Students' Concern Towards Landslide Issues in Northern Hilly Areas of Pakistan

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Abstract

This study investigates the level of comprehension that educated young people have regarding landslide issues as an environmental hazard and their willingness and perception of taking action to combat these issues. Undergraduate students from the field of civil engineering comprised the group that participated in the survey. The survey was taken by 235 different students. The findings demonstrated that the majority of students had an understanding of natural disasters, in particular, the dangers posed by landslides. Even though some had no experience with landslide-related problems, they continued to live in the stone age.

Keywords: Landslides, Disaster, Cross-Sectional Survey

Introduction

Pakistan is positioned at the crossroads of plate boundaries, suffering manifold threats like earthquakes, floods, drought, water-logging, salinization and repeated landslides [1]. In Pakistan, during monsoons, landslides frequently follow beside the highways constructed with hilly landscapes [2]. Attaabad landslide was activated on January 4, 2010, at about 11:30 hours with a multifaceted arrangement of calamitous rapid impact actions, which killed 20 people and caused several other injuries. This landslide congested the Karakoram highway and stopped upper Hunza village commutation from all over the country. And 25000 people are suffering due to the absence of economic activity and unreachability to the items of daily usage. Attaabad landslide and the landslide-induced lake is a unique events in the northern areas of Pakistan [3]. In the past, Numerous people were killed and the Neelum valley road was amputated for days after the 2005 Kashmir earthquake triggered the Donga Kass landslide in northern Pakistan. Some factors that govern landside activity are steep slopes, silty and clayey material, Neelum road construction, river undercutting, precipitation, and seismo-tectonic movement [4].

No doubt landslide problems are undoubtedly aggravating due to rapid economic development, especially on hilly terrain all over the world. Many townships, industrial

areas, and housing schemes have been developed on hilly terrain, including hillside infrastructure facilities like highways, expressways, and light rail transits without estimating land sliding issues and consequences. It is possible to overcome or minimize the effects of landslide hazards if appropriate actions have to be taken, not only on the government level but also on an individual basis. In other words, individuals must be motivated to cultivate knowledge regarding landslides and their consequences. In this regard, this exploratory study has been done to weigh the understanding level of the respondents towards landslide issues and their willingness to counter its occurrence.

Methodology

The findings followed a design for a cross-sectional survey and were steered by running questionnaires to 235 students at different engineering universities in Islamabad, Abbottabad, and Peshawar. These were considered based on their location/region, which directly or indirectly counts under landslide-prone regions (Fig.1). The study was unpaid, and data collection commenced in December 2019.

Fig. 1: Map of Northern areas of Pakistan showing all the surveyed localities

Results and Discussion

The 235 respondents who participated in the survey were from the engineering universities of Islamabad, Peshawar, and Abbottabad. They were both male and female students. The selection had been carried out without any discrimination of cast creed or religion. However, a few of them (15%) were from Karachi. Most of the students were from fourth-year civil engineering.

A) The Understanding level of the students

Familiarity with natural hazard

Regarding the student responses towards familiarity with natural disasters, most respondents stressed that landslides, floods, and tsunamis were examples of natural disasters capable of causing damage to the environment and societies. Approximately 94.3% of the students indicated landslides, 93.6% floods, 76% hurricanes, and 75.3% drought but only 7.3% Tsunami (Fig.2).
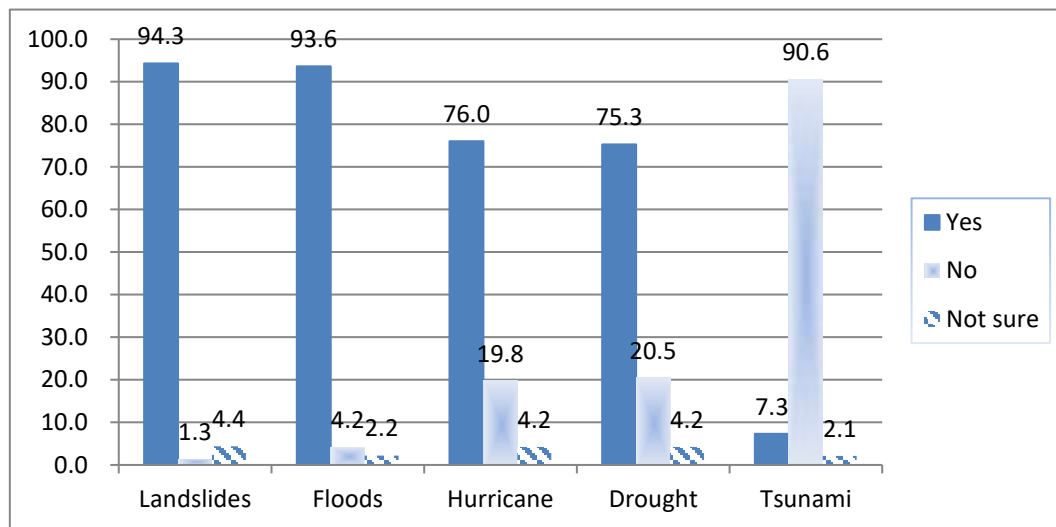

Fig. 2: Students' familiarity with natural disasters

Perception of landslides prone areas

The students' acquaintance with probable landslide zones was also verified. The zones were classified as follows: steep slope, gentle slope, plain land, deforested mountainside & along the coastline or river valleys. It was observed that their understanding level in this regard seems to be appropriate. Most of the students responded without any hesitation, recognizing steep slopes (94.5%), deforested mountainsides (74.6%) & gentle slopes only (47.6%) as landslide-prone areas. On the other hand, 70.0 % of students claimed that plain land areas were not liable to land sliding, while 68.1% favored coastlines /river valleys (Fig. 3).
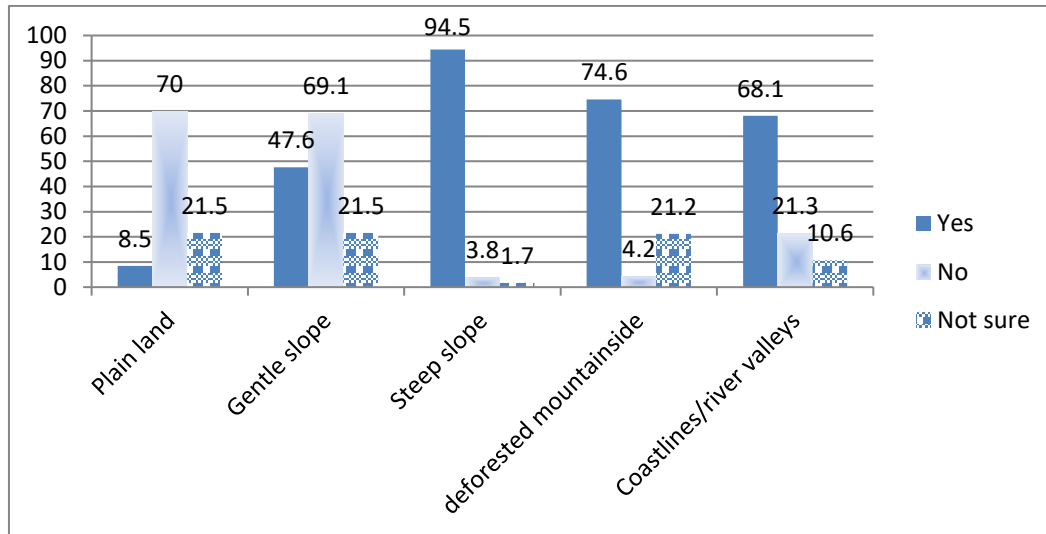
Fig. 3: Students' awareness of potential land slide zones

Update with traumatic landslides

The study revealed that pupils were concerned about natural disasters in northern Pakistan. As already reported in the literature, Pakistan has also been challenged by the landslide hazards like other parts of the sphere, exclusively in the mountainous parts of the country **[5]** (Table 1). One such landslide-prone region of the country is the Pakistani Himalayan region **[6] [7].** One of Pakistan's worst landslide-affected areas is located in this region.

Table 1: History of Landslides in Pakistan [5]

Year	Deaths	Location
August 19, 2019	07	District Pothi (Kashmir)
March 28, 2018	06	Diamer, GB
November 3, 2017	08	Bajaur Agency (FATA), KP
August 3, 2017	05	GB (Landslide)
March 28, 2016	--	KP (Landslides)
October 12, 2015	-	Karachi (Rockslide)
January 4, 2010	20	Attabad, GB
March, 2007	80	District Dir, KP
January, 2007	20	District Kotli (Kashmir)
September, 2006	04	Murree Hills, KP
July, 2006	29	Ghaeel Village (Kalam area), KP
May, 2003	12	Ronal Village (Kohistan), KP
July, 2001	16	Karachi, Hyderabad, Sukkur, Sindh
July, 2001	15	Chitta Katha, Kaghan Valley, KP

Almost all responders (98.3%) students were aware of the 2010 Attabad catastrophe. However, they were nearly completely unaware of the landslide episodes before 2010 (Fig. 4).
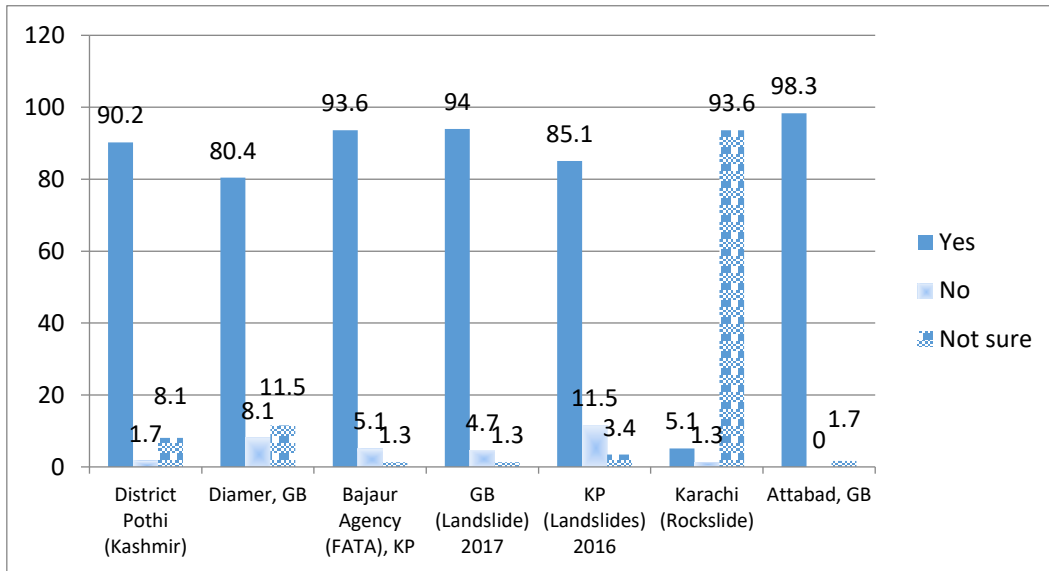

Fig. 4: Students' Awareness of Landslide Disasters

Difference among slope movement modes

The term "landslide" refers to a broad range of processes that cause slope-forming materials, such as rock, soil, artificial fill, or a combination of these, to move outward and downward. The materials could move by falling over, sliding, spreading out, or flowing, among other possible mechanisms **[8]** (Table 2).

Table 2: Movements of Landslides[8]

Motion Type		Classification of Materials		
		Bedrock	Engineering Soils	
			Mainly Coarse	Mainly Fine
Falls		Rockfall	Debris Fall	Earth Fall
Topples		Rock Topple	Debris Topple	Earth Topple
Slides	Rotational	Rock Slide	Debris Slide	Earth Slide
	Translational			
Lateral Spreading		Rock Spread	Debris Spread	Earth Spread
Flows		Rock Flow	Debris Flow	Earth Flow

As stated by Cruden [9] "Landslide is defined as rock or debris movement or slope earth down" The five modes of slope movement/landslides—slide, flow, fall, topple, and spread was posed to the student respondents. From the 235 respondents, 86.3% of the students could not differentiate between the processes of levelling and laying. However, further, towards the mudflow, rock fall and slide, the respondents have some logic to follow, and almost 70.4% were correct in differentiating these remaining three modes.

Sense of landslides Causal/triggering factors

Varnes [8] recognized that Slope movements occupy the sequence of events from "cause to effect". Only when the proper distinction between landslides triggering and contributing factors of landslides is made will effective remedies for controlling slope movements/failures be successful [10]. It might be geological, morphological, or human (Table 3). Compared to the contributing factors, landslides typically start when one dominant factor fails. It could be due to a volcanic eruption, earthquake tremors, heavy rainfall, melting snow, changes in water levels, or even a difference in the geometry of the slope itself. On either hand, it should be remembered that landslides can sometimes happen without any obvious triggering factors but with various causal factors [11]. Numerous researchers interchangeably use the terms "causes," "precursors," and "contributing factors," but these terms have the same definitions [8] [10].

Table 3: The Reasons Why Landslides Occur[12]

Geological Reasons	Causes of Morphology	Man-made factors
Poor/Susceptible Materials	Effects Of the Weather Freeze/Thaw Shrink/Swell	Digging Of Slope
Splitting, Jointing, Material Shearing	Techtronic/Volcanic Pressure	Pumping Out Leakages, Irrigation Mining
Negatively Acquainted (Faults/Bedding Etc.)	Slope Of Accumulation Loading/Crest	Cutting Of Forests
Unlike Permeability, Material Stiffness	Piping/Erosion Vegetation Removal	Slopes Being Encroached Upon

According to the findings of the study, the vast majority of students, or 96.5 percent, were in agreement that landslides were caused by natural phenomena, specifically heavy rain. In terms of the causes, approximately 94.3 percent pointed the finger at soil erosion, 83.4 percent pointed the finger at earthquakes, 85.1 percent pointed the finger at slow rock weathering, and 90.6 percent pointed the finger at other factors that were not considered to be volcanic activity.
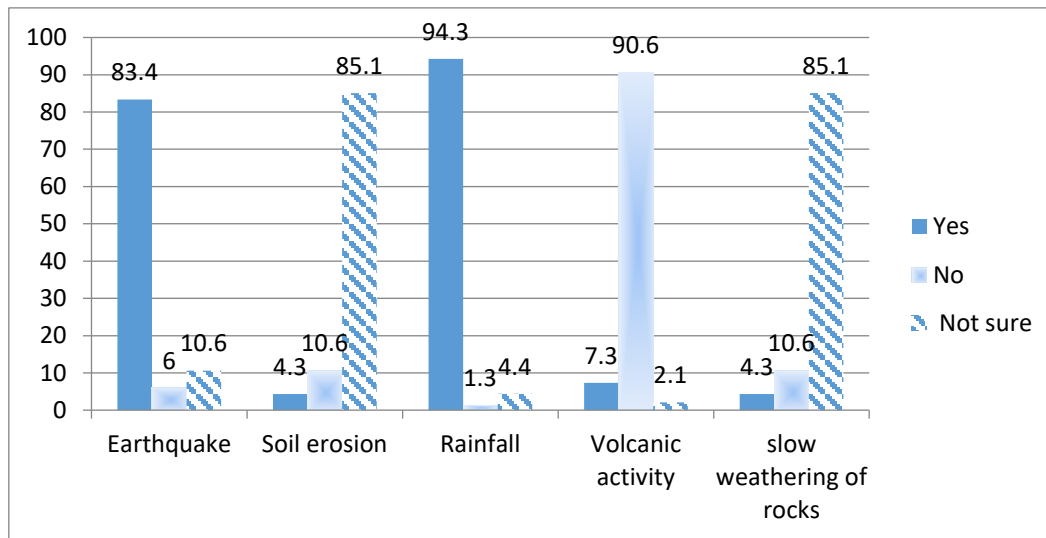
Fig. 5: Knowledge of landslide's natural causes among students

In addition to providing responses regarding the natural causes of landslide occurrences, students were questioned about their perspectives on aspects of landslide occurrences that were caused by human actions. According to the findings of the study, the vast majority of the students agreed that unchecked tree cutting might be the primary factor in the occurrence of landslides. The vast majority of students also pointed the finger at inadequate or nonexistent maintenance; some of them mentioned the loading change, underground drainage system leakages, etc. The overwhelming majority of the students made a direct demand for adequate cover of vegetation on steep slopes.

Conclusion

The research showed that the majority of students had an interest and a preference for acquiring additional knowledge regarding landslide incidents. It investigates the hypothesis that students living in areas prone to landslides had a profound level of concern regarding landslide-related topics. In addition, the vast majority of students talked about their experiences, even if it was only once or twice that they had been put in danger by this. They highlighted the indications of the local landslides, and a few claimed that their homes, which were situated on hilly terrain, were dangerously close to collapsing. It was discovered that almost all the respondents are open to the idea of serving voluntarily against this threat. According to the findings of this study, the vast majority of students have some level of prior knowledge regarding landslides. They have an exceptional level of expertise concerning landslides and their effects.

Conflicts

The authors certify that they do not have any conflicting interests to declare.

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