, (i) Rishikesh-Badrinath in Uttar Pradesh (275 kilometres), (ii) Kalka-Rampur in Himachal Pradesh (200 kilometres), (iii) Mandi-Manali in Himachal Pradesh (100 kilometres), and (iv) Jammu-Srinagar in Jammu and Kashmir (300 kilometres).

The Rishikesh-Badrinath, Kalka-Rampur, and Mandi-Manali highways traverse the Outer and Lesser Himalayas, while the Jammu-Srinagar highway cuts through the Pir Panjal range and extends up to the southern limit of the Great Himalayas. (Fig.3)

These four highways have been selected for the study of landslide and avalanche hazards on the following bases:

1. Most of the newspaper reports mention landslide and avalanche occurrences along these highways since they are
the major highways in the Western Himalayas. Even a minor landslide which has blocked the traffic only for a few hours has been flashed prominently in the newspaper columns.

2. These highways traverse different precipitation, soil, vegetation, human occupancy, altitudinal, lithological, and slope zones of the Himalayas and accordingly produce significant spatial and temporal patterns of these hazards.

3. The various human factors, besides the natural ones, in generating these hazards can be better understood through the study of landslide occurrences along these four highways.

4. Since no serious investigations on the theme of the relationships between human developmental activities and landslides have been made, a preliminary attempt has been made in this thesis to explore this theme along these highways.

Methodology: Collection, Processing, and Presentation of Data

Data on these hazards have been collected primarily by scanning all the issues of The Tribune, a leading daily newspaper of north-west India published from Chandigarh. Each edition of the newspaper has been scanned through. In all about 18,240 issues of the newspaper have been consulted covering a period of 50 years from 1935 to 1984. The daily
editions of the paper are preserved in several libraries and in the office of The Tribune itself where each issue has been kept in the form of micro-films.

In all there are 550 reports published in The Tribune dealing with landslide and avalanche occurrences in the Western Himalayas during the past 50 years. These reports mention that the region had experienced 500 landslides and 165 avalanches during this period.

Each news item has been classified on the basis of the spatial distribution of landslides and avalanches along the four highways. Accordingly Rishikesh-Badrinath highway has 33, Kalka-Rampur highway 154, Mandi-Manali highway has 37, and Jammu-Srinagar highway has 184 reports to its share. (Table 1)

The total of these reports do not add up to 550 because these reports pertain only to the four highways. All the other reports (142) which mention the landslides and avalanches on the tributary roads and in the areas far away from the main study highways have been excluded from the study.

The data have been presented in the form of tables, figures, and maps.

The four highways have been traced from the Survey of India's topographical sheets on the scale of 1: 50,000.

In illustrating a particular aspect of landslides and avalanches some of the reportings of Indian Express and The Times of India, published from Chandigarh and Delhi respectively, have also been scanned through.
Table 1

Number of Reports and Number of Landslides and Avalanches

<table>
<thead>
<tr>
<th>Highway</th>
<th>Reports</th>
<th>Percentage to the total</th>
<th>Landslides</th>
<th>Percentage to the total</th>
<th>Avalanches</th>
<th>Percentage to the total</th>
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<tbody>
<tr>
<td>Rishikesh-Badrinath</td>
<td>33</td>
<td>8</td>
<td>21</td>
<td>3</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>Kalka-Rampur</td>
<td>154</td>
<td>38</td>
<td>250</td>
<td>42</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mandi-Manali</td>
<td>37</td>
<td>9</td>
<td>34</td>
<td>6</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Jammu-Srinagar</td>
<td>184</td>
<td>45</td>
<td>289</td>
<td>49</td>
<td>67</td>
<td>78</td>
</tr>
<tr>
<td>TOTAL</td>
<td>408</td>
<td>100</td>
<td>594</td>
<td>100</td>
<td>86</td>
<td>100</td>
</tr>
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</table>

Source: Based on The Tribune Reports, 1935 - 84.
Reference