



Keywords

Adaptability,
Climate Change,
Community,
Natural Disasters,
Vulnerable

Received: May 26, 2017

Accepted: July 30, 2017

Published: September 8, 2017

Assessing the Vulnerability Due to Climate Change in Binh Minh Ward, Lao Cai City, Lao Cai Province

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Citation

Thi Hong Phuong Dang, Huu Tap Van. Assessing the Vulnerability Due to Climate Change in Binh Minh Ward, Lao Cai City, Lao Cai Province. *American Journal of Environmental Engineering and Science*. Vol. 4, No. 5, 2017, pp. 36-41.

Abstract

Climate change has been happening and therefore increasing not only the intensity and frequency of natural disasters but also many extreme weather phenomena. This leads to the intensified pressure on the located communities and urban infrastructure system in Lao Cai city, especially Binh Minh ward. Natural disasters and climate change is currently having strong effects on daily life and production activities of people at Binh Minh ward. Flash flood and landslide are two most frequently occurred disasters at Binh Minh precinct during the past few years. Aside from many disasters related to flash flood and Red river flood, citizens in this area also have to face with several other disasters such as whirlwind, severe cold, acid rain, prolong heat wave, ect... Agricultural productions sector and resettlement are two main groups which are most vulnerable due to climate change. These two groups mostly consist of low-income households without under developed infrastructure, therefore their adaptability to climate change are still limited.

1. Introduction

Climate change is becoming a threat that opposes to human progress and badly affect economic development – both in Viet Nam and throughout the world. Vulnerability to climate change is a function of sensibility to the climate variability and changes. Climate change is currently a topic of debate that is discussed not only within the physical science community but also by those in policy [6]. The effected is left to be vulnerable or unable to adapt to climate change's impacts. Farming resilience within a co-existence framework has other benefits, including conceptualizing it in ways that encapsulates the people-hazard interactions that occur when disaster strikes as catalysts for change [2]. Adaptive capacity to climate change is the ability of an entity (a local group, a community or a system) to cope and manage disaster risks related to climate change and reduce its own vulnerability. Adaptive capacity can be classified to main groups including: financial capacity, awareness and understanding; the quality of urban infrastructure and natural disaster prevention and control system; the quality of institutional apparatus [7]. Although the number of disaster varies from year to year, monetary damages seem to mount inexorably, even after accounting for inflation [1]. Lao Cai city is located in the headwaters of Red river and Nam Thi river

that originate from Yunnan China. The highly decentralized conditions, dense and compact river system, and the fact that this city is situated in a trough valley surrounded by mountains make it more vulnerable to the impact of climate change [10].

Binh Minh ward is the centre area of Lao Cai city. Along the urbanization process and expansion plan of Lao Cai city, Binh Minh has become one of several areas that undergone vigorous changes. Besides, Lang Chieng rice field here is currently the biggest granary not only in Lao Cai city but also in Lao Cai province. With more than 70% of labor force that focuses on agricultural activities, Binh Minh has been one of those precinct that suffers the most from impacts of climate change, natural disaster, flash flood, landslide and Red river flood [3, 4, 5, 9]. This affects seriously to the daily life and production activities of local community.

This study is going to present some results from research that seeks to assess the vulnerability to climate change, the adaptive capacity of local community and its infrastructure of Binh Minh ward, Lao Cai city. After that, it also suggests some solutions on disaster prevention and management here.

2. Methods

+ Method of data collection, secondary document: collecting all of relevant information and documents like legal documents related to climate change of the city/province, the development plans, planning for socio – economic development; the documents related to hydro meteorological, natural disasters and the information about environment resources of Lao Cai province in general and Binh Minh ward in particular.

+ Method of survey and field research: To conduct surveys on current status of infrastructure, road system, residential building, and factors that relate to the vulnerability to natural disasters.

+ Method of public feedback consultations [8]: In-depth Interviews with 13 households most affected by climate change in Binh Minh ward. Interview based the surveys: Investigating randomly 50 households in the whole ward to have an overall and integrated view of climate change.

+ Method of crop calendar: That's a method used a combination schematic between crop calendar and natural disaster calendar to consider the magnitude of impact of natural disaster to growing season. This calendar also show types of crop plant, timing of planting, reaping and occurring the natural disasters. Crop calendar also shows timing of planting or agricultural production activities affected easily by climate change.

+ Method of data processing and analysis: The data is collected and processed by Microsoft Excel 2010.

3. Results and Discussion

3.1. General Statement on Climate Change Impacts

Binh Minh was considered that one of areas affected seriously by Red river flood and flash flood, plus large of agricultural land (with 49,9ha of rice crop, 107ha of vegetable crop, 47ha of forestry land and 31ha of aquaculture). The damage by natural disasters imposed substantial costs in this locality, especially damage to crop yield, affecting seriously to the production activities and daily life of community. In addition, this ward is located at the Ngoi Duong stream valley, so this lead to occur flash flood caused the tremendous damage to people and property when there is heavy rain. In recently, at ward area, there are some ferocious weather phenomena was appeared like: whirlwind, damaging cold, acid rain, heat waves... damaged to vegetable crop quality and productivity.

Table 1. Synthesis of some kind of disaster and the extent of damage caused by natural disasters in the province, Binh Minh Ward in period of 2008-2015.

No	Year	Disasters causing major damage	The extent of damage		
			Directly affected Population (person)	Number of families forced to move	The land is being used is lost (Ha)
1	2008	Flash floods, landslides, damaging cold	12	4	
2	2009	Flash floods, landslides, prolonged hot weather	488	5	6,2
3	2011	Flash floods, tornadoes, frost	75	2	9,3
4	2012	Flash floods, tornadoes, thunderstorms	0	0	3
5	2013	Heavy rains, landslides	0	0	2
6	2014	Hot sun, heavy rain, flash floods	0	0	3
7	2015	rain, snow, tornadoes and lightning, floods, landslides	83	2	5,1
8	1/2016	rain, snow, tornadoes and lightning, floods, landslides	115	3	2

(Source: Synthesis Report of the Committee PCLB and TKCN, Binh Minh Ward, 2017)

Binh Minh Ward has been divided into 30 residential group of 3.2 The following table synthesis groups more affected by natural disasters in Binh Minh Ward.

3.2.3. In Terms of Infrastructure Quality

In recent times, the infrastructure works to support prevention and disaster risk reduction measures have been improved and upgraded, such as repairs, upgrades along the Hong river and Ngoi Duong river; new construction and upgrading of the drainage system for the entire ward, etc. But the judgment of the Provincial CFSC, this works only meet about 60% of actual needs. Some traffic works, public buildings were built, but not taking into account the factors of natural disasters should sometimes cause adverse effects such as change or prevent flood flows affect people's lives especially agricultural producers. The ward haven't separate water supply systems, which share a common water supply system for the city. So, to meet the needs of the whole ward area is limited.

To October 2016, the Lao Cai province has not warning system for flood, landslide warning signs (nonparticipating measure rainfall and water level gauging stations at Lao Cai). Binh Minh Ward still lacked the means of rescuing flood victims when natural disasters occur. Thus, when a disaster occurred, the risk of damage to people is still very large.

3.2.4. Institutional Capacity

Currently, Lao Cai province in general and in particular Binh Minh Ward has not been an organization formed specifically for the adaptation to climate change. In recently, the Steering Committee's response to climate change established of province is new within the framework of the project: Support to Lao Cai strengthening resistant to climate change and implementing the national target program coping with climate change in Lao Cai province. Opposition to the work of responding to climate change, organized system of flood prevention and search and rescue of Lao Cai has been formed from to ward and in operation for many years. Regulation activities and coordination mechanisms between the different levels and branches were quite clear and it isn't applied effectively.

3.2.5. On Policy, Planning and Planning

Annually, Binh Minh Ward always sticking program action plan implementing the national strategy on prevention, disaster mitigation and plan tasks of the province. This ward develops and implements current plans, plans consistent with its own characteristics. Recently, A climate change response plan was setup for Lao Cai province, including Binh Minh Ward also newly built and approved. On that basis, the wards were initially considered mainstreaming of disaster impact abnormalities in the design, build embankments systems, residential zoning areas along rivers, streams and areas at risk of landslides, flash floods, flooding, switch to switch to new resettlement areas; restructuring and crop and soil structure used in agricultural, material reserves and other resources to respond when a disaster occurs.

In addition, this ward have policies to help people recover from natural disasters, including support for the deceased, the injured, houses collapsed, depending on the level of damage, support for rice seeds poor agricultural development, food

assistance for poor households and policies.

3.3. Assessing the Disaster Forecast by Climate Change in Binh Minh Ward

3.3.1. Status Forecasting of Natural Disasters Caused by Climate Change Community Groups

- (1) Agricultural group: the ward has about 70% of the labor force mainly focuses on farming (rice cultivation, vegetables, flowers, fruit trees), livestock (cattle, poultry, aquaculture), forestry (plantation and forest protection). In particular, rice and vegetables accounted for the highest proportion, followed by livestock and finally forest. Due to the nature of livelihoods, agricultural communities often live in high-risk areas such as riparian Ngoi Duong river, Ngoi Dum river, low-lying areas along the Hong River. Besides, their production are also very sensitive to natural disasters and highly dependent on climate factors. These factors make the agricultural producer groups strongly affected by natural disasters such as damage to crops, plants and animals; the loss of human life and health, infrastructure such as buildings, furniture etc. According to statistics on the extent of the damage in recently, the flash floods, landslides and flooding as the most dangerous natural disasters, often occur in the rainy season of the year. Due to the terrain, the area of rice crops planted in riparian areas Ngoi Duong river, Ngoi Dum river such group 9, 12, and group 17 or 29 along the Hong River as group 30; mainly affected by flash floods, landslides and flooding, that group 12 and 30 are often affected by floods and combinations Hong River flood. Some production areas frequently affected by floods and flooding as the Village Chiang fields - Binh Minh Ward.

Adaptability: In general, agricultural producer groups have the capacity and very limited conditions:

- + Low income and unstable due largely dependent on livestock farming and livelihood while this very sensitive to weather, natural disasters.
- + Awareness and understanding of natural disasters, climate change as well as technical support for production is limited.
- + Infrastructure to support production and disaster prevention did not meet standards.

- (2) Commercial and service group account for about 21% of workers in the labor structure of the ward [3]. The impact of natural disasters such as floods general, landslides and flooding to this group may be mentioned are: washed away or damaged goods due to flooding; damaging house... but often the impact is not great. The adaptability of this group is higher than the community group of agricultural production due to higher income, good urban infrastructure, better access to information easier.

- (3) Resettlement group: include households (usually agricultural groups) must move to set aside land for housing projects for urban development and infrastructure in the ward or former residence is located in an area with high risk of natural disasters. Percentage of households to move due to urbanization accounted for most of the group resettlement and concentrated in Group of 6, 9, 12 and 30. This group organized under the impact of climate change primarily as floods, landslide landslides, flooding, cold weather damage.
- (4) Other population groups: can be understood as community groups living in the central area and not in the above mentioned group. Normally, this is the group of officials, workers and employees. Households in this group are concentrated in the center of the ward organization, it was not affected.

3.3.2. Situation of Calamity Due to Changes Climate Affect Change Infrastructure Projects Binh Minh Ward

Traffic: some online traffic in residential areas has not met the requirements, a suspension bridge spanning the Ngoi

Duong river has twice been washed away when floods (1971 and 2009). Some other areas have narrow roads along the rail, and the terrain is not flat (group 29 and 30), it make difficult for people to move back to the area, it is the most dangerous in the rainy season.

Irrigation: Locations mainly focused on agricultural activities but lacked irrigation system canals, water supply for limited production. Ward with 8 km full irrigation ditch irrigation. Some canals often overburden obstruct the flow, besides the construction of the canal route 30 regional organizations unreasonable, even against rowing difficult for dredging work, the canal canals become traps, the country was not on the production area (group 9). The Hong River systems, has not been built embankments to prevent erosion, the electrical system, which it can not meet the needs of the people.

House: on the ward still many families in difficult areas, houses aren't permanent, live in the vulnerable area due to the unusual weather phenomena.

Educational institutions, health care and social services: was built solidly, so it is less affected than.

Table 5. Consolidated vulnerable in Binh Minh Ward.

Type of disaster	Agricultural production	Traffic	Irrigation	Public construction	House	Medical station
Floods, erosion, soil erosion	+++	++	++	+	+++	+
Drought	++	-	++	-	-	-
Tornado	+	+	-	+	+	-
Frozen, Cold	+	-	-	-	-	+
Hot weather	+	-	+	+	+	+
Acid rain	+	-	-	-	-	-
Declining water quality	+		+			+

(Survey results)

- No impact;

+ Impact lightest level;

++ The impact on the average;

+++ The impact at the highest level.

3.4. Proposed Solution Enhance Climate Change

3.4.1. Means of Rescue and Communications

- (1) Provide shovels, life jackets, hand speakers, medicine bags for each locality ambulance at risk to suffer high risks.
- (2) Develop wireless radio station in the village clusters to be broadcast by loudspeakers to the people grasp the information quickly.
- (3) Skills training for community rescue and the rescue teams of Binh Minh ward.

3.4.2. Infrastructure

- (1) To renovate and upgrade water supply canals to Lang Chieng fields.
- (2) Dredging, widening the stream flow Ngoi Duong river ensure flood drainage capacity when rainstorms.
- (3) Develop stream Ngoi Duong river, Hong River dikes protecting populated areas.
- (4) Consider expanding regional road 29, 30 The rail adjacent to the company Apatit.

- (5) Provide clean water for the remaining residential areas (especially group 29, 30).

- (6) Equipped with an early warning system in the area floods Ngoi Duong river; the water-level posts at the foot of the bridge.

3.4.3. Other Measures

- (1) Water use savings.
- (2) Management of watershed protection forests.
- (3) Manage activities upstream discharge, control acid rain.
- (4) Research into new varieties applications, suitable for the conditions of climate change.
- (5) During the planning and construction of enhancing the integration and evaluation of disaster risk factors take into account the impact of climate change.
- (6) Enhancing the participation of the community in the construction of land use planning, economic development plans of the local society.
- (7) Pilot and replicate the model home with resistance to various types of natural disasters, storms and floods.

4. Conclusion

Climate change has been happening and therefore increasing not only the intensity and frequency of natural disasters but also many extreme weather phenomena. This leads to the intensified pressure on the located communities and urban infrastructure system in Lao Cai city, especially Binh Minh precinct.

Regarding natural disaster: Natural disaster and climate change have currently having the strong effects on daily life and production activities of people at Binh Minh precinct. Flash flood and landslide are two most frequently disasters at Binh Minh precinct during the past few years.

Regarding adaptive capacity:

- (1) The infrastructures: With the advantage of a new urban area, most of residential areas live along the Tran Hung Dao Boulevard and the newly planned routes invested to build the technical urban infrastructures, transport networks, schools in a synchronous way. The public works was judged by their ability to occur disaster risk, so the local flooding never happened and the drainage system is relatively ensured.
- (2) The finance: Binh Minh area are still largely focused to agricultural production, people's lives still face difficulties, poor households make up a high rate, so the response to climate change is still a worrying problem.
- (3) People's awareness: Intellectual level of people is quite equivalent, know about natural disasters and ready for the response when something goes wrong. However, due to the feature of people's production area, flood often come quickly and the response is impossible.

Regarding the vulnerable situation of communities: Agricultural production sector and resettlement are two main groups which are most vulnerable due to climate change. These two groups mostly consist of low-income households with underdeveloped infrastructure, therefore their adaptability to climate change are still limited.

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