

Issues in Implementation of Landslide Mitigation Programmes in Landslide Vulnerable areas of Sri Lanka: Special Reference to Hanguranketha Landslide Area

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Abstract. Human Settlement pattern of Sri Lanka has been evolved from the agriculture based in the dry zone to plantation based in hilly and wet zone to urbanization based urban - rural co – existence. During the British rule, plantation economy dominated large sections in highlands which were the back bone of the country's economy until recent time. Meanwhile in these periods central hill country was considered safe for human settlement even though landslide events occurred. However, since 1980's due to the increase in number of landslide events and higher number of victims landslide is considered as threatened to human settlement. In this background, the government of Sri Lanka embarked on the Landslide Hazard Mapping Project (LHMP) in order to identify the landslide prone areas of the country. This mapping project explored the landslide prone areas and categorized high hazard areas for conservation, medium hazard areas for controlled settlement activities and low hazard areas for normal human settlements. Strangely, the methodology and recommended actions in mapping adopted in early 1990's still appear. Although we all understand that in Sri Lanka, land is a very scarce resource, especially the good residential land is a very scarce resource. One key draw back in the LHMP is the whole sale relocation recommendations adopted in landslide areas. LHMP concluded that 30% in terms of area of Sri Lanka is vulnerable for landslides. This became an eye opening statement in the landslide and development planning spheres.

In Sri Lanka using these conclusions in the year 2005, National Physical Planning Department released and gazetted the National Physical Planning Policy of Sri Lanka. In that they have identified hilly areas as fragile and further settlements are not recommended. This is one of the win – win situations that the project has achieved.

In this background, from the landslide hazard zoning map, NBRO made alert of the settlement and decision makers of the area that landslide was imminent. As alarmed by the NBRO, in the year 2007 number of landslides occurred in the areas which were identified as vulnerable. Considering the scale of impact decision makers implemented number of programmes.

From the aforesaid consequences, this paper attempt to demonstrate the issues and lessons learnt from those programmes with special reference to Hanguranketha landslide area.

Keywords. Landslides, Landslide mitigation measures, Human settlements, Resettlements

1. Introduction

The nature of agricultural activities in Sri Lanka has changed over the centuries based on availability of arable land and water resources. Until the thirteenth century, the village farming communities were mainly on the northern plains around Anuradhapura and then Polonnaruwa, but they later shifted to the southwest. The southwest contains most of the people, and villages are densely clustered with little unused land. In the Central Highlands around Kandy, villagers faced with limited flat land have developed intricately terraced hillsides where they grow rice.

Beginning in the sixteenth century and culminating during the British rule of the nineteenth and twentieth centuries, the plantation economy came to dominate large sections of the central highlands of Sri Lanka with the introduction of export crop plantation such as rubber, tea, cocoa, pepper, cinnamon etc. in these fertile lands. This contributed for the distribution of population and their livelihood were locational specific to these settlements in central high lands. It changed the life-style of the population and they moved into the highlands to work on plantations.



Fig 01: Estate Settlement in Tea Plantation

Not only the export crop cultivation but also the introduction of different crop and vegetable cultivation such as carrot, leeks, beetrots, and cabbage because of different climatic conditions in these fertile lands further attract the population in central high lands and made their livelihood totally depend on these plantation sector employments until now. As a result of population growth and scarcity of land especially, for residential use compel these low income settlement to locate in marginal lands. Consequently haphazard development of these settlements in central high lands began to disturb fragile land which increased the landslide events in these areas.

Landslide is a major natural disaster in central hill country, which prompts by two main causes namely, natural and man-made. Landslide occurred between Galboda and Wattawala Ceylon railway on August 19, 1886 Perera (1925) which was called the most "formidable landslide". But at that time it wasn't consider as a big issue considering the severity of damage but the important to rural transport system was immense. But year by year frequency of occurring landslides increased, consequently damage to property and life increased. Due to haphazard development via inappropriate land use practices in central high lands became a significant issue. Meanwhile, due to aforesaid reasons several areas in central high lands became the landslide black spots. As a result of frequency of landslide and adverse impacts of landslides on the raise several mitigation measures were initiated in order to mitigate the risk face by the settlements in these areas.

2. Mitigation Measures for Landslides

Despite of increase in frequency of landslides due to the dependency of located specific livelihood in central high lands compel to live with landslides in certain areas. Meanwhile, population growth together and scarcity of land lead haphazard development in these natural fragile lands have increased the vulnerability of community. In order to prevent the landslides several studies were carried out in landslide prone areas in Sri Lanka by NBRO. These studies indicates that approximately 80% of the landside incidents causes due to man - made activities rather than natural causes, specially lack of attention during construction and land development.

To protect life and property from landslides and to ensure normal day - to - day activities, several measures have been implemented in terms of

structural and non - structural mitigation measures. As structural mitigation methods retaining walls, disaster resilient buildings have been implemented. Also under the non - structural mitigation measures early warning systems, land use zoning, awareness programmes, creation of guidelines and regulations for steep slopes developed and cultivate special vegetation such as grass, bamboo, etc on unstable slopes have been implemented.

3. Hanguranketha Landslide Area

Hanguranketha is well known landslide black spot which recorded landslides since 1986, NBRO (1990). The landslide hazard zonation map prepared in 1994 by NBRO showed a high intensity of landslides in the areas of Hanguranketha. During this period NBRO has conducted number of awareness programmes in this vulnerable area where communities were enabled in identifying the early warning signs of landslides. In this background, during the north-east rainy season between 10th - 15th January 2007, enormous amount of landslides occurred in Akkara Seeya, Mahawewa, Kandura Kade, Uda Padiyapelella, Elamulla Junction, Pilapitiya Villege, Muloya Oak Watta, Handawalapitiya, Ritiella, Pussalapitiya, Madulla, and in Wettasthenna areas in the northern and eastern slopes of the central hill country, which destroyed nearly 800 houses and displaced about 2500 families in Hanguranketha D.S Division area alone.



Fig 02: Hanguranketha Landslide in 2007

Also it was found that the landslides in 2007 was different to what happen in the past and large number of landslides in a small geographical area was occurred and the population was badly affected. As a result of huge adverse impact of landslides in January 2007, administrators of the area call in NBRO to carry out a spot investigation as an expertise organization

working in the field of landslide. NBRO identified heavy rain along with inappropriate land use practices accelerates landslides in these areas. From the initial investigations, expert team recommended the administrators to relocate the affected settlement and some settlements totally. Further in order to fulfill the immediate and long term requirements of the landslide victims several resettlement sites were identified by the local administrators.

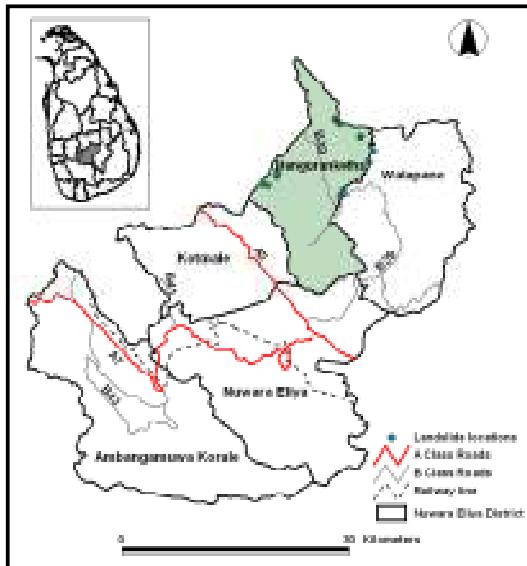


Fig 03: Landslide Locations in Hanguranketha D.S Division

4. Short and Long Term Solutions

Landslides create social and economic issues apart from the large scale physical damages to house and property in the area. Considering the catastrophic situation created by landslide in Hanguranketha in 2007 decision makers identified several measures in order to overcome those issues.

The geological study carried out by NBRO recommended relocating all the affected families irrespective of different risk levels in the area. Also Landslide Hazard Mapping Project where different risk levels and mitigation options are possible to identify decision makers at that time opted to the whole sale relocation. Due to this the local administration fall into a difficult position of finding housing friendly lands or land suitable for housing. Delaying of mitigation options and geological investigations, with large number of affected families in temporary shelters local administrators were compel to find the marginal

lands to relocate these families. It is important to note that part of this affected settlement was created in 1970's as a landslide resettlement from other area. Therefore, a project proposal was developed with the request of The Asia Foundation (TAF) aiming to address the permanent shelter option available with a more holistic approach by the Human Settlements Division (HSD) of NBRO. Proposal will look into the socio-economic aspects of the victims, resettlement options, housing options, human settlement planning and geotechnical interventions needed to create a sustainable permanent shelter programme. Also proposal aimed to look into possibility of creating a model permanent shelter option and emergency management option for regional level relocation site and landslide affected community.

As a short term and an immediate solution for the loss of accommodation of the affected families it was decided to develop 11 house plans on the basis of slope of the terrain, slope stability, income level of the families, number of members in the family etc.

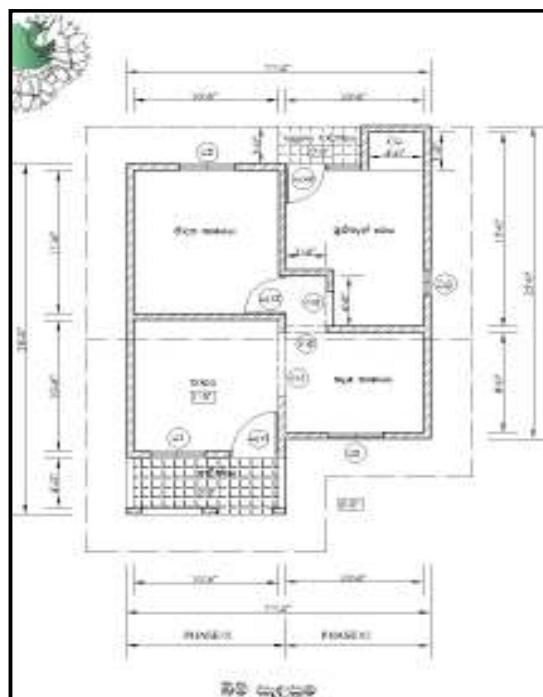


Fig 04: House Plans for Affected Families

Along with the house construction a proper drainage infrastructure plan also need to be constructed, which consist design of drainage & slope protection systems mainly concentrates on natural and man – made causes creates slope failure, suitable protection techniques with

engineering guidance, and the ways to improve the surface and subsurface drainage system using appropriate materials.



Fig 05: Cost Effective Houses



Fig 06: Model House Construction

Meanwhile, in order to transform the livelihood of the affected victims which was totally collapsed by the catastrophic landslide became a long term requirement not only to resilient their affected life but also to avoid the possibilities of landslides in future. To overcome this issue it was identified to promote appropriate land use practices in the areas where predominantly engaged in cultivation. Because, inappropriate land use practices was a main reason accelerated landslide in the area. Hence, it was appropriate to develop a demonstration site with resilient housing along with appropriate land use practices.



Fig 07: Planting Trees for Different Slopes

5. Issues Arose

The main objective of the short term and long term measures was to provide a holistic solution to the community affected by landslides in order to make their affected life back to normal. Even though it was the main consideration by the project implementers at the beginning, following circumstances became the issue between the project implementers and decisions makers when implementing the component the long term best practices project.

- Socio-economic background at the disaster location was not directly investigated.
- It was found that around 2/3 of the area is covered with colluvial soil which was a landslide related phenomena in the history, which is an evidence for unsuitable ground condition for human settlement. It can be considered as marginal land for housing or residential.
- Ground topography shows a highly diverse terrain, therefore when people make their living area and livelihood activities, it will make a mass movement during rainy days.
- Due to limited flat land, potential house holders has to cut the land which will cause some soil instability to the immediate neighbours also it is dangerous during rainy season.

Even though the main objective of long term project was to develop a demonstration site for re-housing with appropriate land use practices to avoid possibility of landslides in future.



Fig 08: Human Settlement in Highly Changing Terrain

6. Discussion & Conclusion

During the last two decades people live in central high lands of Sri Lanka have been affected by landslides accelerate by heavy rain with in appropriate construction practices. As a result of this it is considered as a threat to human settlement in current approach by the policy makers. This paper reveals the issues and lessons learnt from landslide mitigation programmes at Hanguranketha area. Following conclusions can be made considering the above discussion.

Considering the scale of impact due to catastrophic landslide in Hanguranketha and Walapane area in year 2007, NBRO geological team after the spot investigations decided to relocate the affected families. This decision was taken by considering the geological aspects only. It lacks the important aspects such as human settlements, socio-economic, environmental, administration and political will was not considered in this important decision.

Therefore this decision was challenge at different levels, mainly by the local and district level administrators. Reason behind the criticism at the local level was the wholesale relocation decision without considering possible mitigation options such as early warning, preparedness and structural mitigations which included in the concept of "living with landslides".

This led the local administrators to a bigger problem than expected by pressuring them in finding suitable residential lands for relocation. With this back ground the lands selected for resettlement of identified families, were screened by the geological team for possible landslide and some of the lands were earmarked as possible relocation sites.

Relocation site did not provide any facility for farming activities, where most of the families were farmers, which is their main income generation to carry out their day to day life.

Although some of the outcomes were not possible in implementation of this project, this landslide resettlement project became a good eye opener for the landslide management system in Sri Lanka. One good initiative is the 'Development of landslide policy' or mainly policy for landslide affected community relocation for resettlement issues. This led to develop a proposal in creating a regional or district level screening committee for resettlements recommendation on disaster affected communities.

7. Recommendations

In spite of mitigation measures and awareness of the landslide disaster, settlements in central high lands in vulnerable areas for landslides. This is due to the pressure of population growth, scarcity of land and location base economic compulsions and non landslide resilient buildings etc.

Resettlement of population is impractical and may leads to unfavourable economic and social consequences. In order to overcome the above issues experienced during implementation of landslide mitigation programmes, following recommendations are made.

- Preparation of detailed regional level development plans for landslide affected areas along with possible relocation options.
- Also all the relocation proposals should carry a statement which records consideration of the national and regional physical plans. In other words the most attractive option for relocation to be linked to national and regional plans.

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