

GAPS AND SHORTCOMINGS OF THE EARLY WARNING SYSTEM AND RESPONSES: IN MEERIYABEDDA LANDSLIDE (2014) IN SRI LANKA

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ABSTRACT

Early warning systems need to actively involve the communities at risk, facilitate public education and awareness of risks, effectively disseminate alerts and warnings and ensure there is a constant state of preparedness. On the 29th of October 2014, an enormous landslide occurred in Koslanda, Meeriyabeda, tea plantation Estate in Haldummulla DS division in Badulla district causing considerable damages to life and property. The main objectives of this study were to identify the institutional gaps and shortcoming of the early warning system and also to identify the gaps and shortcoming of community responses. 79 families with 271 people are directly affected by this landslide. 517 families with 1691 people are indirectly affected. The numbers of missing persons were recorded as 37. The Meeriyabedda landslide was mainly triggered by the Second Inter-Monsoonal rain which occurred in the month of October and November. The study revealed that the LEVEL 1 landslide warning has been sent out to Haldummulla DS Division but evacuation warning was not issued by the relevant authorities before the landslide occurred. It was also clear that the proper equipment or mechanism was not used by the government authorities to disseminate the warning to the community in an appropriate way. The dissemination of early warning from divisional level to the grass root level must be improved. Preparation of hazard and risk maps for most vulnerable areas must be completed as soon as possible. The awareness level among the community on PRE and POST disaster responses and handling a disastrous situation is not to the satisfaction level in this area. Therefore, intensive and attractive awareness raising programs must be conducted among the communities by responsible authorities. The study identified the best system for effective early warning is as the "Community bases self-evacuating early warning system". It should be introduced to the landslides vulnerable communities in Sri Lanka so that the life and property losses caused by the landslide could be minimized.

Keywords: *Landslide; Risk; Early warning system; Community responses; Disaster management; Institutional gaps and shortcoming*

INTRODUCTION

Early warning systems need to actively involve the communities at risk, facilitate public education and awareness of risks, effectively disseminate alerts and warnings and ensure there is a constant state of preparedness. The early warning system enters into the concept of Disaster Management Cycle in the PRE-DIASTER PHASE and continues even at the POST DISASTER PHASES. In Sri Lanka, the early warning is issued for different disasters through the Disaster Management Centre (DMC), along with other relevant technical agencies like Department of Meteorology (DM), National Building Research Organization (NBRO), Irrigation Department (ID) and etc. (<http://www.worldbank.org/>). NBRO is the responsible authority for landslide risk monitoring in Sri Lanka. DMC disseminates the warnings to relevant agencies and communities with the aid of early warning towers, mobile phones, telephones, radio networks, fax, e-mails etc.

On the 29th of October 2014 at around 7.15 a.m. an enormous landslide occurred in *Koslanda, Meeriyabeda*, tea plantation estate in *Haldummulla* DS division in *Badulla* district causing considerable damages to life and property. District officials received early warnings that the area was in danger, but those warnings were not effectively passed to the villagers. Many experts argue that this particular damage could have been prevented if the early warning system functioning well and communication was properly conducted. Both the institutions and community are failed in the *Meeriyabeddha* incident. Recent landslide events demonstrate the need to improve landslide forecasting and early warning capabilities in order to reduce related risks and protect human lives (Benni, 2012). After this tragic incident, the rescue mission was carried out by Sri Lanka Army in cooperation with DMC and other relevant organizations.

OBJECTIVES OF THE STUDY

The main objectives of this study were: to identify the institutional gaps and shortcoming of the early warning system and also to identify the gaps and shortcoming of community responses. Finally the study suggested an institutional and community response design to minimize the impacts of the landslide.

RESEARCH METHODOLOGY

Primary and secondary data and information have been collected for this research. The primary data was collected through the interviews, questionnaire surveys, observations and field-based data retrieval techniques. The secondary data were collected from published research documents and reports, web information as well as by interviewing government officials of related authorities such as NBRO, DMC, DM and Grama Niladari (GN). The analyses have been done with the aid of appropriate analytical software such as Geographical Information System (GIS), Remote Sensing (RS) Google images, Excel, and Minitab. The household sample of the study was selected as a representative sample of 50% of the directly affected families (*Meeriyabeda*, tea

plantation Estate). Statistics of the affected people was collected from the officer in charge of Art-track Commander/General of the relief and evacuation task force.

RESULTS AND DISCUSSION

(a) Causes and impacts of the 2014 Meeriyabedda landslide:

The *Meeriyabedda* landslide was mainly triggered by the Second Inter-Monsoonal (SIM) rain which occurred in the month of October and November. On the 29th of October 2014, around 7.15 a.m. a massive landslide hit the *Meeriyabedda* Estate in *Kotabakma* GN division. Rainfall data was collected from the *Poonagala* rain gauging station and discovered that the amount of rainfall received in the area for 03 consecutive days from 26th to 29th October was exceeded 500 mm. This has caused to destabilize an area in *Koslanda* located above 06 Estate line houses. NBRO, DMC, and JICA have stated that the flow of the landslide started from the Eastern part of landslide topography. Previous landslide block was about 280 m wide and located at the close area. The upmost steep part of the upper slope, exposed with biotite gneiss, forms a water-catchment landform (JICA, 2014). Therefore, a large amount of rainwater and groundwater was collected by the previous day of the event and then flowed into the landslide area from the steep slope above the landslide area. When landslide mass became saturated, increased the instability condition. As a result, tension cracks were developed and expanded in the upper slope, while the spurts the groundwater near the toe of the landslide and toe collapsed. The whole mass of the landslide subsequently started to move downslope. Subsequent it started moving towards the middle slope, the landslide mass became fluidized by mixing abundant surface and subsurface water, and then changed into the debris flow. As a result, the debris flow moved rapidly downslope, destroying the *Kovil* (Hindu temple) and houses located near the middle slope and extending into the road across the lower slope.

79 families with 271 people are directly affected by the landslide. 517 families with 1691 people are indirectly affected. The main property damages are; 07 Line room complexes (approx. 63 Line room dwellings), 02 x Estate staff quarters, 02 x Milk collecting centres, 01 x Hindu Temple, 01 x Communication Centre (private), 01 x MOH Office, 01 x Community Centre (Sri Lanka Military Data). Affected communities are temporally located in several locations such as *Poonagala* Tamil and Sinhala schools, *Mahakanda* tea factory, *Poonagala* Hindu *Kovil*. Currently, only the *Mahakanda* tea factory is used as a temporary relief centre. Almost a year after the incident there are 88 families still at the *Mahakanda* tea factory. National Disaster Relief Service Centre (NDRSC) provides dry rations to 321 persons stay in the relief centres. For the purchasing of dry rations, they spend 104600 rupees per/week. Reconstruction and resettlement work is expected to complete in 2016. The rest of the vulnerable communities living in the close areas were also identified as risk areas by NBRO. Unfortunately, some families have moved back into their houses without considering the warnings given. New cracks could be observed in some of the houses and the site is still remaining the same risk.

(b) Institutional gaps and shortcomings in the early warning system:**(i) Gaps in the early warning dissemination process:**

NBRO has issued the warnings to the DMC and relevant organizations on the 27th of October 2014. LEVEL 1 landslide watch warning has been sent out to *Haldummulla* DS Division. But evacuation warning was not issued by the NBRO on or before the 29th of October 2014. To evacuate the vulnerable community a LEVEL 3 warning must be issued by the NBRO. The most serious shortcoming of early warning system observed here is that the warning issued by NBRO is only for the whole district or DS divisions. Therefore, the early warning dissemination for the community level becomes less practical. The early warning process has been broken down at Divisional Secretariat level. Even though the officers in charge of disseminating warnings to the grass root level claim they have transmitted the warnings to the community, but the affected community disagrees with it. They say that they did not get any early warnings with regard to the particular landslide. According to the villager, *Mr. Thambaiya Nadaraj* said that, “the Estate superintendent came in the morning at about 6.30 a.m and said “*there is a crack in the hilltop, but you all must come to work today*”. He has lost his daughter and wife due to the landslide. The tragedy could have been avoided if proper early warnings were given to the community.

(ii) Inappropriate early warning dissemination techniques:

Out of 40 respondents, only one person said that a rain gauge was given to the community by the Sri Lanka Red Cross during their awareness program conducted in 2009. Fixing early warning accessory on every potential landslide site is impossible due to high cost and lack of technical knowledge. Therefore, an appropriate early warning system which is suitable for the socio-economic structure of the landslide prone areas should be introduced. The Officer in Charge of disaster relief in the DS division office claims that he and the Grama Niladari have visited the Estate on the 28th night and verbally gave warnings to the community to evacuate. Villagers stated that no one came to see the area before the incident. Hence, it is clear that no proper equipment or mechanism was used by the government authorities to disseminate the warning to the community in an appropriate way. If the warnings were given to the community at the correct time in a proper way where all the community would have been able to hear the warning, and then the life damage caused by the landslide could have been prevented.

(iii) Lack of awareness programs and training:

DMC is the responsible authority for conducting awareness programs and training to the vulnerable communities. *Meeriyabedda* has not been covered by an awareness or training program. On the other hand, in the *Haldummulla* area, several disaster management training programs have been conducted under various organizations before 2014. Among it, the awareness program conducted by the Sri Lanka Red Cross and Red Crescent Society in 2009 is the biggest program. DMC and NBRO have also involved in this event. But this program was done in the

Kotabakma GN division. Even-though the *Meeriyabedda* Estate is under the *Kotabakma* GN division, only very few people from this village have attended to this program. The study found that only 01 person out of 40 people has attended to the program. According to his testimony, this program has not become effective to the people. *Mr. Subramaniam* explained his experience about the program: “*I attended the program. It was fun. The food was given. But they identified the Kovil as the safer location for our area, but the Kovil was the first to be washed away by the Landslide, so even we acted according to what they say we would have to be dead already*”. 21st and 22nd November 2013, an awareness program was planned to be conducted at *Meeriyabedda, Poonagala*. But the community refused to participate in it. On 3rd of December 2013, the Additional Director of DMC in *Badulla* has conducted an awareness program in *Diyagala, Ampitiyawatta*. According to *Badulla* DMC Assistant Director, the *Diyagala* community is responsible for measuring the rainfall with the provided rain gauges and if the limits exceed they were asked to inform the nearby villages. As he mentioned the *Meeriyabedda* Estate is near to *Diyagala* and they are unable to cover all the areas by conducting awareness programs. But according to Google Map calculations, *Diyagala, Ampitiyawatta* is located 136 km Southwest to *Meeriyabedda* Estate. With the education level of tea plantation workers and their financial background, it is unlikely that the villagers are capable of disseminating such warnings. The authorities must have the proper mechanism or well-planned awareness and training conducted to the communities so that they will be able to do what is expected of them.

(iv) Lack of subject knowledge among the responsible government officials:

The officers of the DMC and NDRSC most of the time works with the grass root level. They are responsible for conducting training, educate the communities and conduct relief services to the communities. In the case of *Meeriyabeeda* landslide, many institutional gaps and shortcomings were observed. Among it, lack of knowledge of the government officials about the subject can be understood. During the survey done with the 15 institutional officers, out of the 15, only 04 of them knows the difference between hazard map and risk map.

(v) Lack of relevant data / information and weak coordination among institutions:

To disseminate accurate warnings about landslide geographical, geomorphological, geological as well as social data of a particular area is essential. According to the interview survey with officers, only 02 of them out of 15 said that GN level risk maps are available but they failed to show the maps. Therefore, the future analysis which was planned to be done using GIS was unable to be conducted due to the lack of data. NBRO still haven't covered the whole *Halduummulla* DS division in their hazard mapping. Yet they have not fully covered the hazard mapping in Divisional level and districts level. When considering the post-disaster management phase, the situation is even worse.

(vi) Missing persons:

Exactly after one year from the landslide occurrence in *Meeriyabedda*, the damage and loss estimation records by various government authorities are different from each other. According to *Koslanda* police station, the estimated number of the missing person are recorded as 37 and while a number of corpses are recorded as 08. According to the *Haldumulla* divisional secretary division data, the number of missing persons were recorded as 37 and found corpses as 14. DMC recorded missing number was 22 and corpses found was 12. By analysing data it is clear that the coordination among relevant authorities involve in disaster management process is very weak. The institutions are unable to at least agree on one number of people died during the *Meeriyabedda* landslide which occurred on the 29th of October, 2014. This is a serious shortcoming of the institutions which has to be addressed immediately.

(c) Gaps and shortcomings in community responses:**(i) Unresponsiveness to previously given warnings:**

The first warning to the Estate community was issued on 2005 by NBRO. They were asked to be relocated into another area which does not have landslide risk. But due to various reasons people were reluctant to leave their homes. It was confirmed by the affected people during the questionnaire survey. On 2009 again, the Red Cross and Red Crescent Society with NBRO and DMC involvement have conducted an awareness program to the *Kotabakma* GN division. But most of the people in the *Meeriyabedda* Estate have not attended to it. But due to the unresponsiveness of the community, no education or use was taken from that program. The study revealed that why the community has not responded for early warnings messages are recorded as; No place to go (8%). Income sources will be lessened if moved to other places (27%) and (33%) said no money to build new house and rest of the person could not give the answers.

The answers were categorized into 4 major parts for the analysis. Some of the community members gave more than one reason. According to the results, majority of the people stated that they don't have money to build a house and if they move from their current location their income will be reduced. But according to the DMC, *Badulla* Estate superintended has given land and even houses to the workers of the tea Estate living in *Meeriyabedda* Estate. Apart from it according to the *Badulla* DMC, Assistant Director, 45 housing loans were given to the people in *Meeriyabedda* Estate by National Savings Bank, after considering the 2005 NBRO warnings. But none of the community members mentioned about this assistance. Even today the villagers hesitate to leave their homes due to economic as well as the socio-cultural attachment they have with their own place. But it is not an excuse to the occurrence of a natural hazard.

(ii) Spiritual dependency, “sense of place” and attitudes of the people:

One of the interesting points came out during an interview with the villager is that “*we believed that God will save us, and no harm will come to us*”. Hence, they didn't care much about the

warnings given by the authorities because they were extreme spiritual believers. “Sense of place” is a concept which was introduced by Thuan (1977). It is a combination of characteristics that makes a place special and unique for the particular community. The sense of place involves the human experience in a landscape, the local knowledge, and folklore. The sense of place also grows from identifying oneself in relation to a particular piece of land on the surface of planet Earth. This concept can be applied to explain the human nature in a disaster prone area. No matter how risky the area they live, the people does not like to leave it and relocate in another place. It is the same in the *Meeriyabedda* landslide situation. No matter how much the authorities try to warn them and try to relocate them they tend to live in that own place. It is mainly due to their socio-cultural and economical attachment with the place. But this is a major gap in human response to early warnings, which lead to the result in life losses.

(iii) Irresponsibility of the community:

Another most serious shortcoming in the community response is the careless responses for the early warning mechanism. Most of the time people do not take early warning messages issued by the government seriously. They tend to ignore the warnings and continue their daily activities as planned. According to the village survey, the Estate superintendent has come to the landslide site at around 6.30 a.m. on the 29th of October, 2014. After observing the crack on the hill top he has warned the community to evaluate from that place and go to work. But the people did not listen to his words. Some of them have evacuated and gone back to the houses to get their valuables and they were caught in the landslide debris flow. If they have acted in a responsible manner they could have to be still alive. The tea Estate in *Meeriyabedda* people has had a rain gauge with them for a long time. But it was not used for many years. Several villagers have observed some cracks in the land as well as in some of the buildings since 2-3 days before the occurrence of the landslide. But they were so irresponsible that none of them informed the responsible authorities as soon as they observed the cracks. Still some of the villagers have moved back to their homes at to the risky landslide site. Therefore, a serious attitudinal change is needed for this community.

(iv) Lack of proper early warning communication mechanism:

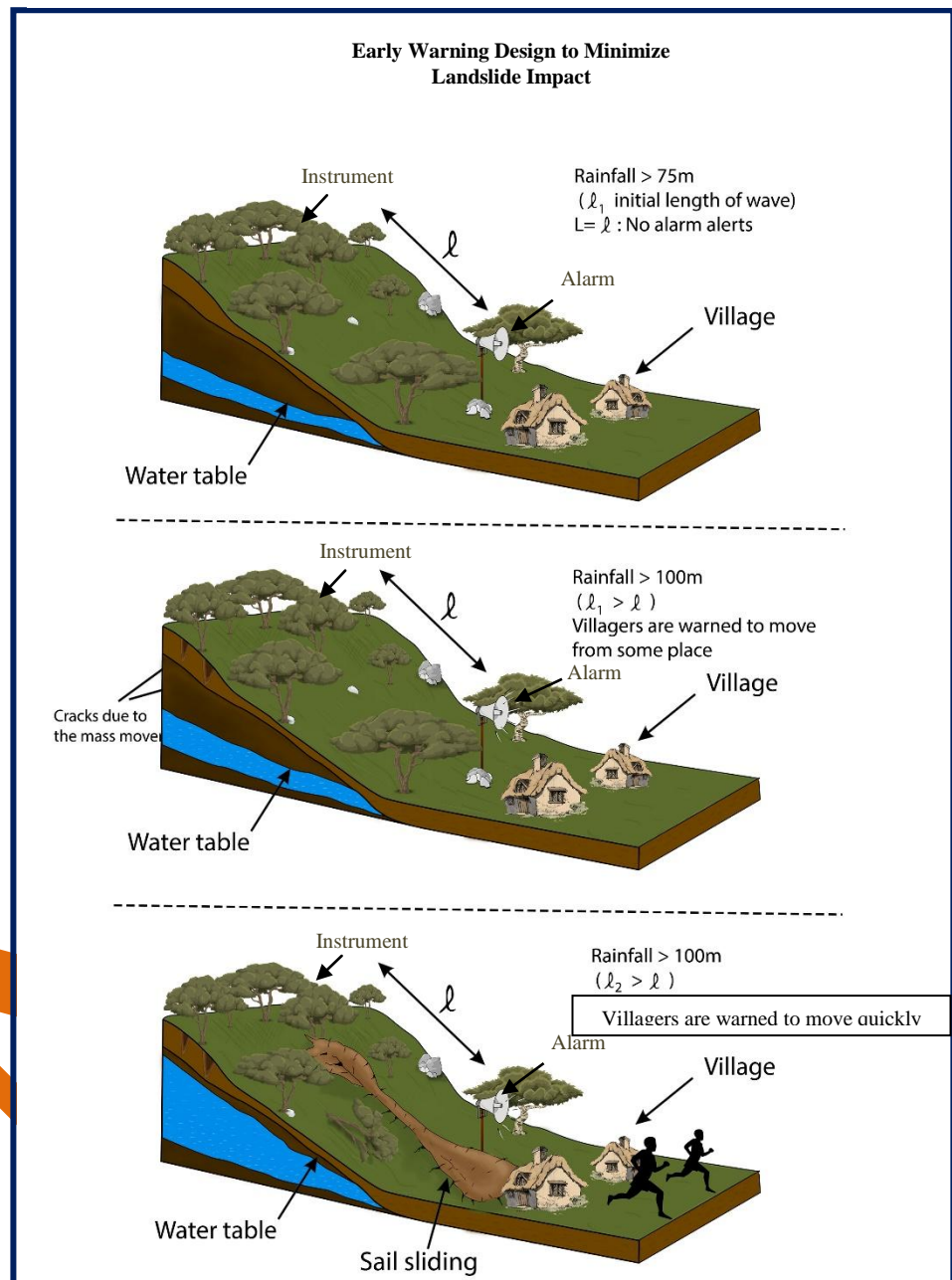
Throughout the survey, the main opinion highlighted by most of the persons was that the community did not receive early warnings before the landslide occurrence. According to the available information, the warnings have reached in writing up to the *Haldummulla* Divisional Secretariat Division level. But after that level up to the grass root level, no written evidence is found to prove that early warnings have being disseminated to the vulnerable community in *Meeriyabedda* Estate. The easiest way was to use the *Kovil* bell. But it was not done. Therefore, they must have to appoint a functioning village committee for early warning communication. They can get a megaphone or a speaker to the village so that all the villagers can get the warnings at the same time.

(v) High dependency on government:

It has been more than a year now after the *Meeriyabedda* landslide incident. But still there are more than 88 families in the *Poonagala* relief centre. Whenever officers visit the camp, they use to point-out the weaknesses of the NDRSC and Government. From the end of the last year, the community living on the other side of the *Meeriyabedda* Estate were also evacuated and sent to the camp due to high risk of landslide.. Government expenditure on camp management is as follow; According to the *Haldumulla* DS Division data and information, the government spends Rs.104600 per week to provide dry rations to these 88 families in the camp. The government has spent Rs.3,909,500 for families of 23 dead people as obituary aids and for dry rations Rs.4, 000,000 and for cooked food Rs.1,000,000 and for Medical support Rs.50, 000.

(vi) An institutional and community response design to minimize the landslide impact:

After considering all the gaps and shortcomings and institutional and community responses a design has been introduced to minimize the landslide impact. Figure 1 shows the design STAGE 1: shows when the daily rainfall has exceeded 75 mm per/day a slight increase of ground water level may occur and the Hill slope will show a slight change. When any change in the Hill slope occurs or when the length of the hill slop slightly change the instrument installed at the top of the hill will record it and send the message through its vibrating wire to the alarm system installed at the bottom of the hill. But in this stage, the alarm will not activate because the change occurred is not enough to initiate a landslide. The STAGE 2 highlights: when the water level exceeds 100 mm per/day, the hill slope create deformation and slight cracks may occur on the surface. Then the instrument will send the recorded measures to the alarm system and alarm will activate in low level sound, informing to the nearby to evacuate. STAGE 3 warns activate: the risk of the landslide is severe when the daily rainfall exceeds 120 mm. Then the alarm system will activate and a large scale warning will be disseminated to the whole village dwellers for evacuation. For this early warning design, a tilt-meter or an extensometer can be used. Tilt meter: is a sensitive inclinometer designed to measure very small changes from the vertical level, either on the ground or in structures. Extensometer is a device that is used to measure changes in the length of an object. It is useful for stress-strain measurements.



Source: Author

CONCLUSION

During the early warning process, many institutional and community response gaps and shortcomings were observed. The most obvious shortcoming in the process by the institutional

side is that the early warnings are being disseminated only up to the district or divisional level. Therefore, it is difficult for the people to know whether their area is included in the early warning message. Hence, dissemination of community level warnings and accurate warnings are needed. The awareness level among the community on PRE and POST disaster activities and handling a disastrous situation is not to the satisfaction level. Therefore, intensive and attractive awareness raising programs must be conducted among the communities by responsible authorities. The information flow of early warning dissemination in Sri Lanka is well defined. But it has many gaps and issues in practical applications. The dissemination of early warning from divisional level to the grass root level must be improved. It has to be monitored frequently. To overcome that issue village committees for early warning communication can be appointed. The knowledge of disaster management among government officials involved in disaster management mechanism at the district level and below relatively low. Hence, training and education programs on disaster management and its mechanisms must be conducted to institutions as well. Apart from it, review of roles and responsibilities in the emergency operation and officers involved in disaster management must be improved. The relocation processes are currently selected by only considering geological and geomorphological factors. Socio-economic and cultural factors must also be considered during the resettlement process and the resettlement guidelines must be improved. The government must implement a mechanism to create employment opportunity for the people in the camp who are mentally and physically fit to work. Food for work and cash for work programmes should be promoted. The lack of existing data for creating hazard and risk mapping is also a serious issue. Therefore hazard and risk maps for most vulnerable district must be completed as soon as possible. Lack of proper instruments and knowledge of operation among the vulnerable community is another major weak point identified in the research. Therefore, proper education and training about the landslide events must be conducted among the villages. Their traditional knowledge on identifying risk can also be improved. The identified the best system for effective early warning is the “community bases self-evacuating early warning system”. It should be introduced to the vulnerable communities in Sri Lanka so that the life and property losses caused by the landslide could be minimized.

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