# PRELUDE

Landslide is a globally experienced natural hazard and can be defined as, *"the movement of a mass of rock, debris or earth down a slope"*. Although individual slope failures generally are not so spectacular or as costly as certain other natural catastrophes like earthquakes, major floods and tornadoes; they are more widespread and the total financial loss due to slope failures probably is greater than that for any other single geologic hazard to mankind. Throughout the world, valleys in mountainous regions have experienced accelerated economic development in response to general population growth and associated demands for increased mining, forestry and agricultural activities. This economic growth has demanded expansion of transportation and communication facilities. The short history of extensive human development in many of these areas has made these slopes highly vulnerable to landslide hazards. Everlasting demand for energy and mineral resources, the Himalayas with its large source of perennial rivers and mineral wealth is seen as a potential place for development of major hydroelectric projects and mining. Strategically vital mountainous areas bordering Pakistan, Tibet-China and Nepal has been experiencing extensive construction of road network; housing development schemes and expansion of present road network along major river valley projects and tourism centres. All these activities have accentuated indiscriminate cutting of the slopes and making them vulnerable to fail.

Living on active or potentially active slopes requires the real time monitoring and implementation of alert systems to avoid loss of human lives. This in-turn necessitates a sound knowledge of how landslides behave. Specifically, the landslide mechanism and dynamics, the landslide triggers, the possible thresholds (i.e., the rainfall intensity and duration) and the expected time of failure. The alert systems are based on the temporal prediction of the landslide failure or reactivation. The prediction may be undertaken on both short- and long-term bases. The purpose of the short-term prediction is to determine the exact moment of the failure or reactivation while the long-term prediction is frequently directed to the assessment of the probability of future occurrence. The short-term prediction may be tackled using physically-based models. However, these models require large quantities of high quality data from the

instruments which could continuously record the data and monitor the response of selected landslides to external factors such as displacement or ground water level fluctuations for reproducibility of landslide behaviour and to validate them. The basic principle to long-term prediction is by making the assessment of present geological conditions and the past seismic events which have been responsible to condition the ground to its present state where only a trigger in the form of an earthquake or heavy rainfall would instigate the landslide.

The strategically vital **Tawaghat – Jipti Route Corridor** of which **Mangti Landslide** forms a part in the eastern most extremity of Kumaun Himalayas, Uttarakhand along the Kali River Valley is witnessing stupendous growth in developmental activities, large scale cutting of slope and indiscriminate blasting for construction of road network along the Indo-Nepal border. This has resulted in development of a number of new landslides and reactivation of many stabilized and dormant landslides. Many studies have been carried out by individual scientists, government and non-government agencies in landslide hazard zonation adopting various approaches like Landslide Susceptibility Index (LSI), Slope Mass Rating (SMR), Numerical Rating Schemes, etc. however, majority of them have been restricted to Lesser Himalaya domain. National Remote Sensing Agency (NRSA, 2001) had also undertaken pilot study along major roads in Uttarakhand and Himachal Pradesh to develop landslide hazard zonation atlas and this is the only preliminary work available on landslide hazard zonation for Tawaghat – Jipti Route corridor. Their approach was basically depended on satellite data products and Geological Survey of India prepared geological maps, which lacked sub-surface information of the terrain, geo-technical properties, rock mechanics and engineering geological inputs that are so vital for understanding slope failure mechanism and predictive mathematical model of specific landslide. Having realized the significance of landslide hazard and its influence towards disrupting the economic growth in the Himalayan region, poor disaster management system and the lacuna in complete characterization and hazard assessment the author was tempted to choose his research problem and make an attempt for prediction of landslide hazard in one of the most strategic and economically developing Higher-Himalayan segment of Kumaun Himalayas.