Geohazards in the East Siang District of Arunachal Pradesh, India: Need for Geoethical Approach for Integrated Flood Mitigation Strategies

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Abstract

The East Siang District represents one of the multi-hazard prone districts of Arunachal Pradesh, India covering an area of approximately 4,005 km^2 drained by the mighty trans-boundary river Siang. It is located in the foothills of the Himalaya and shows wide variation in lithology and topography. Pasighat census town, established in the year 1911, is the headquarter of the district which falls in zone III of the seismic hazard zonation map of North-Eastern region of India, and can experience peak ground acceleration of the order of 200–250 cm/s^2. Flash floods, landslide dam outburst floods (LDOFs) are the major geo-hazards in the district that causes heavy destruction of life and property. Other geohazards include landslides, hailstorm and forest fire spread across the year. The LDOF in Tibet on 11 June 2000 caused death of many people living in the downstream areas of the East Siang district. It also affected more than 10,000 people, submergence of villages and standing crops, and collapse of bridges in Arunachal Pradesh and Assam. The occurrences of flash floods have risen in the past decade causing partial damage to the township of Pasighat. A large numbers of rural link roads, culverts, suspension bridges and wooden bridges have been collapsed due to landslides, flash floods and LDOF time to time. In view of the fact that, Siang is trans-boundary river, temporal coverage in real time and at frequent intervals is 'thus' required for continuous monitoring of behavior of the river in relation to incessant rains, cloudbursts and on-going neotectonic activity. A geoethical approach is needed in establishment of integrated flood mitigation strategies by effectively using adequate technologies and sharing of scientific knowledge at trans-boundary levels.

Keywords

Geohazards • East Siang district • Siang river • Geoethics • Integrated flood mitigation strategies

27.1 Introduction

Disasters are as old as human history more particularly in the vulnerable areas of south-east Asia. It results from the combination of hazard, vulnerability and insufficient capacity or measures to reduce the potential chance of risk (Maskrey 1989). The East Siang District having an area of approximately 4,005 km^2 is one of the multi-hazard prone districts of Arunachal Pradesh, India. The distinctive physical setting of the region vis-a-vis tectonic activities in the Himalayas, has been significantly influencing the river

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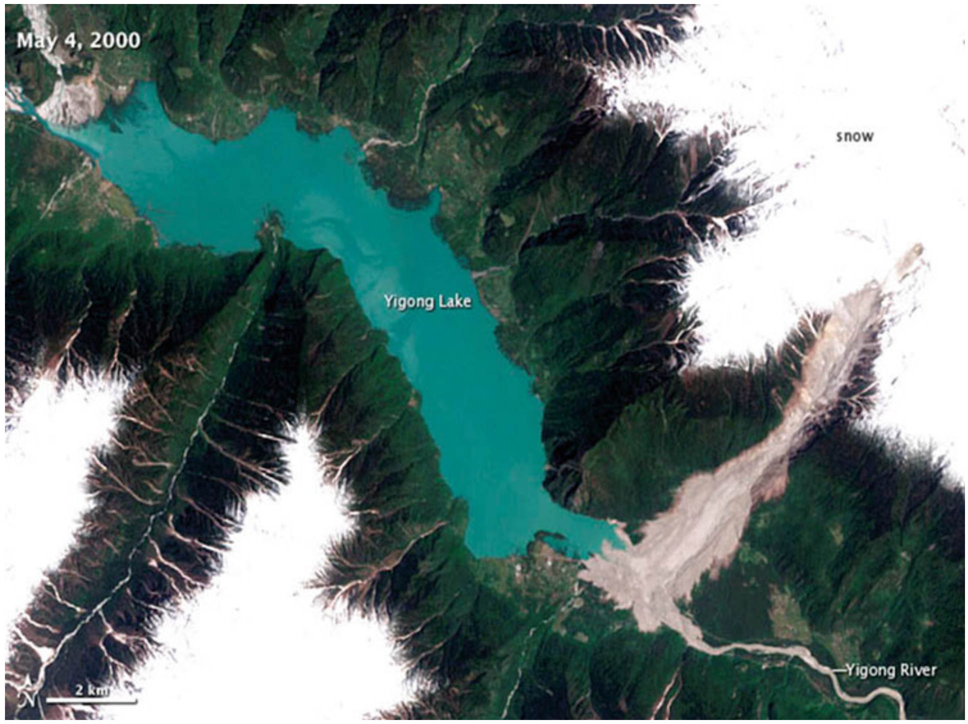

Fig. 27.1 Damming of the Yigong River on May 4, 2000, the cause of LDOF on 11th June 2000 (http://earthobservatory.nasa.gov)

system. Palaeochannel reconstruction suggests gradual eastward migration of the Siang River in response to northeast ward and south eastward ground tilting due to neotectonic activity (Luirei and Bhakuni 2008). The geo-hazards in the district include flash flood, landslide dam outburst flood (LDOF), landslides, hailstorm and forest fire, spread throughout the year. Pasighat town falls in zone III as per seismic zonation and can experience peak ground acceleration of the order of 200 to 250 cm/s^2 (Mohan et al. 2008). Agriculture is the mainstay of the people of the study area. As the topography of the district is characterized by plains as well as hills, the agriculture pattern also varies from hill to plain areas. In the vast tract of alluvial and flood plains, the settled or permanent agriculture is predominantly practiced. The river Siang which is a transboundary river symbolizes extreme manifestation of nature's fury during heavy and prolonged rainfall. The mighty river flowing through the district has numerous tributaries which possess immense hydropower potential. The rainfall pattern, erosion, land-use pressure especially in the flood-plain belt intensify the flood hazard leading to disasters.

27.2 The Milieu

The LDOF on 11 June year 2000 was most devastating for the Pasighat town in the East Siang District. According to various reports it was about 300 million cubic meters of displaced debris, soil, and ice which dammed the Siang River in eastern Tibet. The dam was about 130 m thick, 1.5 km long and 2.6 km wide and was created in eight minutes (Fig. 27.1).

In April 2000, the discharge of the stream flow into the dam lake was about 100 cum/s with the water rising at the rate of 1 m/per day. This flood has affected over 10,000 people including submergence of villages and standing crops (Tewari 2004). Many bridges collapsed in Arunachal Pradesh and Assam including the rural link roads, culverts, suspension bridges and wooden bridges. Flash Floods have become a frequent hazard in the district. Flash floods in the month of June, 2013, damaged horticultural gardens, fish ponds and water pipelines besides a large area of crop fields in all circles of the district. Consequently it is observed that LDOF's and Flash floods deeply influence the East Siang district situated in the south eastern part of Arunachal Pradesh. We find some strata in the society are more prone to sufferings due to the disasters including people from weaker class, gender and age. In this perception it is felt that integrated mitigation strategies are very essential in the vulnerable catchments like that of river Siang. The satellite based observational networks have proved to be very effective in many parts of world. Satellite data captured in the near real time and adequate hydro-meteorological information always increases the integrated approach to assess risk, capacity building and time to respond. It also ensures disaster services using the available resources. The value of warning increases when people have a considerable amount of lead time. It is an era of information and communication technology therefore mitigating flood disaster is highly dependent on infrastructural capacity of the stakeholders. In a study based on remote sensing data under the DMIS programme (2004), some ground measures were suggested to alleviate the impact of flood hazard in the district, like

1. Strengthening of existing bunds/embankments.
2. Construction of rehabilitation shelters at safe levels.
3. Prevention of permanent structures in the severe and very high flood hazard zones and
4. Stabilization of slopes.

In the recent time the structural measures like construction of dams have raised conflict between the planners and the environmentalists therefore the principal non-structural option lies in use of appropriate technologies which will help the people living in the vulnerable catchments. A deep geo-environmental research using advanced technology for reducing the impact of the hazard in the catchment is apposite.

27.3 Importance of Geoethics in Flood Hazard Management and Mitigation

The trans-boundary catchments are very important focal point for geoethical intervention considering that the flood hazard in these catchments have enormous impact on several sections of the society covering one or more states and countries falling within the catchment. The Flood Mitigation plans for the vulnerable catchments are the matter of conscientious study for saving life and property of the people. Appropriate and adequate access ways for integrated flood mitigation strategies are the composite structure of proactive ethical practice for the improvement of the life of the people in the vulnerable catchments. For that reason a move toward conjugal planning by the stakeholders at appropriate level is the only way to live in synchronization with the catchment level disasters. Geoethical approaches in integrated mitigation strategies are very effective for environmental emergencies (Peppoloni and Di Capua 2012). It is succinctly felt by the global geoscientific community that geoethics is essential for judiciously assessing structural and non-structural mitigation strategies for flood hazard management, environmental security and sustainable development. However, the significant issue lies in striking balance equilibrium at policy level in the decision-making.

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