ASSESSING CLIMATE CHANGE RISK AND VULNERABILITY FOR AGRICULTURAL SECTOR IN HOA BINH PROVINCE

Le Ngoc Cau, Pham Van Sy, Ngo Thi Van Anh,
Le Van Quy, Mai Trong Hoang
Viet Nam Institute of Meteorology, Hydrology and Climate change

Received: 02 August 2021; Accepted: 24 August 2021

Abstract: *Hoa Binh is the Northern mountainous province of Viet Nam, with the economy still depends on agriculture. Hoa Binh province in general and the province's agricultural sector in particular have been affected by climate change. Under the climate change scenario, 2016, temperature and precipitation are increasing. This will put more pressure on the province's agricultural sector. This study, using climate change scenario information and documents and local data, assesses the vulnerability and risks of the provincial agricultural sector to climate change to 2030. The results show that some poor mountainous districts, dependent on agriculture, have high sensitivity and high risk, such as Luong Son, Lac Son, and Kimboi district. While Hoa Binh city has low vulnerability and low level of risk because of its small area of agricultural land, small proportion of agriculture in the economy, and high adaptability. In addition, the study also proposes some major solutions on planning, technology, capacity building and economy to minimize the impacts of climate change on districts with high vulnerability and risk.*

Keywords: *Hoa Binh province, climate change, vulnerability, risk.*

1. Introduction

Hoa Binh is the Northern mountainous province of Viet Nam, located at geographical coordinates from 20°39' to 21°08' North latitude; 104°48' to 104°51' East longitude, still facing many difficulties with low starting point in economic development. At present and in the coming years, agricultural production and rural economy of Hoa Binh will still occupy a very important position and make great contributions to the socio-economic development of Hoa Binh province. The province has branded agricultural products that are reaching far to meet the needs of domestic and international customers. According to the report of the Provincial Statistics Office, the province's gross domestic product (GRDP) (at 2010 constant prices) was estimated at 29,423.07 billion VND, an increase of 3.80% compared to 2019. In which, the agriculture, forestry and fishery sector reached VND 6,387.23 billion, up 4.33%. The economic structure continues to shift in the right direction, with the proportion of agriculture, forestry and fishery 22.95%. The province's livestock industry is also gradually shifting towards large-scale production, the form of farms, concentrated farms, using high-yield breeds, changing husbandry methods, and ensuring disease safety [1, 2].

Recently, due to the impact of climate change, high mountainous areas are frequently affected by flash floods, landslides, forest fires, and droughts, causing adverse impacts on the environment, water resources, health, food security, especially the agricultural sector (crop, livestock) of the province. Specifically, the mountainous districts such as Da Bac, Mai Chau, and Cao Phong are often affected by flash floods and landslides, causing heavy damage to crops. In addition, Yen Thuy, Lac Son, and Tan Lac districts, which are in low mountainous terrain, also are affected by climate change. Climate change has been increasing drought, causing

Corresponding author: *Le Ngoc Cau*
E-mail: *caukttv@gmail.com*

water shortage for production and daily life, reducing crop and livestock productivity [3].

According to the scenario of climate change and sea level rise, 2016, by the middle of the century, the average annual temperature of Hoa Binh province will increase by 1.6 to 2.2 degrees for the RCP4.5 and RCP8.5 scenarios. Temperature increases at the end of century, century with levels from 2.3 to 3.9 degrees for scenarios RCP4.5 and RCP8.5. Similarly, rainfall will increase from about 12% to 21% in the middle and end of the century for both RCP4.5 and RCP8.5 scenarios. In addition, natural disasters such as storms, prolonged heat and drought are expected to increase in the province [4]. This will impact and huge risks for Hoa Binh province in general and agriculture in particular, therefore, this study conducted assessment of vulnerability and risk from the impact of Climate change, in particular temperature change and rainfall change, affects the agricultural sector of Hoa Binh province. In addition, the study also proposes some solutions to minimize the impacts of climate change on districts with high vulnerability and risk. The research results will be a useful scientific basis for local authorities to take appropriate mitigation measures to reduce risks caused by climate change impacts.

2. Methodology

2.1. Vulnerability and risk assessment approach

Risk assessment is the starting point for climate change adaptation and disaster risk reduction and sharing. According to IPCC (2012) and SREX (2015) [5, 6, 7, 8] risk is composed of 3 elements (Figure 1):

(1) Hazard (H: Hazard).

(2) Exposure to hazards (E: Exposure).

(3) Vulnerability (V: Vulnerability).

If one of the three elements is missing, there is no natural disaster risk. The formula for calculating disaster risk is expressed in the following expression:

$$R = f(H, E, V)$$

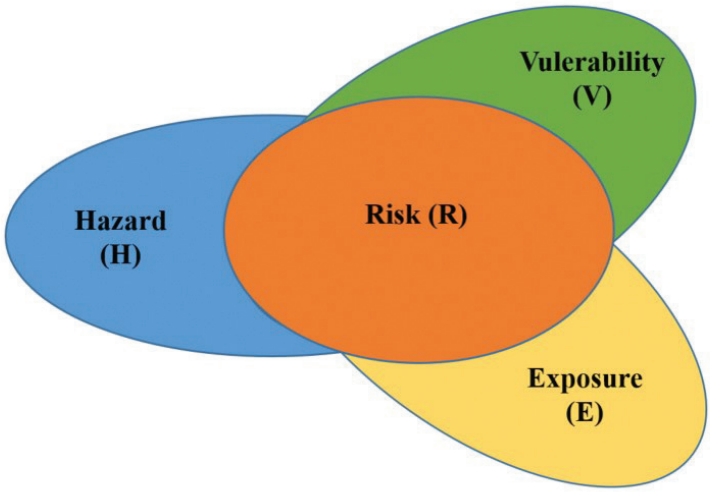

Figure 1. IPCC's approach to risk identification

Vulnerability (V) is expressed mathematically as follows:

$$V = f(S, AC)$$

In which: *S* is sensitivity; and *AC* is adaptive capacity.

2.2. Selection of indicators for vulnerability and risk assessment for the agricultural sector

The change in temperature, precipitation due to climate change has a big impact on growth, productivity, seasonality of crops, increases the risk of disease outbreaks and greatly affects the reproduction and growth of aquatic species.

Within the framework of the study, the vulnerability and risk assessment method is based on calculating the vulnerability index (V) from the vulnerability indicators as sensitivity (S) and adaptive capacity (AC), hazard (H) and exposure (E) via component indicators. Therefore, the development of a set of vulnerability and risk indicators is very important, it must characterize the sensitivity and adaptive capacity of the assessed object, and the characteristics of the hazard affecting that object. This is a method of assessing disaster risk and quantitative risk, comparing localities (districts) in the province with each other to determine which localities are more vulnerable to climate change.

The selection of the vulnerability and risk indicators is based on consideration of climate change scenarios, documents and secondary socio-economic situation information available at the provincial and district levels (such as Yearbook, statistics, general reports of the industry…) and combined with the analysis of primary survey information in the locality (direct interview by questionnaire, expert consultation...), especially information on the capacity of localities to adapt to climate change.

By synthesizing and evaluating the collected data, the study has selected a set of indicators to assess the climate change vulnerability and risk due to temperature and rainfall changes for the agricultural sector up to 2030 as presented in Appendix A1 - A4.

3. Results

3.1. Assessment of Vulnerability to climate change of the agricultural sector of Hoa Binh province

Sensitivity: the agricultural sector of Hoa Binh province is characterized by a relatively high proportion of the province's economy (about 13 - 22%), however the value of agricultural production is not high due to high productivity and production level is still low. The crop sector plays a major role in the structure of the agricultural sector. However, in recent years and in the coming time, the agricultural sector of this province has gradually changed its structure towards improving the value and efficiency of production, transforming from small-scale farming to concentrated industrial crops and fruit trees, gradually increasing the proportion of livestock and aquaculture in the structure of the agricultural sector. The agricultural sector is inherently very sensitive to the impacts of climate change such as temperature changes, rainfall changes, floods, landslides... In which, cultivation is the most sensitive field due to farming; Plant growth is highly dependent on natural conditions. Moreover, Hoa Binh province has a high altitude and steep slope, so it is more difficult for agricultural cultivation to supply water for irrigation, to prevent drought and soil erosion. Due to limited capital combined with difficult mountainous terrain conditions, investment in infrastructure for the agricultural sector in this area such as irrigation canals has not met the demand. In general, the agricultural production value of Hoa Binh province has not developed commensurate with its potential, and the production efficiency is not high. However, agriculture is still the main source of income for the people and makes an important contribution to the economy of the province. Thus, the agricultural sector of Hoa Binh province is sensitive to climate change because the province's economy and people's income depend heavily on agriculture. Specifically, districts with high agricultural sensitivity to climate change are Luong Son, Tan Lac and Lac Son districts (Table 1 & 2).

Adaptive capacity: In general, the city and some districts have been selected by the state and international NGOs to implement a number of adaptation-related projects and programs. Climate change, the awareness as well as actions of people and local authorities on climate change adaptation is better. In addition, the ability to adapt to climate change is also reflected in the economic conditions of the people. Besides, in the field of agriculture, it is very important to change the needs of crops, livestock and crops to suit changing climate conditions. In the context of climate change like today, with the trend of average temperature increasing, the frequency of occurrence of severe heat waves and even severe cold spells has also increased,

the rainy season and rainfall in each region are also increasing. The change leads to the unsuitability of the previous traditional crop, livestock and crop structure. Faced with this problem, the agricultural sector of each locality needs to study the specific conditions of their locality in order to take specific actions to adapt to the climate change situation. For example, research on changing plant structure, choosing to replace with drought-tolerant and flood-tolerant varieties. Or research on changing crops, farming techniques such as 3 decrease 3 increase, alternate wet-dry irrigation, fruit tree planting model, industrial plants for export, etc. to increase production efficiency and adapt to climate change (Table 1 & 2).

Vulnerability: The results of vulnerability assessment pointed out that the Hoa Binh city has low agricultural vulnerability to Climate Change. Due to Hoa Binh city has a low level of agricultural sensitivity (small agricultural land area, agriculture only accounts for a small proportion of the economy) and at the same time, has high adaptability, so the combined vulnerability to climate change is only at low level. Meanwhile, the poor and remote districts with large agricultural land, their economy dependent on agriculture and poor irrigation such as Luong Son, Tan Lac, Lac Son, Lac Thuy districts are sensitive. At the same time, the adaptive capacity is low (low income, ability to change crop structure, low crop, limited awareness of climate change) leading to a high degree of vulnerability to climate change. The remaining districts have moderate agricultural vulnerability to climate change (Figure 2 and Table 1).

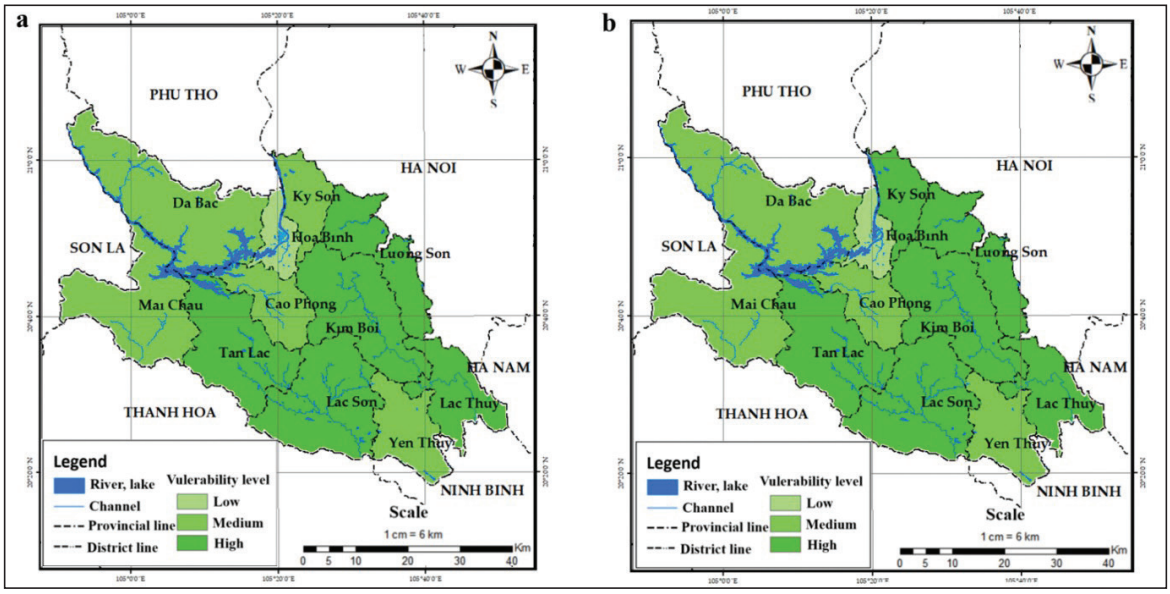

Figure 2. Map of agricultural vulnerability to climate change for year 2030. (a) due to the change of temperature and (b) due to the change of rainfall

3.2. Assessment of Risk to climate change of the agricultural sector of Hoa Binh province

Hazard: According to the climate change scenarios for the RCP 4.5 scenario, by 2030, it is shown that Ky Son, Luong Son and Da Bac districts have a high degree of danger due to temperature change from high to very high due to the changing trend. Annual average and extreme temperature changes are higher than in other districts, Ky Son, Kim Boi and Luong Son districts have a high level of danger due to the change in rainfall from high to very high due to the trend of changing annual rainfall, the maximum 1- and 5-day rainfall changes increase (Table 1 & 2).

Exposure: Lac Son district has an area of agricultural land is very high (13127 ha), the area of aquaculture large (501 ha) and the large number of cattle and poultry, so the level of

exposure of the district is facing a very high level of hazard. Next is the Luong Son district which has a high level of hazard. The remaining districts mostly level from moderate to very low (Table 1 & 2).

Risk: The results show that, for temperature change, Hoa Binh province has 2 districts with high risk including Luong Son and Lac Son, because Luong Son district has a very high risk due to temperature change, and both exposure and vulnerability are high. For Lac Son district, although the hazard level is only moderate, the vulnerability is high and the exposure level is very high (a large area of agricultural and aquaculture land, a large number of cattle and poultry are abundant and the canal system is poor). Hoa Binh city has a very low level of risk because the city has the least agricultural land area (2191 ha) and the number of livestock and poultry is not much. In addition, as a mountainous district with a small area of aquaculture, the number of livestock and poultry is not much, the level of danger to temperature changes is not high, so the risk level is low. The remaining districts have a moderate level of risk due to temperature change (Figure 3 and Table 1 & 2).

For rainfall change: Luong Son district has a high level of risk, due to its high tendency to change rainfall, along with high exposure and vulnerability (Luong Son district is one of the poorest districts in the world). In remote areas, large agricultural land, poor irrigation system, Kim Boi and Lac Son districts also have a high level of risk due to changes in rainfall. For Kim Boi district, the level of risk is high. This is because it is also a poor district, with a high degree of sensitivity and low adaptability, and a high level of danger. As for Lac Son district, although it has a low level of hazard due to changes in rainfall but this is a poor district with poor adaptability, a purely agricultural district with a large area of agricultural land, aquaculture and livestock and poultry raising, so exposure is very high to hazards. Hoa Binh city and Mai Chau district are two areas with low risk from rainfall variability because the level of hazard, exposure and vulnerability is only low to moderate. Ky Son, Lacthuy disricts, etc. have a medium level of risk due to changes in rainfall (Figure 3 and Table 1 & 2).

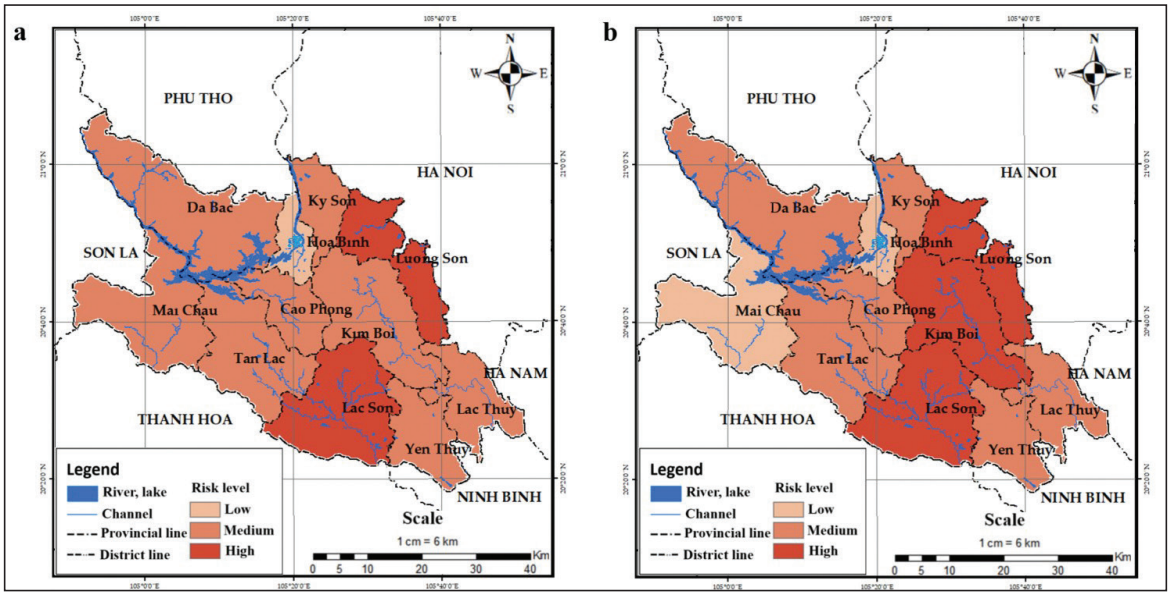

Figure 3. Map of agricultural risk to climate change for year 2030.
(a) due to the change of temperature and (b) due to the change of rainfall

Table 1. Levels of agricultural sensitivity, adaptive capacity, vulnerability, hazard, exposure and risk due to temperature change of the districts in Hoa Binh provinc

District	S	Level (S)	AC	Level (AC)	V	Level (V)	H	Level (H)	E	Level E	R	Level (R)
Hoa Binh city	0.25	L	0.33	H	0.29	L	0.40	L	0.02	VL	0.24	L
Da Bac	0.48	M	0.58	M	0.53	M	0.81	H	0.24	L	0.53	M
Ky Son	0.35	L	0.85	VL	0.60	M	0.77	H	0.06	VL	0.48	M
Luong Son	0.56	M	0.78	L	0.67	H	0.88	H	0.70	H	0.75	H
Kim Boi	0.59	M	0.70	L	0.65	H	0.54	M	0.50	M	0.56	M
Cao Phong	0.42	M	0.54	M	0.48	M	0.44	M	0.25	L	0.39	L
Tan Lac	0.66	H	0.65	L	0.66	H	0.48	M	0.52	M	0.55	M
Mai Chau	0.37	L	0.69	L	0.53	M	0.35	L	0.36	L	0.41	M
Lac Son	0.70	H	0.72	L	0.71	H	0.58	M	0.94	H	0.74	H
Yen Thuy	0.41	M	0.52	M	0.47	M	0.37	L	0.43	M	0.42	M
Lac Thuy	0.58	M	0.68	L	0.63	H	0.36	L	0.57	M	0.52	M

Note: VL is very low; L is low; M is medium; H is high and VH is very high

Table 2. Levels of agricultural sensitivity, adaptive capacity, vulnerability, hazard, exposure and risk due to rainfall change of the districts in Hoa Binh province

District	S	Level (S)	AC	Level (AC)	V	Level (V)	H	Level (H)	E	Level E	R	Level (R)
Hoa Binh city	0.30	L	0.36	H	0.33	L	0.55	M	0.03	VL	0.30	L
Da Bac	0.42	M	0.67	L	0.54	M	0.49	M	0.23	L	0.42	M
Ky Son	0.40	M	0.90	VL	0.65	H	0.77	H	0.05	VL	0.49	M
Luong Son	0.62	H	0.87	VL	0.74	H	0.97	H	0.69	H	0.79	H
Kim Boi	0.62	H	0.72	L	0.67	H	0.73	H	0.49	M	0.63	H
Cao Phong	0.42	M	0.61	L	0.51	M	0.53	M	0.24	L	0.43	M
Tan Lac	0.66	H	0.71	L	0.69	H	0.52	M	0.50	M	0.57	M
Mai Chau	0.26	L	0.70	L	0.48	M	0.31	L	0.34	L	0.38	L
Lac Son	0.71	H	0.79	L	0.75	H	0.31	L	0.90	H	0.66	H
Yen Thuy	0.47	M	0.59	M	0.53	M	0.39	L	0.46	M	0.46	M
Lac Thuy	0.68	H	0.72	L	0.70	H	0.37	L	0.53	M	0.53	M

Note: VL is very low; L is low; M is medium; H is high and VH is very high

3.3. Some solutions applied to districts with high vulnerability and high risk due to climate change

According to the results of the vulnerability and risk assessment, the districts with a high level of vulnerability and risk due to climate change in agriculture in Hoa Binh province include Luong Son, Tan Lac, Lac Son, Lac Thuy and Kim Boi districts. Therefore, these districts need to implement some solutions to improve the adaptive capacity and reduce the effect of climate change. Based on the guidelines on building application solutions with climate change, a number of application solutions can be considered and applied to districts with high vulnerability and high-risk levels in Hoa Binh province, which are:

- Solutions on planning and technology

(Transformation of structure and services of susceptible crops; Researching and creating new plant varieties and livestock to adapt to weather changes, disease sensing; Application of crops with advanced, modern and high-tech production models; agricultural model 4.0);

- Solutions for capacity building (Communication, training, technical guidance for farmers; Training and capacity building for sector managers; Upgrading the forecasting and warning system early, preventing risks and losses);

- Economic solutions (diversification of capital sources for climate change adaptation (ODA, international funding, private sector, enterprises); applying financial policies (price stabilization, agricultural insurance, etc.) Districts need to consider and consider criteria when choosing adaptation solutions, depending on the priorities, strategies, orientations of each district and the sharing of responsibilities of the stakeholders. Solutions need to ensure feasibility, be suitable with available resources, characteristics of each locality, ensure flexibility, be able to adjust when there are changes in climate factors; integrated and linked with existing local agricultural development plans, plans and policies and related fields.

4. Conclusions

Hoa Binh is a province that has been affected by climate change. Under the scenarios of climate change and sea level rise, 2016, temperature and rainfall tend to increase in the mid and end of the century, will be a great influence with the province in general and agriculture, in particular. Based on local data, climate change scenarios, vulnerability and risk assessment approaches, the main results of the study are as follows:

1. The poor, remote districts have high vulnerability due to large agricultural land area, economy dependent on agriculture and weak irrigation system such as Luong Son, Tan Lac, Lac Son, Lac Thuy district. Their sensitivity is moderate to high, while their adaptive capacity is low. Meanwhile, Hoa Binh city has a low level of vulnerability due to low agricultural sensitivity because of the small area of agricultural land, agriculture accounts for only a small proportion of the economy, and at the same time, has high adaptability.

2. The districts of Luong Son and Lac Son and Kim Boi are at high risk because they are agriculturally dependent, have high exposure to hazards, and are highly vulnerable. Meanwhile, Hoa Binh city and Mai Chau district 2 area with the level of risk due to climate change at a low level by the level of hazard, exposure and vulnerability only at low to medium. The remaining districts such as Da Bac, Ky Son, Lac Thuy, etc. have medium level of risk.

3. Districts with high level and high risk due to climate change in agriculture in Hoa Binh province include: Luong Son, Tan Lac, Lac Son, Lac Thuy and Kim Boi need to take some measures such as: Researching and creating new plant varieties and livestock to adapt to weather changes, disease sensing; Upgrading the forecasting and warning system early, preventing risks and losses; Districts need to consider and consider criteria when choosing adaptation solutions, depending on the priorities, strategies, orientations of each district and the sharing of responsibilities of the stakeholders.

References

1. Trung Long (2020), *"Hoa Binh: Create strong and comprehensive changes in the field of agriculture", http://consosukien.vn*.
2. Trung Han Dat (2018), "*Hoa Binh accelerates the restructuring of the agricultural sector"*, *https://nhandan.vn*.
3. Thuy An (2020), *"Press conference to announce socio-economic statistics for 2020"*, *http://Hoa Binh.gov.vn.*
4. Ministry of Natural Resources and Environment (2016), *Climate change scenario, sea level rise for*

Viet Nam, Viet Nam Publishing House of Natural Resources, Environment and Cartography, Ha Noi.
5. IPCC (2007), *AR4 Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change Core Writing Team*, Cambridge University Press, Cambridge, UK, and New York, USA.
6. IPCC (2014), *AR5 Climate change 2014: Impact, Adaptation and Vulnerability*. Working group II- IPCC, Cambridge University Press, Cambridge, UK, and New York, USA.
7. IPCC (2012), *"Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation". A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, UK, and New York, USA.
8. IMHEN and UNDP (2015), *SREX: Viet Nam Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*, Viet Nam Publishing House of Natural Resources, Environment and Cartography, Ha Noi.

Appendix

Table A1. Data on sensitivity indicators for agricultural sector of districts in Hoa Binh province

VULERABILITY INDICATORS			**SENSITIVITY**									
Component indicators			**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**
No	**Province**	**District**	Average area of agricultural land per capita (m^2/ person)	Rice yield (ton/ ha)	Production of grain crops (tons)	Aquacultural production (tons)	Pork production output (tons)	Total value of agricultural production (billion VND)	GDP contribution of agriculture sector (%)	Number of non-agricultural individual economic establishments	Ratio of solidified canal length (%)	Average terrain elevation (m)
1	Hoa Binh	Hoa Binh city	167	51	8259	948	2012	299	4.38	8240	76	171
2	Hoa Binh	Da Bac	739	49	36045	1180	2368	824	25.68	1556	72	476
3	Hoa Binh	Ky Son	565	52	18070	179	3917	460	29.62	1417	70	173
4	Hoa Binh	Luong Son	305	55	29045	1111	11962	1993	13.75	3756	112	185
5	Hoa Binh	Kim Boi	564	54	53540	506	9837	1351	40.81	3924	50	238
6	Hoa Binh	Cao Phong	1427	54	15987	612	2898	881	47.97	1598	70	349
7	Hoa Binh	Tan Lac	917	54	47720	1155	7530	2322	35.07	4068	26	341
8	Hoa Binh	Mai Chau	1335	47	31217	242	2480	856	41.76	2313	77	607
9	Hoa Binh	Lac Son	631	55	75539	702	12554	1808	46.82	5015	45	262
10	Hoa Binh	Yen Thuy	850	51	31377	622	6316	822	38.86	2764	69	139

Table A2. Data on adaptive capacity indicators for agricultural sector of districts in Hoa Binh province

RISK INDICATORS			ADAPTIVE CAPACITY					
Component indicators			AC1	AC2	AC3	AC4	AC5	AC6
No	Province	District	Averrage income per capita/year (million dong)	Ability to change the structure of crops, livestock and crops to adapt to climate change (% of area)	Number of agricultural staff s and veterinary trained on climate change	High school graduation rate (%)	Community's awareness about climate change (%)	Awareness and actions of the local government to respond to climate change
1	Hoa Binh	Hoa Binh city	70	0	8	98.5	97.26	8.51
2	Hoa Binh	Da Bac	27.2	3.1	5	94.9	82.05	3.70
3	Hoa Binh	Ky Son	52	3.2	3	73.9	98.15	15.14
4	Hoa Binh	Luong Son	47.5	1.5	4	90.6	93.19	15.17
5	Hoa Binh	Kim Boi	32.5	2.1	6	98.7	93.40	14.70
6	Hoa Binh	Cao Phong	48	3.6	7	99.7	93.86	11.90
7	Hoa Binh	Tan Lac	34.21	1.9	8	97.79	92.39	6.65
8	Hoa Binh	Mai Chau	27	0.94	10	97.19	89.43	8.33
9	Hoa Binh	Lac Son	38.8	2.8	4	95.5	90.32	7.10
10	Hoa Binh	Yen Thuy	32.4	12.0	5	96.7	94.61	14.32

Table A3. Data on Hazard indicators for agricultural sector of districts in Hoa Binh province (2030)

RISK INDICATORS			**HAZARD**					
			Temperature change			**Rainfall change**		
Component indicators			***H1***	***H2***	***H3***	***H1***	***H2***	***H3***
No	**Province**	**District**	annual temperature change (degrees/year)	Minimum temperature change (degrees/feet)	Maximum temperature change (degrees/grips)	Change in average annual rainfall (mm/year)	Maximum 1-day rainfall change (mm/year)	The largest 5-day rainfall change (mm/year)
1	Hoa Binh	Hoa Binh city	1.02	0.93	1.30	7.23	29.27	26.33
2	Hoa Binh	Da Bac	1.05	0.96	1.31	7.21	28.21	26.24
3	Hoa Binh	Ky Son	1.05	0.96	1.30	8.04	30.69	28.82
4	Hoa Binh	Luong Son	1.05	0.99	1.29	8.58	32.39	30.72
5	Hoa Binh	Kim Boi	1.01	0.97	1.29	7.11	33.13	27.10
6	Hoa Binh	Cao Phong	1.01	0.94	1.30	7.17	29.85	25.59
7	Hoa Binh	Tan Lac	1.01	0.96	1.30	7.48	29.29	25.11
8	Hoa Binh	Mai Chau	1.01	0.92	1.30	7.37	25.11	24.61
9	Hoa Binh	Lac Son	1.00	0.99	1.29	6.47	29.14	22.40
10	Hoa Binh	Yen Thuy	1.00	0.99	1.25	5.20	31.47	24.51

Table A4. Data on Exposure indicators for agricultural sector of districts in Hoa Binh province (2030)

RISK INDICATORS			EXPOSURE			
Component indicators			*E1*	*E2*	*E3*	*E4*
No	**Province**	**District**	**Area of agricultural land (ha)**	**Aquaculture area (ha)**	**Number of cattle**	**Number of poultry**
1	Hoa Binh	Hoa Binh city	2191	171	14254	230511
2	Hoa Binh	Da Bac	6485	108	47333	347987
3	Hoa Binh	Ky Son	2782	105	34103	309844
4	Hoa Binh	Luong Son	7200	400	96800	1500000
5	Hoa Binh	Kim Boi	9254	211	94354	860552
6	Hoa Binh	Cao Phong	8588	80	31811	255235
7	Hoa Binh	Tan Lac	10940	154	82431	704200
8	Hoa Binh	Mai Chau	10229	82	43998	276681
9	Hoa Binh	Lac Son	13127	541	138010	988029
10	Hoa Binh	Yen Thuy	7742	468	62177	763685