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Impacts of extreme weather events in Bao Lam, Vietnam

With ideas for adaptation to climate change

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Sammanfattning

Klimatförändringen medför mer extrema väderhändelser som lokalsamhällen runt om i världen behöver anpassa sig till. I denna rapport beskrivs en studie av vilka effekter extrema väderhändelser får idag i syfte att utgöra en kunskapsplattform för framtida klimatanpassningsåtgärder. Området som studerats heter Bao Lam distriktet och ligger i Cao Bang provinsen i nordöstra Vietnam. Metoden som använts kallas Lokal klimateffektprofil (LCLIP) vilket innebar att uppgifter om nuvarande effekter av extrema väderhändelser samlats in med hjälp av lokal medierapportering och intervjuer med representanter för Bao Lams distrikt.

Totalt hittade vi dokumentation om 21extrema väderhändelser som orsakat skador och dessa kategoriserades. Det extrema vädret varierade; från värmebölja, torka, virvelvinder och hagel till kyla och kraftigt regn som orsakade översvämningar, ras och skred. Skadorna blev stora, från dödsfall och skadade människor och djur till skador på egendom och avbrott i kommunikation och transporter. Sådana effekter är allvarliga speciellt med tanke på att området behöver utvecklas även framöver då extrema väderhändelser blir vanligare i och med klimatförändringen. Undersökningen visar också att kvinnor och män påverkas olika av extremt väder, bland annat p.g.a. att arbetsfördelningen mellan könen varierar.

Idéer till framtida klimatanpassning presenteras, baserat på vad som är känt om distriktets ambitioner, relevanta klimatscenarier och effekterna av extremt väder idag. Medan det redan finns en effektiv krishanteringsorganisation i distriktet, saknas för närvarande framförhållning vad gäller klimatanpassning, och existerande planer behöver uppdateras med åtgärdsförslag. Vissa sådana förslag presenteras för sektorerna utbildning, jord-och skogsbruk samt infrastruktur.

Nyckelord: Klimatanpassning, lokal klimateffektprofil, LCLIP, extremt väder, Vietnam

Summary

Climate change means more extreme weather events to which local societies around the world will have to adapt. This report describes a study of the impacts of extreme weather events today, conducted with the aim of providing a platform for climate change adaptation in the future. The study area was the district of Bao Lam, in the province of Cao Bang in north-eastern Vietnam. The method used was Local Climate Impacts Profile (LCLIP) and data on the current impacts of extreme weather in the district were collected by a media trawl and through interviews with representatives of Bao Lam district authorities.

In all, data on the impacts of 21 extreme weather events were collected and categorised. These events ranged from heat, drought, whirlwinds and hail to cold spells and heavy precipitation leading to flash floods and landslides. Damage was substantial, ranging from loss of lives and injuries to damaged private and public property and interrupted communications systems. Such impacts are serious in view of the need for socio-economic development in the district at present and increasingly so in the future with more extreme weather. The survey also showed that extreme weather today affects men and women differently due to e.g. differences in division of labour.

Ideas for future adaptation actions are presented based on what is known about the district's ambitions, local climate change and impacts of extreme weather. While there already is an effective rescue organisation in the district, pro-active adaptation measures are currently lacking and should be included in future plans. Within the fields of education, forestry, agriculture and infrastructure, some such measures are proposed.

Keywords: Adaptation, climate change, LCLIP, local level, extreme weather events

Contents

Foreword

This report presents the results of a project sponsored by Sida (Swedish International Development Cooperation Agency) in Hanoi, Vietnam, within a funding mechanism called Partner-Driven Cooperation. In the project, which was collaboration between the Vietnamese NGO WARECOD (Centre for Water Resources Conservation and Development) and the Swedish research institute FOI (Swedish Defence Research Agency), two climate change adaptation tools were applied in two districts in the Cao Bang province in north-eastern region of Vietnam. These tools had previously been developed and used at the local level in Sweden and the UK, but this was the first time for them to be applied outside that context.

A Local Climate Impacts Profile (LCLIP) and Socio-Economic Scenarios obtained using the two tools resulted in two different reports targeted at the authorities in Bao Lam and Nguyen Binh districts. This is the report from Bao Lam. In order to carry out our investigations, close collaboration with the authorities in Bao Lam was required and we appreciate their cooperation. In particular we want to thank Mr. Nguyen Duy Lai - The Chairman of the People's Committee, Mr To The Lanh - The Vice Chairman of the People's Council, Mr. La Hong Quang - The Vice Director of the Natural Resources and Environment Division, Mr. To Van Hung - The Vice Director of the Agriculture and Rural Development Division, Mr Anh Văn An - The Vice Director of the Planning and Financial Division, Mr. Mong Van Tue - The Director of the Trade and Industry Division, Mr. Nong Van Phuong - The Director of Labour, Invalids and Social Affairs, Ms. To Thi Duyen - The Vice Chairwoman of the Fatherland's Front, Mr. Dam Van Can - The Director of the Forest Agency, Mr.Nong Ich Cau - The Vice Secretary of Youth Union, Ms. Mong Thi My - The Head of the Statistics Office, Mr. Nong Hai Chau - The Vice Chairman of the Farmers' Union, Ms. Luong Bich Hoan - The Chairman of the Women's Union, Mr. Doan Van Tot - The Director of the Agriculture Extension Station and Mr. Luc Van Tra–the Education Division. We also want to thank all the persons from Bao Lam who commented on a draft version of this report and who attended a seminar where the draft was presented and commented upon.

The contents of this report are the sole responsibility of the authors. The report is also available in Vietnamese.

1. Introduction and aim

Climate change is considered one of the greatest challenges that humankind is facing at present. In recent years it has become apparent that climate change, including more extreme weather events, will affect every country on earth, regardless of efforts to reduce emissions of greenhouse gases. This is because the large amounts of such gases already emitted have a long-life time in the atmosphere. In addition, emissions continue to increase, giving little hope of stabilising the global temperature increase at 2 degrees C above pre-industrial levels, a goal that has been embraced by the international community. Instead, larger changes in climate are foreseen, with so far poorly understood consequences.

Although the historical responsibility for emissions of greenhouse gases is not distributed equally among nations and societies, a changing climate affects all. Adaptation to climate change, which has been defined as "a process by which strategies to moderate, cope with and take advantage of the consequences of climatic events are enhanced, developed, and implemented" by the United Nations Development Program[1], is therefore starting to take off in societies around the world. Local authorities play a crucial role in this, because it is at the local level that increasingly hot weather, stronger winds and more intense precipitation will be experienced. Thus local authorities will have to deal with more patients at the local hospitals, more compensation being paid to residents for damage to houses and crops and a greater need for repair to roads and other infrastructure due to landslides and flooding.

In Vietnam, climate change adaptation at the local level is in its infancy, as it is in many other parts of the world. Because of this, a project was launched in 2012 to help start up this work by applying two tools for climate change adaptation previously used only in European municipalities. In this report we describe the use of one of these tools, Local Climate Impacts Profile (LCLIP), which was applied in the district of Bao Lam, located in the province of Cao Bang in north-eastern Vietnam and bordering China.

The report is structured as follows:

- Chapter 2 presents some facts about land use and socio-economics in Bao Lam and a summary of future development plans and the future climate.
- Chapter 3 contains a description of the LCLIP method and how it was applied in Bao Lam.

[1] See more at: http://www.vcccar.org.au/climate-change-adaptation-definitions#sthash.7JgMvfx0.dpuf

- Chapter 4 presents the results obtained using the method, i.e. impacts of current extreme weather events are analysed.
- Chapter 5 discusses possible adaptation ideas in the light of climate change.

2. Background

2.1 Bao Lam-a description

The following text is based on the publication *Land Use Project up to 2020 and Land Use Plan for 5 years (2011 - 2015)* issued in 2011 by the People's Committee of Bao Lam District, and on the authors' own impressions during visits to the district in 2012/2013.

Bao Lam is a highland district located within the region of Cao Bang in north-eastern Vietnam with ambitions to have high economic growth rate during the coming decades (14% per year 2011-2020), accompanied by development of infrastructure (e.g. irrigation, roads and electricity), a more diversified economy, more industrialisation, improved living standards, less poverty, more jobs and encouragement of the cultural identity of minorities. This will be achieved by mobilising the strengths of the district and by attracting funds from provincial and central government. At the same time, this development must consider that Bao Lam borders China.

Bao Lam currently has 56,943 inhabitants (2010) and covers an area of 91,206 ha, of which 79% is used for forestry and 2% for arable purposes (People's Committee of Bao Lam District, 2011, p. 33-34). The district has 14 communes and has demonstrated impressive growth recently (10-11% per annum during 2005-2010), with positive changes in both infrastructure and economic performance. Nevertheless, the challenges are still numerous. The topography, with numerous mountains and valleys intercepted by rivers, streams and creeks, renders development of infrastructure such as roads and electricity costly. The terrain also means that flat areas suited for intensive farming are few and that the district is vulnerable to erosion and landslides. About 64% of households lived below the poverty line in 2010 (People's Committee of Bao Lam District, 2011, p. 17) and most inhabitants today depend on small-scale agriculture. However, there is potential for extended mining and forestry and agriculture can also be developed. Examples of metals present in the district are gold, antimony, zinc, lead and copper. The main agricultural crops are rice, corn and soybean, while animal husbandry of cows and pigs is common. In the forests, species such as mahogany, teak and bamboo can be found. Current plans are to increase forest cover by planting trees on bare land and other land not suitable for farming.

The climate in the Bao Lam region consists of four seasons that differ in terms of rainfall and temperature. During winter, which lasts from late November to the last week of March, agricultural non-irrigated land usually becomes dry and cold spells, including frost, occur in high mountain areas, causing difficulties for farmers and livestock owners. The monsoon starts in April and lasts until September-October and the summer season lasts from late May to mid or late

September. During this period, the average temperature is 26 degrees C and 85% of the annual precipitation of 1,200-1,400 mm falls, with August being the wettest month. During the monsoon season, erosion and landslides on steep slopes are common and are exacerbated by deforestation by farmers.

Land is considered a valuable resource, according to the People's Committee of Bao Lam District (2011). Industrial development is the main focus up to 2020, and land is being set aside for this purpose. In agriculture, cultivation can be extended, new varieties (e.g. of fruit trees and high-yielding rice) can be introduced and the irrigation system, now covering just 40% of agricultural land, can be extended in order to allow cultivation also during the dry season. There are also plans to develop livestock farms in relation to processing enterprises. There is potential to manage forestry, including increased protection of existing forests, regeneration of forests and creation of new forests. New forests should be developed in order to provide raw materials for the paper, glue and laminate industries. Some land will also be used for building new hydropower stations, but land for new urban development must not intrude on paddy fields. All in all, this extended and improved use of land is expected to contribute strongly to better socio-economic conditions for the population, including better health, employment opportunities and education.

2.2 Climate change in Bao Lam

In this section climate change scenarios relevant for Bao Lam are presented, while an explanation of the relationship between weather and climate is given in Appendix 1. With climate change, extreme weather events such as e.g. heat waves, dry spells and intense precipitation will become more common, while others, such as very cold days, will be rarer. However, how extremes develop is difficult to predict, so climate change scenarios are usually presented as annual and seasonal changes in temperature and precipitation only. With further development of science, however, more will be known about the exact nature of extreme events.

Over and over again, Vietnam is ranked among the top countries in terms of risks of impacts from climate change. Most often this has to do with the fact that a large proportion of the population is living in low-elevation coastal zones. Another highlighted risk in Vietnam is tropical cyclones (Imamura and Dang Van To, 2007).

These warning signals have triggered interest within Vietnam in further investigating the issue. In 2009 the Ministry for Natural Resources and Environment in Vietnam published official climate scenarios for the period 2020

to 2100 (MONRE, 2009). [2]The ministry's scenarios are based on three different levels of future emissions of greenhouse gases, one low emissions scenario (called B1 in the IPCC terminology, see Nakicenovic et al. 2000), one medium scenario (B2) and one high emissions scenario (A2). Hence the projections, i.e. the climate scenarios, depict three different levels with regard to future climate change. Information regarding changes in temperature and precipitation are provided for Vietnam's seven climate zones (Bao Lam is located in the north-east zone). Table 1 shows the expected changes in temperature until 2100 for these seven zones.[3]

Table 1: Changes (increases) in mean annual temperature in Vietnam by 2100 relative to the period 1980-1999 for three levels of greenhouse gas emissions: low (B1), medium (B2) and high (A2)

	B1 (low)	B2 (medium)	A2 (high)
North West	1.7°C	2.6°C	3.3°C
North East	1.7°C	2.5°C	3.2°C
North Delta	1.6°C	2.4°C	3.1°C
North Central	1.9°C	2.8°C	3.6°C
South Central	1.2°C	1.9°C	2.4°C
Central Highlands	1.1°C	1.6°C	2.1°C
South	1.4°C	2.0°C	2.6°C

As Table 1 shows, there are great differences between the different emissions scenarios. The increase in temperature for the high (A2) scenario is almost double that in the low (B1) scenario. This reflects the huge uncertainty surrounding climate change. Table 1 also indicates that the northern part of Vietnam will experience the most severe increases in temperature.

Table 2 shows the expected changes in annual precipitation from the period 1980-1999 until 2100 for the three scenarios. For all regions and for all

[2]Since the completion of this project it has come to our knowledge that there are now updated climate scenarios at the province level.

[3] The climate scenario based on medium emissions levels of greenhouse gases (B2) was used in a report on climate change and its potential effects in the Cao Bang region, initiated by the Cao Bang People's Committee and published by its Department of Natural Resources and Environment in coordination with other concerned agencies (Cao Bang People's Committee, 2011).

scenarios, an increase in precipitation is expected, but the most severe changes are expected to take place in the northern regions.

Table 2: Changes (increases) in annual precipitation in Vietnam by 2100 relative to the period 1980-1999 for three levels of greenhouse gas emissions: low (B1), medium (B2) and high (A2)

	B1 (low)	B2 (medium)	A2 (high)
North West	4.8%	7.4%	9.3%
North East	4.8%	7.3%	9.3%
North Delta	5.2%	7.9%	10.1%
North Central	5.0%	7.7%	9.7%
South Central	2.2%	3.2%	4.1%
Central Highlands	1.0%	1.4%	1.8%
South	1.0%	1.5%	1.9%

Concerning seasonal changes, this is shown in Table 3 for the North East region, where Bao Lam is located.

Table 3: Mean temperature change (increases) in the North East region of Vietnam relative to 1980-1999. In cases with an interval, the lower figure represents the low emissions scenario (B1) and the higher figure the high emissions scenario (A2).

	2030	2040	2050	2060	2070	2080	2090	2100
Dec-Feb	0.9°C	1.2°C	1.4-1.5°C	1.7-2.0°C	1.9-2.3°C	1.9-2.8°C	2.0-3.3°C	2.0-3.8°C
Mar-May	0.8°C	1.1°C	1.4-1.5°C	1.6-1.8°C	1.7-2.1°C	1.8-2.6°C	1.8-3.0°C	1.8-3.5°C
Jun-Aug	0.5°C	0.6-0.7°C	0.8°C	0.9-1.0°C	1.0-1.2°C	1.0-1.5°C	1.1-1.8°C	1.1-2.1°C
Sep-Nov	0.7°C	1.0-1.1°C	1.3°C	1.4-1.7°C	1.6-2.1°C	1.7-2.4°C	1.7-2.9°C	1.7-3.4°C

Table 3 clearly shows the huge seasonal variations expected. For example, while the winter temperature (Dec-Feb) is expected to increase by 2.0-3.8°C, the summer (Jun-Aug) temperature is only expected to increase by 1.1-2.1°C by

2100. Less variation between summer and winter is thus one aspect of climate change in the Bao Lam district in the long run. For 2030, however, differences between temperature increases in seasons are small. The projected changes in precipitation are shown in Table 4.

Table 4: Mean change (increases and decreases) in precipitation in the North East region of Vietnam relative to 1980-1999. In cases with an interval, the lower figure represents the low emission scenario (B1) and the higher figure the high emissions scenario (A2).

	2030	2040	2050	2060	2070	2080	2090	2100
Dec-Feb	1.1%	1.6 – 1.5%	1.9%	2.1— 2.4%	2.3— 3.0%	2.5— 3.5%	2.5— 4.2%	2.5— 4.9%
Mar-May	-1.3%	-1.8— -1.7%	-2.2%	-2.4— 2.8%	-2.7— 3.4%	-2.8— -4.1%	-2.9— -4.9%	-2.9— -5.6%
Jun-Aug	3.7%	5.1— 4.9%	6.6%	7.1— 7.9%	7.8— 9.8%	8.1— 11.8%	8.3— 13.7%	8.3— 16.1%
Sep-Nov	0.9%	1.2%	1.5%	1.7— 1.9%	1.9— 2.4%	1.9— 2.8%	2.0— 3.3%	2.0— 3.8%

The most severe changes are expected in the summer and seasonal variations in precipitation will become even more important than today in the future. While the figures given in Table 2 for the period up to 2100 show an increase in precipitation from 4.8% (low scenario) to 9.3% (high scenario), Table 4 shows this to be divided into a *decrease* in spring precipitation and a substantial increase in summer. This aspect of climate change in the Bao Lam district, i.e. increased seasonal variations, is very important to take into account in climate change adaptation planning. As precipitation increases, high rainfall intensity is also likely to become more common.

In order to produce more relevant data for districts such as Bao Lam, the Vietnam Institute of Meteorology, Hydrology and Environment (IMHEN) and Hanoi University of Science (HUS) in collaboration with Australian scientists, are currently developing a new set of climate change scenarios for Vietnam.[4] In this work, high-resolution projections for various regions in Vietnam will be

[4] See csiro.au/en/Organisation-Structure/Flagships/Climate-Adaptation-Flagship/Vietnam-Climate-Projections-Project.aspx

produced. An important part of the project will be a number of outreach activities in order to disseminate the results of the project.

3. Method

3.1 Local climate impacts profile (LCLIP) in UK and Sweden

The LCLIP tool for climate change adaptation was developed in the UK for promoting the understanding of current vulnerability to weather and climate in an organisation, thereby catalysing further awareness and action (UKCIP, 2009). Furthermore, the LCLIP is reported to demonstrate the extent to which the authority, community or organisation is prepared and able to respond now (UKCIP, 2012a) and this makes the tool useful with respect to the development of planning policies. The procedure for performing an LCLIP includes the following four steps:

1) *Project planning*, which includes the purpose of the LCLIP (e.g. "take a first step into adaptation activity"), the scope (e.g. geographical area or how far back in time information will be collected), the outputs (e.g. a report) and the personnel available.
2) *Building a database* about extreme weather events, impacts and responses. Information can be found in the local media (media trawl) or departmental records about e.g. emergency responses to weather-related incidents, or other departmental information related to this, such as costs and disruption time.
3) *Data analysis*, which includes interviewing relevant local authority officers about issues such as events, costs, significance and responses.
4) *Outcomes and an agenda for further work*, which includes sharing findings with relevant officers, producing LCLIP outputs and sharing messages, and circulating a summary report.

On the LCLIP website (UKCIP, 2012b), information on case studies in the UK is available (about one page each),while for Sweden there is documentation on case studies in Carlsson-Kanyama and Blennow, (2013). Judging from this information, each LCLIP is tailored to the municipality in question. Some, but not all, studies have included a media trawl, for example, and some, but not all, have included interviews. Some of the LCLIPs were carried out by students, some by external researchers and some by the municipal officers themselves. Challenges when applying LCLIPs in Sweden have been analysed and include finding articles for the media trawl and involving women and representatives of non-technical departments. Municipalities in Sweden appreciated the results from the LCLIPs because it gave them a cross-departmental overview of their weather-related vulnerabilities. The LCLIP was considered a good tool mainly for beginners in climate change adaptation and was used e.g. as input to the comprehensive plan (Carlsson-Kanyama and Blennow, 2013).

3.2 Applying the LCLIP in Bao Lam

The first stage in the LCLIP, *Project Planning* (see above), was partly carried out in Bao Lam District during August 2012, when staff from FOI and WARECOD met with representatives of the district authorities to discuss possibilities for collaboration. FOI staff described how an LCLIP is carried out, the potential benefits to the district authorities and the resources required in terms of staff hours from the district. The district agreed to participate and to have the results presented in a report. The representative from the district emphasised that the report should focus on Bao Lam, thereby indicating that general information on e.g. adaptation to climate change was less relevant. The rest of the project planning phase was carried out during autumn 2012 and spring 2013, when interviews with key personnel from the district were conducted by WARECOD in collaboration with FOI and where local newspapers were searched in the media trawl.

The second stage of the LCLIP, *Building a Database*(see above), was carried out partly by conducting a media trawl using a regional newspaper, Cao Bang News, where a search was made for articles about the impacts of extreme weather events in Bao Lam (a list of the 20 items were compiled). We found no other newspaper that could be used. This trawl went five years back in time, thus covering the period 2008-2012, and was carried out by staff at the Cao Bang News office. Headings in the database were:

- Page in the newspaper
- Date of publication
- Type of event
- Damage
- Rescue team and actions taken
- Value of the damage/recovery
- Days of recovery

As a complement to this information, interviews were carried out in Bao Lam during April 2013 with a total of 16 representatives from the district. These interviews were conducted by staff from FOI and WARECOD in two teams, with one representative from each organisation in each team. During the interviews, several of the representatives listed extreme weather events and their impacts in terms of deaths and economic losses, which added to the information about impacts of extreme events in Bao Lam district collected during the media trawl.

The third stage, *Data Analysis* (see above), was conducted mainly in April 2013 as mentioned above, when 16 representatives of the district were interviewed (a list of the interviewees is included in Appendix 2). Notes were taken during the interviews and transcribed later. The interviewees were asked to what extent they remembered extreme weather events such as heat waves, cold spells, heavy rain and flooding, and strong winds and to elaborate on the impacts those events had had on the district, what had been done to repair damage, and also to some extent what could be done in the future, given that some of these events may become more common with climate change. An innovation compared with how LCLIP has been used in the UK and Sweden was that a specific question about whether impacts differ between women and men was asked in Bao Lam. During the data analysis stage, various planning documents for Bao Lam were also examined in order to increase the understanding of the district.

The fourth stage, *Outcomes and Agenda for Further Work*, took place during summer/autumn 2013, when this report was written by FOI and WARECOD and presented to Bao Lam district. The stage *Agenda for further Work* is not covered in this report which however hopes to give the foundation for developing such an agenda by the district itself. During the report writing phase, we synthesised results from the media trawl and the interviews and tried to draw some conclusions for the future based on current vulnerabilities, societal ambitions and natural conditions, as well as climate change scenarios. A draft version of this report was presented in Bao Lam district in September 2013, and an evaluation was carried through a questionnaire that was filled out by 14 respondents, see Appendix 2 for questions and results. During a seminar where the draft report was presented, also in September 2013, comments and suggestions were also collected and all were considered in the final version of the report (this version). .

4. Impacts of extreme weather events and how they are counteracted today

In this section, we combine material collected during the media trawl of the Cao Bang News with material collected during the interviews (see section 3.2) and suggestions made during a seminar (see section 3.2) . The text is structured according to weather type. An observation made by the interviewees is that since 2005, disasters such as landslides and flash floods are occurring every year and that extreme weather events such as whirlwinds and droughts are happening more frequently. Their impacts can be both great and small. Examples of drought impacts during the past years are that it is impossible to cultivate in some areas during the dry season, that spring crops have to be delayed until June and that this reduction in cultivation is leading to poverty.

Another observation is that extreme weather affects women more than men. However, men do more work during the recovery phase and are more exposed at that stage. The explanations given for these gender differences are several, one being that women are the main labour source in families and they have to earn money and carry out production activities (collect water for irrigation and cattle) and take care of children even during drought, heat and heavy rains. This is most pronounced among the minority people living in the district. Another explanation is that women are weaker than men, resulting in e.g. it being more challenging for a woman to cross a river than for a man. Only 60% of women in the study region know how to swim, compared with 90% of men. One interviewee stated that "For the Vietnamese men nothing is impossible. They are strong!" as a way of perhaps explaining why women are more vulnerable than men to extreme weather events.

A third observation made by the interviewees was that minority people, who often live high up in the mountains and who cultivates on steep slopes with small possibilities for irrigation, are more vulnerable to extreme weather than others. Examples are cold spells which are more severe in the mountains, heavy rains which may cause landslides on sloping land and droughts that impact those without irrigation to a larger degree than those with access to water.

4.1 Heat

No records of problems related to heat were found in the media trawl, but during the interviews the following event was reported:

- During *May to September 2012* it was very hot, up to 40 degrees C, resulting in problems for children with a long distance, 5-7 km, to walk to and from school. The homes of some children were also too hot,

affecting homework. This is because there are two communes in the district without electricity and therefore use of fans is not possible, including in the schools in those communes. In such schools the teachers also suffer, affecting the quality of teaching. Measures taken already include giving financial support to some families to buy umbrellas for the children (in order to protect them from the rain and sun), but it is unclear whether the funds are actually used for this purpose.

4.2 Strong winds and hail[5]

- In *March 2013* there were strong winds and hail during the night (the size of hen eggs, 6 cm long!!) that damaged roofs, e.g. of a primary school, and caused a teacher's house to collapse. These school buildings were repaired the same day by the teachers and the villagers and no school day was lost. Fortunately, the hail came in the night when people and cattle were indoors; otherwise worse damage would have occurred.

- In *July 2010* whirlwind and hail caused damage amounting to more than one million VND. The roofs of 870 houses were damaged, of which four were completely blown away. About 17,000 ha of maize were also damaged and two buffaloes died. Local authorities established checking delegations that visited the households in the affected areas in order to estimate the damage and provide support. Local people who were less affected helped the storm victims to repair their houses.

- In *May 2010* over 550 houses had their roofs blown away due to whirlwind in combination with heavy rain. Over 20 houses collapsed and five teacher's rooms and one cultural house were severely damaged. District and commune authorities helped in the recovery. The Youth Union mobilised young people, who helped people to clean up mud and in some cases to move.

- In *August 2008* a whirlwind hit two communes in the district (Thach Lam and Quang Lam), damaging the houses of many local people. Two houses collapsed and 37 houses had half or more of their roofs blown off. Three teacher's houses lost their roofs and a wall was cracked for 4 metres. In response to this event, representatives of the Flood and Storm Committee and the People's Committee went to the affected areas to

[5]It has been pointed out to us the damage costs for hail and strong winds are too low but we lack other information about that than the one presented here.

mobilise people. Villagers whose houses had collapsed received 3 million VND each and those with houses where the whole roof had disappeared received 2 million VND each.

4.3 Cold spells

- In *January to February 2013*, there was a cold spell with snow in the Vinh Quang commune. The cold killed buffalos and cows and 3 billion VND were paid in compensation to farmers.

- During *November and December 2012* it was quite cold for several weeks, with a minimum temperature of 4 degrees C. This low temperature caused problems for some schoolchildren who could not walk to school because they had no clothing that could protect them from the cold. In the high mountains, children missed two weeks of classes because of this. Once the children came to school, temperatures were not a problem because the classrooms became warm enough once the windows and doors were closed. In order to compensate for the loss of time at school, classes were taught in the weekends once the cold period was over, but not all children attended.

- In *January to March 2009*, there was a cold period accompanied by light rain lasting about 45 days. The temperature fell as low as below 5 degrees C, while the maximum temperature was only 15 degrees C. Snow and frost occurred in high mountain communes such as Vinh Phong, Yen Tho, Nam Quang and Nam Cao. Severe damage occurred: more than 2000 cows, buffalos and horses died and crops like maize, upland rice, wet rice, cassava, soybean and sweet potato were destroyed. Economic assistance was given to the affected households by the authorities. For buffaloes less than 12 months old500,000 VND each were paid out, while for buffaloes aged 12-24 months the corresponding sum was 1 million VND and for buffaloes older than 24 months it 1.5 million VND was given. Fertilisers and seeds were given to households, who also received thick cloth in order to make walls for their buffalo huts. Additional assistance was provided to poor households, with fibro cement sheets for roofing and to rebuild or build cattle huts.

- In *2008* there was a cold spell, resulting in the death of many cattle. As a result of this, the Farmers' Union encouraged people not to take their cattle out when it is too cold, but to leave them indoors and store food for them.

4.4 Heavy rains and flooding (resulting in e.g. landslides)

- In *July 2012*, heavy rains caused flooding whereby a bridge on road 34 after near Pac Miau town was inundated by 1.5 to 2 metres of water, causing traffic jams. Many roads were also affected by landslides and flooding and people could not get through.
- In *May 2012* a major flood swept away one house and damaged many crops (Yen Tho commune). The Steering Committee for Flood and Storm Control and the Search and Rescue team from Cao Bang evacuated local people, calculated damage and helped local people restore buildings. During this time, five days of rain, hail and whirlwinds caused flooding and landslides in many areas.
- In *May 2010*, heavy rain and whirlwinds caused damage to the whole province of Cao Bang, with Bao Lam being one of the worst affected districts. Four people were injured, 658 houses had their roofs blown off and 11 schools were damaged.
- In *July 2009*, diluvial rain (rain that causes floods) made Bao Lam totally isolated, as road 34 was blocked by landslides with 10,000 m^3 of soil and rock. Many local people's houses were also affected by landslides as well as a school (in Duc Hanh) where tables were also destroyed. Bao Lam also had a lengthy power cut and 400 ha of maize and rice were silted up with soil. 105 households needed to be resettled and 202 houses were inundated. Three people died in this event, two people went missing and two people were injured. Representatives of the district mobilised the police, the military and the local armed forces to evacuate people from risky areas. A large number of people, several thousands, were mobilised to fix the roads in the district and the commune mobilised parents to repair the schools. The district supported households where someone had died with 3 million VND per person. The Fatherland Front Committee at the provincial level supported those whose houses had collapsed with 5 million VND each. The Committee also supported households where someone had died, gone missing and was injured. In total, the sum paid out for this purpose was 10 billion VND. Other organisations that helped to pay for the damage were Tuoitre Newspaper, Young Enterprise Association and the Youth Union of the Provincial Police.
- In *July 2009* heavy and long-lasting rains caused many landslides and the high discharge in the rivers (originating from China) caused many inundations, where e.g. the water covered the main national road (road 34) for about 24 hours, stopping traffic from going through. Electricity

and telegraph poles fell down, thus interrupting communications for half a day. Three people died, 2 went missing, and 2 were injured while sleeping. 27 houses collapsed in the early morning due to the rain lasting overnight, 223 houses were impacted and the most affected ethnic groups were the Hmong people living on the hillsides. The district supported households living in areas damaged by landslides to reclaim land elsewhere. Households were also given money for buying fibro cement sheets for roofing and for maize cultivation.

- In *October 2009*, several communes were hit by rain, whirlwind and flash floods, whereby two houses collapsed and needed to be moved to another site. The Gold Heart Fund supported the affected communes with material for education.

- In *2008* there was a landslide whereby a whole village in Duc Hanh commune had to be resettled permanently. New roads and other infrastructure were built for this village, such as electric lines, water, a cultural house, kindergarten and roads. A lot of volunteers, even from provincial Youth Union, came to help. People were very happy with the solution given the circumstances; a success story.

- In *July 2007*, heavy rain lasting for two uninterrupted days led to flash floods that damaged roads and houses, as well as causing fallen trees. The communes mostly affected were hillsides in Thach Lam, and Nam Cao. 2-3 persons were killed and the total losses were estimated to more than 20 billion VND by the district.

- In *July 2004*, there was a major flood caused by heavy rains that damaged trees, crops and houses (some houses floated away) and that caused landslides, thus damaging farm land. In some cases borders between farms disappeared. 7-8 people were killed and the most severely affected communes were Thach Lam, Nam Quang, and Nam Cao. The District People Committee organised a task force to access the damage sites and check the damage and to take measures for restoration. These measures included: information to the affected inhabitants and assistance to the affected households with food (e.g. one box of instant noodle), food stuffs, blankets, mosquito nets, fertilisers, seeds and young cows. Borders between farmlands were re-established as there were good maps available. Destroyed farmland was compensated with 5 million VND per ha and the repair took months. The households that were located at risk of more landslides were provided with about 20 million VND for moving and were given fertilisers and seeds to cultivate in the new places. Beside the district's support, assistance was also provided by other donors such as the Farmers' Union, which provided

labour, rice and maize, and the Fatherland Front, which raised funds for the affected, such as one day's salary from all officials. The rescue and support operations faced several challenges due to the poor communication facilities in the district. For example, it took the district missions two days to reach the affected areas.

4.5 Drought

No reports of drought-related impacts were found in the Cao Bang News, but during the interviews the following events were reported:

- In*July to September 2012*, there was little rain, affecting crop production negatively.

- During *January to April, 2012* there was small and only scattered rains, resulting in too little water for irrigation. The impacts were severe: the maize seedlings died at the two-leaf stage and there was not enough drinking water in all households, with the result that some households had to carry water from the lowlands. Cattle were affected as well, due to reduced grass yield. Fortunately there were no forest fires, owing to good propaganda and application of forest fire prevention and control measures. The district helped households by educating them about growing grass of a certain species for cattle (*voi*), storage of grass including fermentation and using banana stems for feed. At first people had doubts about these new practices, but they have now become accepted. The *voi* grass can be harvested every three months and then fermented, and 50% of households are now doing this. However, the cost of the plastic wrapping is somewhat prohibitive and it has to be ordered in advance.

- In *January to April 2010*, there was drought as rains were few and limited during the whole period. At the same time it was unusually hot, with temperatures around 30degreesC during the Tet holiday (normally late January or early February) and 35-37 degrees C from March. As a consequence, streams and other water sources nearly dried up, including the cracks in the mountain sides where groundwater usually surfaces. That meant that local people in the mountains had to walk far to get water for activities such as cattle rearing. Crops failed to grow because of the dry weather and irrigation failed. The district helped affected farmers with fertilisers and seeds for the next cropping season and some households were given rice. The Fatherland Front advised people to cultivate crops with short rotation periods, such as soya bean.

5. Possible adaptation options given more extreme weather events in the future

In this section, we combine material presented about Bao Lam's future plans (section 2.1) with what is known about the future climate in the district (section 2.2) and add knowledge and insights acquired during the media trawl and interviews (section 4) with our own interpretations and the comments that were given to the draft version of this report. The text is structured according to activity.

5.1 General impressions

An overwhelming impression from the material collected during the interviews and the media trawl is that the Bao Lam district is very hard hit by extreme weather already today and that this weather causes loss of lives, illness, discomfort, hunger and loss of property for the inhabitants of Bao Lam. Given that future climate change with more extreme weather will hit a district in great need of socio-economic development, measures to lower the impacts of future extreme weather events should be taken very seriously.

Another overall impression from the material is that Bao Lam district today has a rather efficient rescue organisation that can respond to extreme weather events even in the future, given ample resources. The Flood Prevention and Control Board under the District People's committee (DPC) plays a key role here and provides a platform for cooperation between different departments. However, the board already today lacks resources such as communication radios, boats, life-jackets and fire trucks. For fire-beating, so far the only available equipment is tree branches!

In terms of planning, strategies for adapting to climate change seem to be in their infancy in the district, and it seems to be in this area that efforts are most needed at present.[6]In other words, pro-active climate change adaptation is needed to complement the existing reactive system. For this pro-active phase to occur, education and information are highly needed according to several informants, who need to know more about climate change before being able to use their specific competences in a comprehensive and forward-looking climate change adaptation action plan. As pointed out during the seminar, the authorities need to

[6]For Cao Bang province there is however a plan for adaptation developed in 2011. SeeCao Bang People's Committee, 2011.

become much more aware of climate change in order to successfully include such considerations in their socio-economic plans.

Another overall impression which forms the basis for a recommendation is that information about extreme weather events, their costs and damage, is not kept by any department in a comprehensive manner today. This makes it difficult to appreciate the total costs of such events and therefore to prioritise and evaluate actions for the future. However, the Statistics Office in Bao Lam has expressed an interest in keeping such a register, given that other offices and departments collaborate and that they are educated about climate change. Regarding access to good maps of the district, the military possess those already today, but are hesitant to share this information with district divisions for security reasons. This may be an obstacle to successful adaptation of the district. Another obstacle is the current poor communication about adaptation to climate change between the province and district level, with the district level being unaware of e.g. the plan for adaptation to climate change at the provincial level. On the upside, however, is the longstanding tradition of helping each other in the district when natural disasters occur. This makes Bao Lam district much more robust to upcoming climate change than otherwise.

Concerning women's involvement in future climate change adaptation work, there seems to be, at least among certain officials, a recognition that it is of utmost importance that women become highly involved. As pointed out before, women are the main users of natural resources such as land and water. It is the women who will have to cope with upcoming droughts, heat waves and heavy rain, while at the same time contributing to economic development that strongly depends upon how agricultural and forest land is used. This dependency is especially pronounced among minority groups.

5.2 Education

Given Bao Lam district's ambition to promote rapid development, adapting the education system to upcoming more extreme weather events is of critical importance. A good education will enable young persons to contribute to the district's ambitious plans, both as employees in e.g. the mining sector, but also as entrepreneurs in forestry and agriculture. At present, extreme weather events are interrupting education, lowering its quality and damaging buildings.

Several adaptation options can be identified for the future, however. These include using building techniques to lower temperatures indoors during heat waves, such as green roofs[7], using fans where electricity is installed, installing

[7] Read more about green roofs at e.g. http://eucities-adapt.eu/cms/assets/Uploads/UserFiles/48/Factsheet%20Green%20Roofs%20and%20walls_71.pdf

electricity in schools that do not have it, extending facilities for boarding for the most vulnerable children and helping poor households to buy umbrellas and thick clothes for their children so that they can reach school without interruptions and suffering. In addition, schools and teacher's houses should be constructed in a sturdier way to prevent damage due to increasingly strong winds and heavy rainfall. Locating schools in areas that are not prone to landslides and flooding is also of importance and should be dealt with in planning. Some of the proposed measures will also affect gender equality in the district in a positive way by making it easier for girls, who now are more affected than boys by heat and cold, to attend school.

5.3 Forestry

Developing forestry is one of the more important strategies for achieving the expected economic growth in coming years and that includes plans for establishing forests on bare land. So far, however, such plans have not considered climate change, which will lead to a more pronounced dry season (with increased risks of forest fires) and increasingly wet summers when heavy precipitation, landslides and flash floods can cause trees to fall down.

Given climate change, it seems that Bao Lam district needs to step up its efforts to conserve certain forests in order to prevent erosion and landslides and to take increased measures to encourage current policies for forest plantation on land not suitable for farming, e.g. some steep hillsides. Such areas could be identified in collaboration with those who use the land presently in order to map land mainly suitable for forestry efficiently. Fortunately, there is already extensive experience in the district of how to manage forest which can be drawn upon. For example, measures for avoiding forest fires seem to be well-communicated already and 130 units for forest fighting have been created. It is important that such efforts are continued in the future. Regarding forest plantations, obstacles currently encountered are lack of capital and the low income from forest plantations and new business models are required. A positive change is that slash and burn agriculture has diminished, but it is still practised in some areas. There have been 38 cases where people were convicted of felling trees illegally in recent years. One interviewee says that there is not enough attention to deforestation by the People's Committee at present. The current project to prevent deforestation and reforestation has encountered some obstacles in that the remuneration paid is too low and that income from forestry is only generated after 5-10 years. One solution to this latter problem could be to combine trees and crops on the same field, see further below.

5.4 Agriculture

Agriculture is another sector that is of the utmost importance for future economic growth. Already today there are substantial problems within this sector due to extreme weather events and it is important to take measures so that these problems do not increase in the future.

Regarding the problem of cold spells, which are killing livestock at present, it is unclear whether such events will be more common in the future. Climate scenarios show that winter temperatures will increase, but further information is needed before prognoses can be made.

Increasing drought during spring is a problem that will become more common in the future and efforts to find drought-tolerant species, water harvesting and preservation of fodder should be stepped up. Fortunately, such measures are already underway, as are efforts to upgrade irrigation systems. For those areas that are too hilly for traditional irrigations systems, solutions for local water harvesting can be developed. Another solution is to convert farmland on slopes into livestock farms with fodder cultivation that give a good soil cover throughout the year.

New ways of combining crops and trees can also help by diversifying income while protecting the soil from the impacts of intense rains thereby enabling more sustainable farming on sloping land than today. There is already an example of this in Bao Lam (Ca Tam village in Yen Tho commune), where a farmer has converted land into a mixed plantation, thereby increasing the yearly income from maize from 25-30 million VND/ha to 70 million VND/ha. The farming system is based on indigenous knowledge and local varieties are mixed with new seed and advanced technology. Spreading knowledge about such production methods (agro-forestry) and developing them further could be a very good way to cope with climate change and the need for economic development in Bao Lam.

5.5 Infrastructure

Functioning infrastructure is vital to economic growth and already today communication in the district is challenged by extreme weather events such as floods and landslides. These have caused substantial interruptions that cannot be tolerated in a well-functioning society and continued investments in infrastructure are therefore needed.

In order to cope with demands for better functioning and extended infrastructure in the future, informed land use planning has to be considered to a larger extent than today. For example, it might not be advisable to grow annual crops without any soil conservation measures on steep slopes just above the national road as is

done now. Instead, such areas should be left to forest or farming using methods where erosion is minimised. Land use planning has its challenges, as pointed out in the publication *Land Use Project up to 2020 and Land Use Plan for 5 years (2011 – 2015),* (People Committee of Bao Lam,2011),which states that "land management is not monitored strictly enough" (p. 27) and that "violation in the use of land, and unplanned land still exist (p. 46). However, with better maps and collaboration between authorities at different levels, there are prospects to improve land use in order to safeguard infrastructure from serious negative impacts of future extreme weather events.

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Appendix 1: Climate and weather – a clarification

Climate is the statistical properties of the weather, so it follows that climate change must be about *changing* statistical properties of the weather. A typical weather parameter is the temperature on June 30th 2013 at 14:00 in Cao Bang city, expressed as °C. Another weather parameter is the total precipitation in Cao Bang city on June 30th 2013, expressed as mm. When climatologists talk about averages in this way, they are usually talking about averages over 20 or 30 years. These are the types of time periods necessary for ruling out the rather substantial variations that can take place from one year to another.

Another important climate parameter is variability, which is a measure of e.g. how much a parameter is varying from year to year. Consider the following two hypothetical series of temperature at 14:00 June 1st at the same location:

Series 1									
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
22°C	20°C	18°C	19°C	20°C	21°C	20°C	22°C	20°C	18°C

Series 2									
1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15°C	17°C	23°C	20°C	26°C	28°C	16°C	18°C	17°C	20°C

It can easily be seen that these two time series have the same average temperature (20°C) but that the variation from year to year is much larger in series 2. There are several variability measures that can capture this difference between the two series.

In essence, climate change implies that both averages and the variations in many climate parameters will change. The most well-known example of changing averages is that the surface temperature of the earth is increasing. Today, the mean surface temperature of the earth is approximately 0.8°C higher than in the preindustrial level and this is expected to increase in the coming decades (IPCC 2007). How much the temperature will increase is very difficult to predict, since

climate change is surrounded by deep uncertainty. In its fourth assessment report, the IPCC panel on climate change indicated a span from +1.8°C to 4.0°C degrees as a global average (IPCC 2007). It is important to note that these figures are averages, and the temperature increase will vary across the globe. Figure A1 depicts how the temperature will increase until the period 2090-2099.

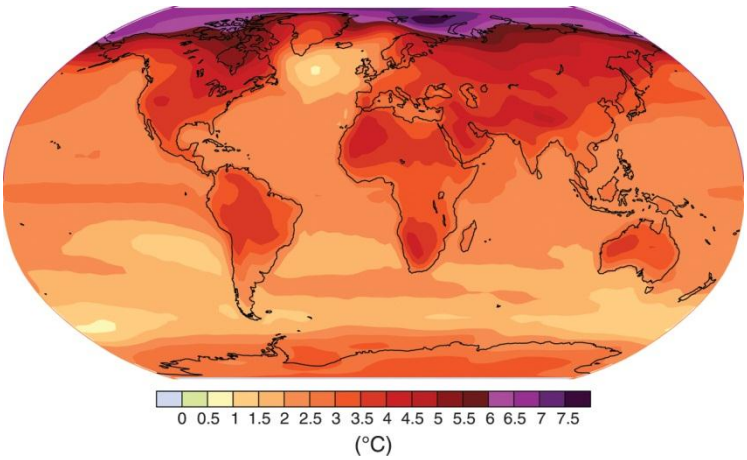

Figure A1: *Temperature increase between the period 1980-1999 and 2090-2099. The calculations shown in this map are based on a medium level of emissions of greenhouse gases (source: Figure SPM6 IPCC AR4 Synthesis report; IPCC 2007).*

Climate change will also lead to changes in the frequency, intensity, spatial extent, duration and timing of extreme weather. Already today we can see that some weather extremes have changed as a result of anthropogenic influences. In the terminology of a recently published IPCC report (IPCC 2012), it is *likely* that anthropogenic influences have led to an increase in extreme daily minimum and maximum temperatures at the global scale and there is *medium confidence* that anthropogenic influences have contributed to intensification of extreme precipitation at the global scale. Furthermore, it is *likely* that there has been an anthropogenic influence on increasing extreme coastal high water due to an increase in mean sea level.

Projecting future changes in e.g. the frequency and intensity of extreme weather is a difficult task. However, projected changes in climate extremes under different scenarios of greenhouse gas emissions do not strongly diverge in the coming two to three decades. At the same time, these changes are relatively small (on this time scale) compared with the natural climate variability, see Figure A2. For longer projections, towards the year 2100, model uncertainty as well as uncertainty with regard to emissions levels dominate. In any case, in the

IPCC report (IPCC 2012) a number of statements are made, e.g. it is stated that it is *virtually certain* that increases in the frequency and magnitude of warm daily temperature extremes and decreases in cold extremes will occur in the 21st century at the global scale and it is *very likely* that the length, frequency and/or intensity of warm spells or heat waves will increase over most land areas. Increased intensity, duration and frequency of extreme weather events will pose a serious threat to many parts of society, today and increasingly so in the future.

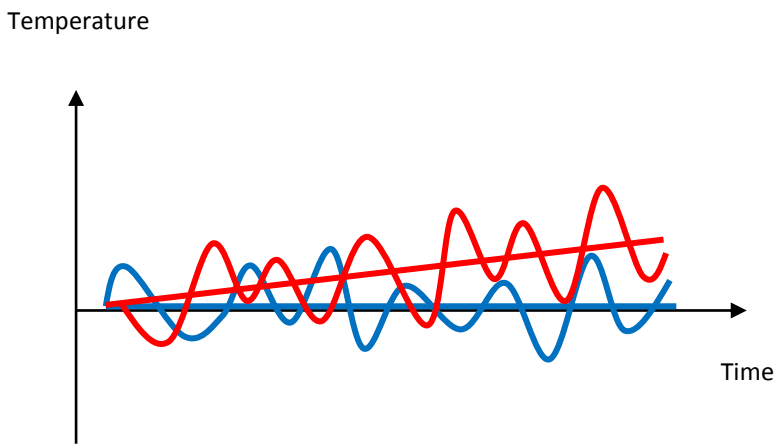

Figure A2: *Schematic diagram showing the changes in a climate variable, e.g. temperature, over time. The blue line shows the temperature without climate change and the red line shows the temperature with climate change. The straight lines show the corresponding averages. It is evident from the diagram that for shorter periods it is difficult to tell whether a certain temperature is due to natural variability or climate change.*

Appendix 2: Evaluation of the draft report Impacts of Extreme weather events in Bao Lam, Vietnam

Instructions: If you work in Bao Lam district, please read the report and fill in this questionnaire. Then either mail it (carlsson@foi.se), fax it (+46 8 6660 31 00), send it by post (FOI, att. Annika Carlsson-Kanyama, 16490 Stockholm, Sweden). **1. Introduction and aim**

To what extent is the Introduction and aim section clear? Answer on a scale from 1 to 5 where 1 is not at all and 5 is very much

1 2 3 4 5

Comments:
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2. Background

To what extent does the description of climate change in Bao Lam contain useful information for you?

Answer on a scale from 1 to 5 where 1 is not at all and 5 is very much

1 2 3 4 5

Comments:
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……..

3. Method

To what extent is the description of how the LCLIP was used in Bao Lam (3.2) correct?
Answer on a scale from 1 to 5 where 1 is not at all and 5 is very much[8]

1 2 3 4 5

Comments:
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If there is information missing in the Method section, please specify it below

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4. Impacts of extreme weather events and how they are counteracted today

a) To what extent does this section portray the **impacts** of extreme weather events in Bao Lam in a correct way?

Answer on a scale from 1 to 5 where 1 is not correct at all and 5 is very correct

1 2 3 4 5

[8] This question should only be answered by those who were part of planning or executing LCLIP in Bao Lam.

Comments:

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If there are elements missing in this section, please specify them below

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b) To what extent does this section portray the **responses to** extreme weather events in Bao Lam in a correct way?

Answer on a scale from 1 to 5 where 1 is not correct at all and 5 is very correct

1 2 3 4 5

Comments:

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If there are elements missing in this section, please specify them below

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5. Possible adaptation options given more extreme events in the future (see the report)

a) To what extent does the section 5.1 (General impressions) contain useful suggestions?
Answer on a scale from 1 to 5 where 1 is not useful at all and 5 is very useful

1 2 3 4 5

Comments:
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If there are elements missing in this section, please specify them below

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b) To what extent does the section 5.2 (Education) contain useful suggestions?
Answer on a scale from 1 to five where 1 is not useful at and 5 is very useful

1 2 3 4 5

Comments:
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If there are elements missing in this section, please specify them below

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c) To what extent does the section 5.3 (Forestry) contain useful suggestions?
Answer on a scale from 1 to 5 where 1 is not useful at all and 5 is very useful

1 2 3 4 5

Comments:
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If there are elements missing in this section, please specify them below

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d) To what extent does the section 5.4 (Agriculture) contain useful suggestions?
Answer on a scale from 1 to 5 where 1 is not useful at all and 5 is very useful

1 2 3 4 5

Comments:

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If there are elements missing in this section, please specify them below

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e) To what extent does the section 5.5 (Infrastructure) contain useful suggestions?
Answer on a scale from 1 to 5 where 1 is not useful at all and 5 is very useful

1 2 3 4 5

Comments:

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If there are elements missing in this section, please specify them below

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6. Overall impressions of the report

To what extent can the contents of the report, as a whole, help climate change adaptation planning in Bao Lam district?

Answer on a scale from 1 to 5 where 1 is not at all and 5 is very much

1 2 3 4 5

Comments:
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Thanks for your contributions!

Summary of results

All in all, high scores were received in answer to all questions, none received a lower score than 4.2 and the highest score was 4.9. The last questions, number 6 (To what extent can the contents of the report, as a whole, help climate change adaptation planning in Bao Lam district?) received a score of 4.4 (see further below).

Question	Average score (1 to 5)
1	4,7
2	4.8
3	4.6
4a	4.6
4b	4.5
5a	4.9
5b	4.7
5c	4.5
5d	4.2
5e	4.6
6	4.4

Comments made in the questionnaires were related to that Bao Lams location close to China should be highlighted, that forestry is already planned for bare land and hills and that this policy should be continued, that short term industrial crops could be developed for increased production, that continuing investing in infrastructure is important, that the general recommendations made should be implemented and that authorities at state levels should facilitate actions in the annual socioeconomic plan and in medium and long term plans. Further, suggestions were made for developing areas that cannot be irrigated into areas for livestock and other than water demanding crops, that the assessment of damage from hail and tornadoes was too low, to grow plants in front and back yards and that heavy rain have caused floods and flash floods in several areas.

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