

Article

Flash Floods and Mitigation in Lao Cai Province, Vietnam

Tran Thuy Linh

Viet Nam Meteorological and Hydrological Administration, Ministry of Natural Resources and Environment

[Email: Tranlinh1809@gmail.com]

Abstract: Mountainous topography with steep slopes and high rate of precipitation renders Lao Cai Province in Vietnam at risk to flash floods and landslide hazards. The Province had experienced severe disaster events in the past from flash floods and landslides due to storm events resulting in the loss of lives and property damage. This paper briefly highlights existing implementation of mitigation and prevention plans for flash floods and landslide disasters in the area. Based on the performance from previous events, several recommendations are proposed to improve the existing strategies at Lao Cai Province.

Keywords: Flash floods, landslides, hazards in high elevation area.

INTRODUCTION

Lao Cai is a mountainous area in the Northwest of Vietnam. It has a complex terrain and is greatly influenced by two high mountain ranges running parallel to each other, namely Hoang Lien Son on the west and Voi Mountain on the east. The absolute elevation varies greatly, from 53 m to 3143 m with extremely rough terrain. This province lies within tropical climate conditions, under the influence of monsoons with the average annual precipitation ranging from 1400mm to 2800mm. The maximum daily precipitation can reach over 240mm. Lao Cai has a dense network of rivers and streams; about 107 large and small streams with densities of 0.9-1.7km/ km².

In the mountainous areas, flash floods have high-flow velocity and amplitude. It takes shorter time to reach the peak of flow and fall back to base level. The flow also contains a high level of sediments that can result in severe damages downstream. During big storm events, areas with slope gradients of 20° to 30° and low vegetation cover will experience runoff and overland flow of rivers and streams. In the Lao Cai Province, greater amount of flow to rivers and streams in a short time lead to higher potential forces resulting in flash floods and landslides.

The two main river systems are the Red River and Chay River, which include many tributaries flowing in high elevation over steep areas with a large range of annual total discharge. Hydropower plants are arranged in a terrace-like fashion to prevent the flow of water. Hence, the water level fluctuates and is under the influence of the operation of the hydropower plants. Natural conditions as well as human influence associated with the rapid progress of urbanization, infrastructure construction and mineral resources exploitation have made Lao Cai Province sensitive to flash floods and landslides. The Lao Cai Province has had limited investigation related to future climate conditions, risk assessment as well as vulnerability assessment to delineate vulnerable communities and sectors (Nguyen 2015).

HISTORICAL EVENTS

In August 2016, two consecutive flash floods and landslides resulted in severe damage to the Province. The impact of the second storm (Nida) left 5 people dead, 7 missing and 9 injured. During the storm, 969 houses were seriously damaged and thousands of hectares of crops were destroyed within 4 days (2-5 August 2016). Two weeks after that, the third storm (Dian) caused floods and landslides which led to the deaths of 7 people, 1 missing person, and 364 damaged houses.

More than 2000 cattle were also wiped out by the water flow. Meanwhile, floods associated with landslides on September 2013 in Can Ho A village, Khoang commune, Sa Pa district dragged tens of thousands of rock debris, which killed 11 people, wounded 17 people and caused great damage to property. Heavy rains in 2018 resulted in a single flash flood event that caused houses to collapse, and traffic was paralyzed, causing damages estimated at USD 7 million (VnExpress, 2018).

EXISTING MITIGATION AND PROPOSED IMPROVEMENTS

Mitigation of the impacts of flash floods involves structural and non-structural approaches. Structural methods include planting and protecting headwater forest; constructing reservoir to regulate water in areas having high frequencies of flash floods; clearing the flood drainage systems and gutters; building dikes and retaining walls; dividing floods into small flows; constructing additional emergency spillways in reservoirs; and expanding the flood drainage of road systems. Non-structural methods include establishing flash flood distribution maps; planning for land use restrictions in areas with high risk of flash floods; combining agroforestry measurements to reduce erosion and enhance soil quality; evacuating people from high risk areas; installing automatic rain gauges for early warning.

To mitigate the impact of flash floods, Lao Cai Province had put in place a warning system based on data collection from meteorology and hydrology stations. Currently, Lao Cai Province has installed 10 meteorological and hydrological monitoring stations and 22 rain gauges, as well as weather radar. However, requirement for early warning and forecasting purposes is yet to be fulfilled due to scarcity of the stations, degraded infrastructure, and old technology. Areas with high frequencies of flash floods are riparian zones and streams that are associated with land cultivation and water sources for industrial and domestic use. These areas are often found in remote areas where delivering early warning to the locals becomes a challenge. Relocation of the locals residing from areas of high risk to flash floods and landslides areas is yet to be accomplished due to their attachment to the cultivated land.

Several recommendations can be made to improve the mitigation efforts from flash floods impacts in Lao Cai Province. These include constructing flood distribution maps and placing warning signs in areas with high frequency of flash floods. Promoting the restoration and protection of headwater forests has brought positive performance and needs to be continued.

Article

The Lao Cai Province has planted 8.450ha of forest in 2017, accounting for 118.2% of the plan, including 520.3ha of protection forest. Flood drainage clearance should also be promptly executed and properly planned before the onset of rainy seasons and after heavy storm events. Public awareness of the danger of flash floods should also be reinforced via local media channels such as the radio and television. This will ensure public access to information and improve their preparedness to flash floods.

CONCLUDING REMARKS

Mitigation of the impacts of flash floods in the Lao Cai Province involves structural and non-structural approaches. Early warning systems based on using meteorological and hydrological monitoring stations, as well as rain gauges and weather radar, are found to be

insufficient due to its scarcity, degraded infrastructure and old technology. More needs to be done, including formulation of flood distribution maps, promoting forest restoration and protection, improvement of awareness, and access to information to enhance the preparedness of communities to disasters.

REFERENCES

- VnExpress, 2018. Flash floods ravage northern Vietnam. VnExpress, June 26, 2018 <https://e.vnexpress.net/news/video/flash-floods-ravage-northern-vietnam-3768345.html>
- Nguyen, P.N., Tran T.T., Tyler, S., Nguyen Q.Q., Bach T.S., Nguyen N.H., Pham K. & Dang T.H. 2015. Local planning for climate adaptation: Vietnam's experience. Asian Cities Climate Resilience, Working Paper Series, 24, 1-39.

Registration is now open!

Official website
www.ukm.my/sti4drr



The Second National Conference aims to strengthen science, technology and innovation on disaster risk reduction in Malaysia, convened by the National Disaster Management Agency (NADMA Malaysia), Academy of Sciences Malaysia (ASM) and Universiti Kebangsaan Malaysia's Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM), with support from key partners. This is a follow-up from the inaugural National Conference on Science, Technology and Innovation for Disaster Risk Reduction was successfully held on 5-6 October 2017 at Puri Pujangga UKM Bangi, under the aegis of NADMA Malaysia. The aim of the Conference is to provide an insight into the state of disaster risk reduction (DRR) in Malaysia, in relation to climate change and sustainable development. This Conference also serves as the national platform for exchange of good practices in DRR among researchers and practitioners. In Malaysia, the National Disaster Management Agency (NADMA Malaysia) is Focal Point for the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030.

The Conference will cover themes on disaster risk reduction based on similarity of issues and challenges to be addressed. The themes are as follows:

- Geological Hazards - Landslides and Earthquakes;
- Hydro-meteorological Hazards – Extreme Flooding and Weather;
- Health and Emerging Hazards;
- Critical Infrastructure and DRR; and
- DRR Governance, Risk Management and Insurance.

Universities, research institutes and civil society organisations are invited to contribute papers in the form of poster presentations for the Conference themes. The Conference will highlight DRR innovation in Malaysia. The contributions should focus on products of DRR innovation such as models, approaches and methods, among others. The innovation must be at the stage of pilot testing or already implemented, after being peer-reviewed.

Interested parties are requested to submit an abstract (200-300 words) of their proposed contribution to the Secretariat, latest by **30 June 2019**. The organisers will inform selected parties of their acceptance by **15 July 2019**. Abstracts for poster presentations can be submitted to the Secretariat via conference website [www.ukm.my/sti4drr]. Kindly note that the manuscript must be written in English. The submission of full manuscripts is encouraged, to be considered for publication in an indexed journal. The deadline for full manuscripts is **1 November 2019**.

You are invited to register and keep abreast of developments at <http://www.ukm.my/sti4drr>.