

Review Responding to Natural Disaster According to Disaster Risk Levels

Chun-Tse Wang¹, Tien-Yin Chou², Yao-Min Fang²

¹Ph.D program of Infrastructure Planning and Engineering, College of Construction and Development, Feng Chia University, Taiwan

²GIS research Center, Feng Chia University 100 Wenhwa Rd, Situn, Taichung city 40724, Taiwan

Abstract: This study focuses on reviewing types of disasters affecting natural and socio-economic conditions and identifying weather and climate, types of natural disasters, and levels of risk caused by natural disasters that may occur in the province. Lao Cai. The main impacts of related natural disasters such as storms, mud and rock floods, flash floods, landslides, salinization, drought, forest fires, coastal erosion, riverbank erosion, sedimentation of coastal rivers... strongly affect residential areas and infrastructure in all regions. Populations located in different geographical and climatic regions of Vietnam have different levels of exposure and vulnerability. This paper presents methods of disaster response according to disaster risk level, a case study of Lao Cai province, Vietnam. As a result of the research, policymakers can make decisions based on the local disaster risk level.

Keywords: disasters affecting natural; natural disasters; climatic regions of Vietnam; Lao Cai province; Vietnam Climate Change.

I. INTRODUCTION

In recent years, natural disasters worldwide and in the region have become increasingly complicated and unpredictable, which is one of the biggest concerns of humanity. In our country, natural disasters have been taking place very seriously with extreme, unusual, difficult to predict, and warning factors. In the past 20 years, regions across the country have suffered from almost all types of natural disasters (except for tsunamis), causing heavy loss of life, property, and infrastructure and adverse impacts on the environment and the environment living, production, and business environment of the people. Statistics show that natural disasters tend to increase abnormally, the number of occurrences increases, and the intensity is getting more serious. Floods, inundations, flash floods, landslides, extreme cold, harmful cold, hot sun, drought, and saltwater intrusion are extreme weather events.

Lao Cai is a mountainous province in the Northwest, 296 km from Hanoi by railway and 245 km by the highway. The East borders Ha Giang province; the West borders Lai Chau province; The South borders Yen Bai province, the North borders Yunnan province (China) with 182,086 km of border [1].

The topography of Lao Cai province is very complex, stratified at high altitudes, and strongly fragmented. The two main mountain ranges are Hoang Lien Son mountain range and Con Voi mountain range, with the same direction of Northwest - Southeast, located to the East and West, creating the average lowland between these two mountain ranges is an area to the West of this mountain range. Hoang Lien Son. Lands with slopes above 250 make up 80% of the province's land area. The typical terrain is mainly high mountains, steep hills, and deep crevices when heavy rain is easy to cause landslides, floods, and flash floods. The landscape is divided into two regions, with characteristics of heat background and affected by different climates, weather, and natural disasters, including:

The high mountainous region, including Sa Pa, Si Ma Cai, Bac Ha, Muong Khuong, and part of Bat Xat and Van Ban districts, are often affected by natural disasters such as tornadoes, tube floods, and flash floods, hail, heavy rain, flooding, landslides, lightning, drought, severe cold, harmful cold...

The low-lying area, including Bao Thang, Bao Yen, Lao Cai city, and part of Bat Xat district, is often flooded due to the influence of tropical depressions, storm circulation, especially heavy rain, and local precipitation.

Because Lao Cai province is located deep inland, it is less directly affected by the storm but is affected by storm circulation and tropical depression. However, because it is located in the East of the Con Voi mountain range and Hoang Lien Son is one of the heavy rain centers of the country. The average rainfall in 2017 reached 69,657 mm [1]. The influence of storm circulation in the province is mainly thunderstorms, prolonged rain, heavy rain causing flooding in low-lying areas, flash floods, and landslides in mountainous regions.

II. LITERATURE REIVEW

2.1. Region climate

Lao Cai has a tropical monsoon climate, divided into two distinct seasons; annual average temperature of 20,090C; average humidity is over 86.13% [2]. Due to the geographical position of Lao Cai province, located deep inland, it is less directly affected by the storm. Still, it is affected by storm circulation and tropical depression, thunderstorms, prolonged rain, and heavy rain that causes flooding in low-lying areas, flash floods, landslides in mountainous regions, and deep ravines.

Lao Cai is a province converging all three ecological regions: mountainous, midland, and plain. It has complex topography influenced by hot, humid, and monsoon tropical climates. Climate sub-regions have many differences, which are frequently affected by 16/19 natural disasters such as heavy rain, hail, pipe flood, flash flood, drought, landslide, lightning, and a bad cold [3]. Although located deep inland and not directly affected by storms, every time a strong storm hits the northern coastal provinces, the storm's circulation, combined with the low trench, often causes heavy rain to create floods, landslides and rocks have caused severe property damage and deaths in the province.

2.2. Population, labor, poor households

The average population of the province in 2017: 694,416 people, of which: 351,037 men; female 343,379 people; average: 109 people/km² [1]

Labor force aged 15 and over: 1) Total: 436,861 people, in which: Female 210,975 people; male 225,886 people; 2) Urban labor: 87,672 people, 349,189 people in rural areas [1].

The rate of poor households in 2018 according to the new criteria is 21.92%; per capita income/month at current prices 2,652 thousand dong; percentage of urban population supplied with clean water through a centralized water supply system 100%; rate of households using hygienic water source 87% [1].

2.3. Scope of influence and number of occurrences of different types of disasters

Lao Cai province is not directly affected by storms. Still, it is affected by storm circulation, causing heavy rain, pipe floods, flash floods, landslides, and inundation in low-lying and urban areas. Tropical depressions affecting Lao Cai province usually have weakened winds of about five ÷ 6 (from 35 ÷ 45 km/h) accompanied by rain lasting 2-3 days [2].

The number of tropical depressions affecting Lao Cai province averages 3-5 times per year. Lowland areas such as Lao Cai City, Bao Yen, and Bao Thang are often affected by tropical depressions, and the damage they cause is more significant than the damage caused by other districts.

The province has frequent storms, lightning strikes, and hailstorms, especially during the rainy season. This natural disaster often occurs in extremes and irregularities that can directly affect people, property, and crops.

Heavy rain, flood, inundation: The type of natural disaster that causes the most significant damage; Heavy rains can cause floods, flash floods, landslides, traffic jams, destruction of people's property, houses, and crops, and flooding. The number of heavy rains in the province average from 06÷07 times/year; rainfall >100 mm/period. Scope of influence: In the whole province, in which the most affected localities are concentrated in the districts of Bao Yen, Bao Thang, Van Ban, Lao Cai city, some lowland communes of Bat Xat district, Muong Khuong.

Slips, landslides, and land subsidence in the province are often caused by prolonged heavy rain, heavy rain, poor geological structure combined with terrain slope, or the construction of works that leave deep pits and pits.

Landslides can cause damage to people, houses, properties, and crops cause traffic jams and damage many other properties, machinery and equipment. According to the Institute of Geophysics investigation results in Lao Cai province, there are currently 453 landslide sites. However, 350 warning signs have been installed to proactively warn people to prevent landslides.

III. RESPONSE TO NATURAL DISASTER ACCORDING TO DISASTER LEVELS [4]

Purpose

Direct, administer, proactively prevent and respond promptly; minimize damage caused by natural disasters; ensure the sustainable development of people's livelihood and economy - a society in the province.

There is smooth coordination among all levels, sectors, and localities in preventing, responding to, and overcoming the consequences of natural disasters. Assign responsibilities of local government; mobilize appropriate human resources in response to types of natural disasters according to levels of risk caused by natural disasters.

Minimizing damage caused by natural disasters, especially people, property, and essential structures. Timely relocation and evacuate people in critical areas at high risk of natural disasters to safe places; stable, sure, especially for the elderly, people with disabilities, children, and women.

3.1. Level 1:

3.1.1. For tropical depression, heavy rain, flooding

Firmly grasp the list of households and promptly notify 41,378 households with unsafe houses and 1,371 households with houses that must be relocated, of which 305 households need to move urgently to prevent and respond proactively. Completing the plan to arrange the population out of dangerous disaster areas before the rainy season to avoid landslides, pipe floods, and flash floods; stabilize life for households to feel secure in production.

There are specific measures to deal with locations with a high risk of landslides, tube floods, and flash floods that have been identified and newly arisen. Actively evacuate people and property of the State and the people out of dangerous areas where safety is not guaranteed; focus on implementing measures to ensure safety for people, especially vulnerable people, in all-natural disaster situations.

Coordinating with the electricity management agency, the Environment Company pruning branches and branches of tall, fragile trees, trees located near houses, power grids, etc., before natural disasters occur; check the safety and solidity of billboards, billboards, posters; areas of leaf houses, temporary houses, and scaffolding of high-rise buildings under construction.

Urgent mobilization of human resources, supplies, vehicles, equipment and necessities to promptly respond to natural disasters. Take measures to ensure safety for houses, offices, hospitals, schools, warehouses, constructions, and economic, security, and defence establishments.

- Monitor, guide, and proactively implement synchronous measures to prevent people and vehicles from entering dangerous areas on rivers and streams; the roads, and underground overflows are deeply flooded; Areas at risk of incidents, natural disasters, etc.

Ensuring traffic and communication meet the requirements of directing and commanding natural disaster prevention and control. Ensure security, social order, and safety, and protect property of the State and people in disaster-hit areas.

Carry out search and rescue activities under the motto "Save people first, save property later", rescue the injured, and support food, medicine, drinking water, and other necessities in the area affected by natural disasters, disaster zones, dismembered areas, severely flooded areas, and evacuation sites.

Actively take measures to protect production; restore and restore production; quickly overcome environmental pollution; stamp out epidemics; control epidemics not to let epidemics out; stabilize people's life right after the rain and flood disaster passes. Inspect, detect and handle incidents of natural disaster prevention and control works, essential socio-economic, security, and defense works.

Prepare rescue forces, including the Army, Police, Militia and Self-Defense Forces and other troops mobilized at the district and commune levels in the district and commune levels.

Means and equipment:

- Canoes, boats, canoes, buoys, life jackets
- Cranes, excavators, drills, concrete cutters
- Water pumps
- Traffic rescue vehicles, ambulances
- Chainsaws and other specialized equipment

3.1.2. For floods, flash floods, and landslides:

Directing the duty to monitor and monitor the happenings of rain and flood when seeing the occurrence of heavy rain for a long time, to handle situations, and to prevent flash floods and landslides. Directing the evacuation of people, commanding forces participating in the response at the scene, and directing the supply of food and food in vulnerable areas. Make a complete list of households/household members for each critical position. Identify evacuation locations with minimum accommodation and safety requirements; assist in relocating people to a safe place before flash floods and landslides occur. Quickly deploy the plan to ensure that people at the evacuation place have: necessities, food, drinking water, and temporary shelter in a safe place. Handling traffic jams due to landslides and providing food for the divided area. Carry out rescue and rescue for people, works, and infrastructure in the affected area.

3.2. Level 2:

The Central Steering Committee for Natural Disaster Prevention and Control: Assume the prime responsibility for, and coordinate with the National Committee for Incident and Disaster Response, and Search and Rescue, which is responsible for directly directing, operating, or mobilizing resources. They assist in responding to natural disaster situations with complicated developments, the risk of significant consequences, or when receiving requests for assistance from the Chairman of the People's Committee, the Head of the Commanding Committee for Natural Disaster Prevention and Control, and local search and rescue. The forces participating in disaster prevention and control in the locality must closely coordinate under the unified command of the Chairman of the Provincial People's Committee or an authorized person.

3.2.1. For tropical depressions, heavy rain, flooding

District and commune level: Implement as a measure to respond to level 1 natural disasters.

Provincial level: Determine the appropriate time to put up the banned sign to ensure people's and property's safety. Directing the work of ensuring the safety of houses, infrastructure, and measures to protect production. Guide to inspecting the bracing of houses, pruning branches, harvesting crops, and cage cages when there is storm circulation, or tropical depression. Directing the People's Committees of districts and cities to review and identify affected areas; determine the number of households that need to be evacuated. Assisting in evacuating people from potentially affected areas, mainly low-lying and low-lying areas, in which the focus is on vulnerable subjects: the elderly, children, and people with disabilities. Be ready to rescue and rescue forces in case of emergencies. Assign tasks to departments, agencies, and units according to their functions, studies, and management fields; clearly define the appropriate commanding role for each disaster situation. On duty 24/24h to monitor and capture information, transmit information, and handle natural disaster situations. Continue to patrol directly at key points in case of emergencies, proactively respond or support people to respond.

Mobilize forces and means to timely rescue the injured; seriously injured people must be quickly transferred to the upper level for treatment; urgently search for missing people (if any).

Mobilize forces to evacuate and move survivors to a safe place; set up tents; provide emergency relief in necessary conditions for the compatriots; encourage, visit, and share grief and loss; provide timely material and spiritual support for those who have lost loved ones or property.

3.2.2. For floods, flash floods, landslides

District and commune level: Implement as a measure to respond to level 1 natural disasters.

Provincial level: Directing the work of the monitoring committee to monitor the changes of rain and flood; command the forces participating in the joint response; directing the evacuation of people; mobilize forces to coordinate with village communities and relatives of victims in timely implementation of funeral support (if any).

To make statistics, assess the damage level, and compare current policies with current regulations to submit to the Head of the Central Steering Committee for Disaster Prevention or the Government for consideration and decision on the level of emergency relief for the affected families' damage caused by natural disasters.

Organizations to overcome the consequences caused by floods, flash floods, and landslides, including 1) The communication system is given top priority so that local authorities can report on the damage caused by natural disasters in the area and requests for rescue, rescue, and emergency relief; 2) The system of roads, bridges, and roads for people's lives ensures that rescue, rescue and emergency relief work can reach people in disaster-affected areas as soon as possible. 3) Direct relevant localities, departments, and branches to clean and sanitize the environment, especially the environment, to prevent epidemics from arising. When detecting signs of an epidemic, it is necessary to concentrate forces and means to zone, surround and extinguish the epidemic quickly, limiting the spread to the community.

Carry out rescue and rescue for people and infrastructure works in the damaged area. Deploy forces to ensure security and order in the damaged area. Directing the mobilization of materials and human resources to deal with damage.

3.2. Level 3:

Specific response measures to all types of disaster level 3

- a) Provincial level: The Chairman of the provincial People's Committee directs the departments and branches, members of the Provincial Steering Committee for Natural Disaster Prevention and Control and Search and Rescue, the People's Committees of the districts and cities, to mobilize the total resources of the province force, establish a Front Steering Committee to direct the troops to respond.

- b) District and commune levels: Maximize resources and coordinate with external reinforcements to respond. Neighboring districts and communes urgently mobilize available resources to aid and help affected localities cope.
- c) Means and equipment: Canoes, boats, boats, amphibious vehicles, buoys, life jackets; cranes, excavators, concrete cutters, concrete chisels; concrete drill; pumping stations, water pumps, cooling equipment systems, water supply equipment; traffic rescue vehicles, ambulances; chainsaws and other standard and specialized equipment.

IV. SOLUTIONS TO PREVENT AND MINIMIZE THE IMPACT OF NATURAL DISASTER WITH URBAN PLANNING AND MANAGEMENT TOOLS

There are many adaptation and DRM approaches to disaster risk reduction. Disaster risk management in Vietnam is mainly about low-regret activities that reduce exposure and vulnerability to extreme events.

DRM focuses on reducing exposure and vulnerability and increasing resilience to the potential adverse effects of disasters since risks cannot be completely eliminated. Through good management of urban ecosystems and development processes, risks can be mitigated, and, in the event of a phenomenon occurring, its impacts can be mitigated.

Reducing exposure to hazards: The construction land assessment map assesses urban development land selection. This can also be considered a risk warning map to avoid construction and urban development activities in high-risk areas, reducing exposure to natural hazards. Besides, land use functions in spaces with different levels of risk are also proposed. Residential areas that need a level of safety cannot be located in areas along rivers and streams prone to frequent and flash floods. In contrast, areas of seasonal flooding or landslides can still be reserved for agriculture or open space.

Strengthening resilience to change risks: To enhance urban resilience, solutions for planning the urban protection works are proposed in the context of technical preparation planning through solutions such as reservoirs, dikes, dams...

Transformation: The long-term solutions in disaster response are transforming functional spaces and development activities from vulnerable to less vulnerable or more resilient. This is especially necessary in the context of climate change. Instead of forming industrial zones in coastal areas, the formation of eco-tourism areas can be more sustainable, the risk of damage is more minor.

Reducing vulnerability: The development orientations of technical and social infrastructure have a direct impact on exposure to natural disasters. First of all, renovating and upgrading existing urban areas, poor residential areas in urban areas, on the one hand, creates the beauty, face and living quality of the residential regions, on the other hand, reduces the vulnerability of urban areas these objects and improve resilience as well as resilience when natural disasters occur.

Prepare, respond and recover: Urban planning is an essential tool for urban development management. A good plan that integrates disaster risk response helps urban authorities to relocate and resettle high-risk areas, indicating technical and social infrastructure works for service for disaster prevention, showing how to move to shelters in emergencies. A spatial orientation map also helps plan urban recovery and reconstruction when natural disasters occur.

Risk transfer and sharing: Located in the tropical monsoon climate, hydro-meteorological disasters are common in Vietnamese cities. Technical preparation planning, especially surface water drainage planning, is indispensable in urban planning. Solving to cut floods, slow floods, regulate flows, protect green corridors in urban areas, develop space systems for water storage, etc are forms of natural disaster transfer in different spaces.

V. CONCLUSION

In summary, in urban planning, to be able to implement the above-principled solutions, a "soft" approach in responding to natural disasters, using non-structural measures in combination with structural calculations. Through planning, urban design should be emphasized by efficiency, timeliness, and economy. In the planning design, it is necessary to link disaster prevention with spatial and land use planning, to reserve natural space for ecological services and green infrastructures such as climate regulation, flow, and balance between natural and urban systems. Besides, it is also necessary to rethink the approach in urban planning, construction, and management to deal with uncertain and unpredictable factors; improving resilience in the context of the urban development market is influenced by many factors with high uncertainty. Disaster prevention needs to be considered from the overall planning problem to the detailed design for each urban area. Each project in the direction of a flexible approach, respecting nature, relying on nature, and ensuring balance between protect-adaptation-retreat by the characteristics of each specific area, instead of trying to mitigate the impact of a

disaster by adapting and reducing damage, accepting the disaster if it does not cause any harm. But the above solutions aim to reduce vulnerability, reduce objects' exposure to natural disasters, and improve urban resilience.

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REFERENCES

- [1] Lao Cai province, “Statistic Year book” 2019-2022.
- [2] Ministry of Construction, 2015. Report on assessment of impacts of flash floods, landslides, urban flooding on infrastructure planning and population in Northern provinces and cities and Thanh Hoa.
- [3] IMHEN and UNDP, 2015. Vietnam Special Report on Disaster Risk Management and Extremes to Promote Adaptation to Climate Change (SREX).
- [4] Central Steering Committee for Natural Disaster Prevention and Control, 2018. Report on natural disaster prevention and control and key tasks in the coming time.