

Role of Different Vegetation Types in Reducing the Earthquake Damages in Muzaffarabad District

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Abstract: The 8th October, 2005, earthquake proved to be one of the devastating events in the country's history. The toll on property and human lives were at high. However, there were reports that areas with better vegetation covers suffered minimal or no damages. To investigate this, a study to assess the role of different vegetation types in reducing earthquake damages was conducted in Muzaffarabad District. It was revealing that substantial vegetation cover acted as a barrier against natural hazards such as earthquake. On the other hand, it was also proved that amongst different land uses, forest lands were the most effective in terms of reducing earthquake damages.

Key words: Earthquake • Forest lands

INTRODUCTION

Pakistan was confronted with the trauma of earthquake on October 8, 2005. The intensity of which was recorded as 7.6 on Richter Scale [1]. This was happened at an early timing of 8:50 am. It was one of the devastating events in the history of Pakistan. The areas adversely affected were Abbottabad, Batagram, Kohistan, Poonch, Mansehra, Muzaffarabad, Bagh and Shangla. The reports of damages were as high as 58,000 people died, 77,000 injured and 3.8 million shelter less [2]. This region with most of the earthquakes damages is been located on the Himalayan Region (34.21 latitude and 73.28 longitude) and also eminent for the biodiversity it harbors. The biodiversity of this earthquake hit region, however, was very much before under the threats of gradually escalating anthropogenic pressures. During the earthquake, the areas without vegetation cover were inflicted with more damages than the areas having good vegetation covers.

Therefore, this study was conducted to understand the role of different vegetation types in minimizing the damages caused by the earthquakes and investigating earthquake induced damages in different land use types.

MATERIALS AND METHODS

Muzaffarabad, the capital of Azad Jammu and Kashmir, is spread over an area of 6117 square kilometer. The elevation is 3000m above sea level. It is located between 34.24 latitude and 73.22 longitude in North-East of Pakistan.

The population of Muzaffarabad is about 0.746 million, with density of 136 persons per square kilometer and 86.35% of the population resides in rural areas [3].

The area is hilly and mountainous. There are three main categories of soil, high plateau soils, hill slope soils and inters mountainous valley soils. The valley soils are productive for agriculture due to being fertile and alluvial. The hill slopes, whereas, are shallow and prone to erosion.

Muzaffarabad is also the catchment area of the Jehlum and Neelum Rivers. There is no extensive canal system for agriculture. The farmers dependents on rain water and usually small channels that are connected to perennial water sources. The forests form 59% of the area and are also one of the major source of income for the local people [3]. The dominant forest tree species are *Cedrus deodara*, *Pinus wallichiana*, *Picea smithiana*, *Pinus roxburghii*, *Juglans regia* and *Olea ferruginea* etc. The deforestation rate, however, is at high in AJK.

The climate of the Muzaffarabad region is known to be subtropical highland type, being warm in summer and cold in winter. Temperature ranges from 25°C to 42°C in summer and -3°C to 15°C in the winter. The agricultural crops cultivated in summer (kharif) and winter (rabi) are maize and wheat respectively. Livestock found includes buffalo, sheep, goat, horse, mule and ass. The grazing of sheep, goats and cattle is both pastoral and sedentary.

Transects were laid on both sides of River Jehlum, having an elevation of 3000m. Each of the transect measured 10 km in length. These transects were traversed between the villages lying on both sides of the river bank. The villages bifurcated by Transect 1 were Maira Kalan [lower Mohallah (34.19 latitude, 73.30 longitude) and upper Mohallah (34.19 latitude, 73.30 longitude)], Ganj Chattar Payain (34.20 latitude, 73.30 longitude), Danna (34.20 latitude, 73.31 longitude) and Payain top (34.21 latitude, 73.32 longitude). The villages bisected by transect 2 included Sund Garan (34.19 latitude, 73.30 longitude), Kabbabut (34.19 latitude, 73.29 longitude) and Asgharabad (34.19 latitude, 73.29 longitude). After every half km a plot was laid on each of the transect. Overall 20 plots of 10 × 10 meter (m) size were laid on both transects respectively. The extent and form of earthquake induced damages on different land uses were investigated at each plot. The extent of earthquake induced damages were categorized as heavy ($\geq 70\%$), moderate ($\leq 70\%$) and light ($\leq 30\%$) and was estimated through ocular estimation of ground cover. Both of the slopes, where the transects were laid, were estimated to be between 60% to 70%. Vegetation in each plot was also recorded and Global Positioning System (GIS) Coordinates were also recorded for all plots. Informal interviews were also conducted with local villagers to record their perceptions regarding the significance of vegetation against natural hazards and potential threats to natural resources of the area.

RESULTS

Damages at Transect 1: The heavy cracks were recorded at grass land, plot 7, with an extent being more than 70%. The plot no. 7 was the most severely of them all and plot no. 6, a forest land, was least affected. As already mentioned the slope was estimated as 60%-70%.

Heavy landslides were recorded on plots 1, 11 and 12. The grass and agriculture lands were affected the most with earthquake induced landslides.

It was revealing to observe that grass and agricultural lands had the most of uprooted trees. Plot 1 was the most affected of all.

Similarly, the broken trees were encountered more on grass and agricultural lands.

Again, the grass and agricultural lands had the most of damages in the form of tree root system damages.

Transect 2: The cracks were observed on grass lands. The plots, where these cracks were noticed, were 8 and 15.

The trees were uprooted in plot 2, which was a grass land.

Similarly, the only landslide was again observed in plot 2, a grass land.

DISCUSSIONS

The study has shown that most of the earthquake damages were induced on degraded and deteriorated lands. On the other hand, the areas with substantial vegetation have offered considerable resistance against the earthquake induced damages [4].

In case of different land uses, the grass lands were found to be the most affected by the earthquake damages followed by agricultural lands and barren rocks. The forest lands, whereas, had the least of damages among the land uses. This could be owing to the fact that the root systems not only provide an anchorage for the forest trees but also at the same time helps in binding the soil altogether. In case of forest lands, the only damage occurred at plot 6, where had a minimum vegetation cover in comparison to others.

One of the major problems observed in these earthquake stricken areas was the overwhelming pressure on forest resources. Forest trees were still cut down illegally for fuelwood and timber requirements by local inhabitants. There is an immediate need to restrain this escalating cutting down of forest trees. In addition, the degraded lands should be rehabilitated through planting of indigenous vegetation with appropriate participatory strategies.

The vegetation intercepted by the two transects were *Ailanthus glandulosa*, *Melia azederach*, *Morus alba*, *Olea ferruginea*, *Ficus palmate*, *Celtis australis*, *Bauhinia variegata*, *Acacia modesta*, *Acacia nilotica*, *Pinus roxburghii*, *Zizyphus jujuba*, *Ficus carica*, *Pistacia integerrima*, *Salmalia malabaricum*, *Robinia pseudoacacia*, *Alnus nitida*, *Grawia oppositifolia*, *Pyrus pashia*, *Dodonea viscosa* and *Cynodon dactylon*.

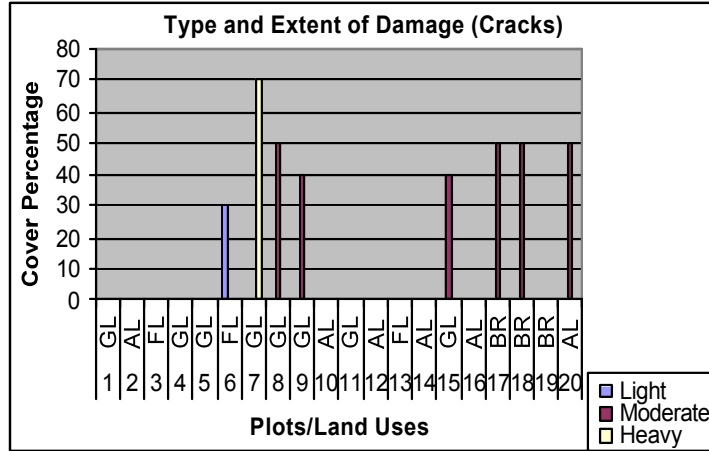


Fig. 1: Type and Extent of Damage (Cracks)

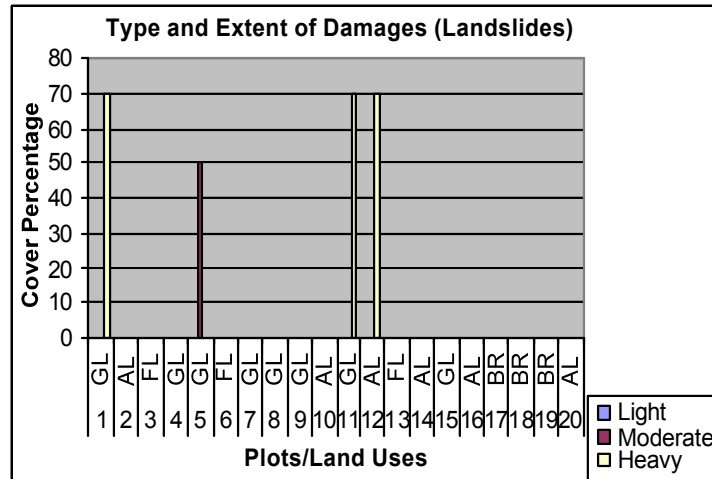


Fig. 2: Type and Extent of Damages (Landslides)

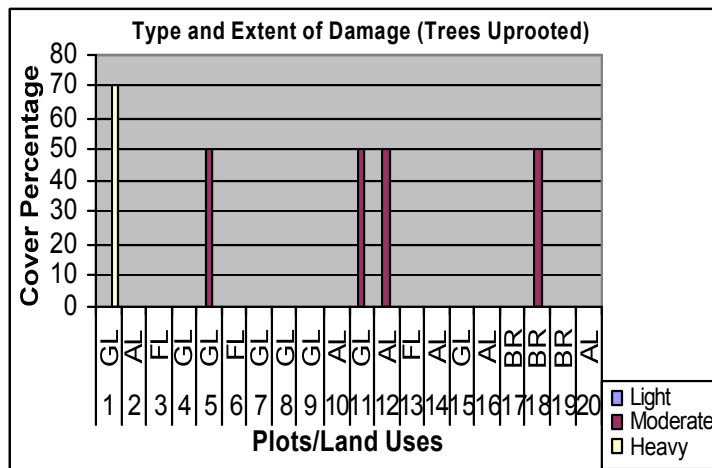


Fig. 3: Type and Extent of Damage (Trees Uprooted)

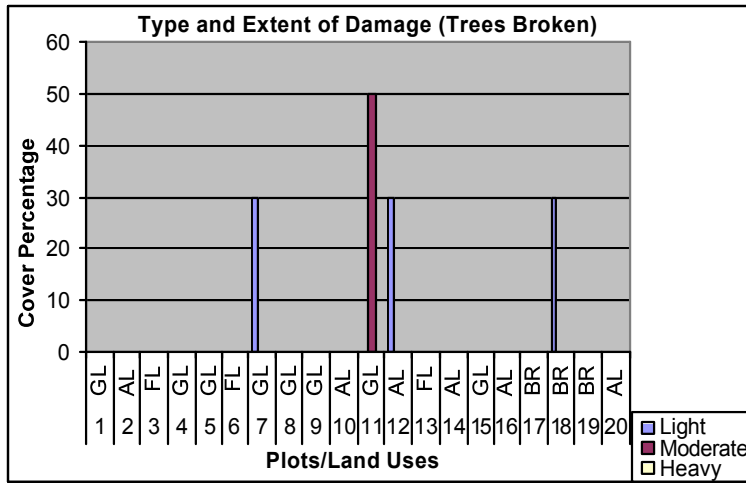


Fig. 4: Type and Extent of Damage (Trees Broken)

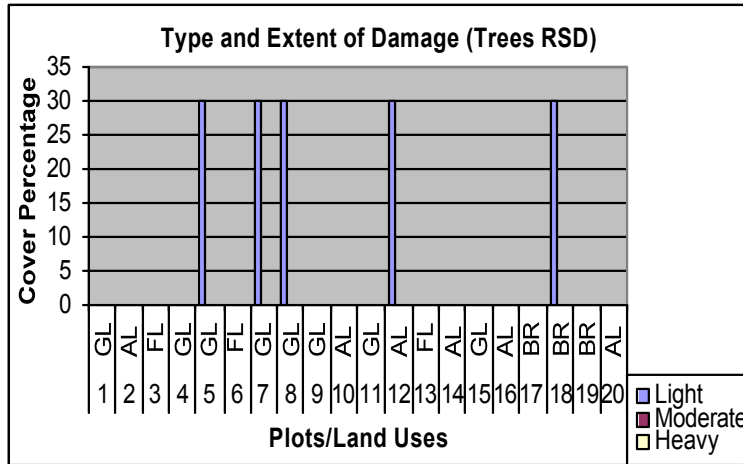


Fig. 5: Type and Extent of Damage (Trees RSD)

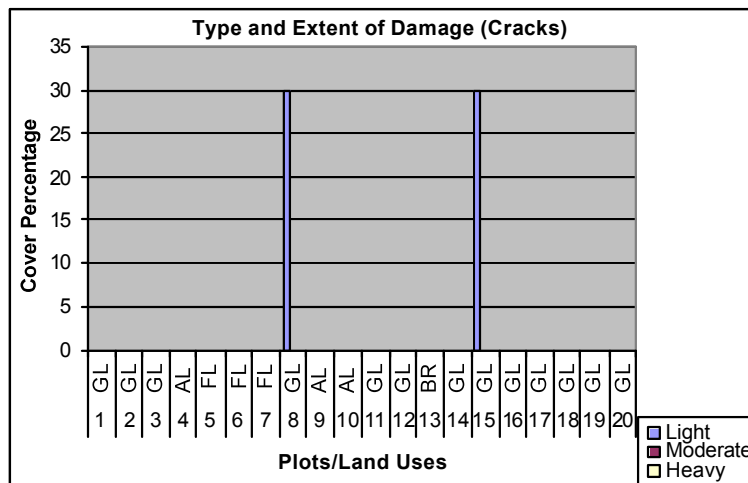


Fig. 6: Type and Extent of Damage (Cracks)

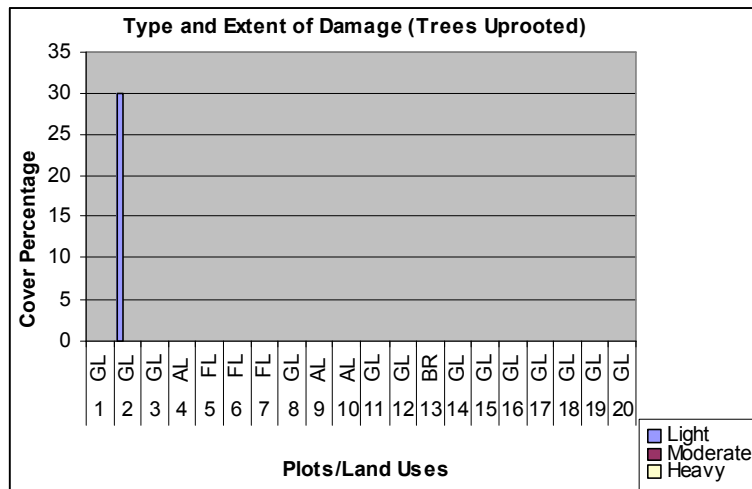


Fig. 7: Type and Extent of Damage (Trees Uprooted)

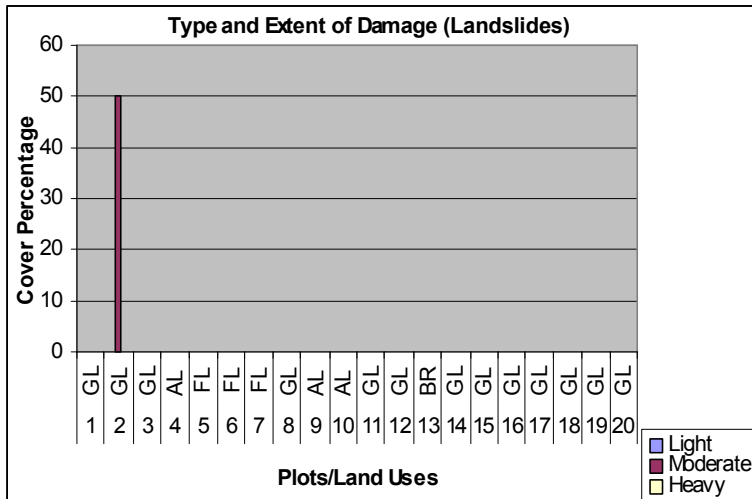


Fig. 8: Type and Extent of Damage (Landslides)

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REFERENCES

1. IUCN. 2006. An Assessment of Environmental Risks and Needs Islamabad Pakistan, pp: 27.
2. IUCN. 2005. Preliminary Environmental Assessment of the Earthquake in Pakistan, IUCN Field Mission Report Pakistan, pp: 9.
3. Earthquake Rehabilitation and Reconstruction Authority (ERRA). 2007. District Profile, Muzaffarabad/Neelum. Islamabad, pp: 92.
4. IUCN/WWF. 2005. The IUCN/WWF Forest Conservation Newsletter, pp: 16.