



REPORT

Vulnerability Assessment: a case study of Truong Yen commune in Trang An scenic landscape complex, Ninh Binh, Vietnam.

Center for Environment and Community Research – CECR



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List of Abbreviations

UCRSEA: Urban Climate Change Resilience in South East Asian
CECR: Center for Environment and Community Research

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Executive Summary

Vulnerability Assessment: a case study of Truong Yen commune in Trang An scenic landscape complex, Ninh Binh, Vietnam is implemented by the Center for Environment and Community Research. This assessment is part of the Urban Climate Resilience of South-East Asian program focusing on secondary cities in Southeast Asia. The study has the goal of assessing the vulnerabilities that the community in two wards of Truong Yen commune, Ninh Binh - is facing in the context of urbanization and a changing climate. This report specifically examines the adaptive capacity of local people to the shocks and stresses from the process of urbanization, and how this capacity might be weakened by the impacts of climate change, thus to identify good indigenous practices as well as gaps in the community's awareness and adaptive capacity.

In 2015, 33.6% of Vietnamese population lived in the urban areas. The urbanization rate has been increasing rapidly by an average 3.4% per year, among the fastest in the region. Rapid urbanization has spread far beyond the big cities of Hanoi and HCM City. Ninh Binh - a level II city – has been identified by the UCRSEA network as being exposed to climate change related risks, in the context of rapid urbanization. This trend not only has significant impacts on the local livelihoods, but the development of urban infrastructure and changes in land use have profound implications for climate vulnerability of the local community.

The research was conducted in 2 research sites in Truong Yen commune, which lies at the core of the Trang An UNESCO heritage complex. The research methodology involved a mixed methods approach of qualitative and quantitative work. This included a desk review, key informant interviews, local governance self-assessment, a household questionnaire, focus group discussions (FGDs) and life histories.

The vulnerability assessment findings are separated into four parts. The first part presents the findings on the impacts of urbanization in Truong Yen to local livelihoods. The second part presents findings of local community's awareness of climate change from key information interviews and output of focus group discussions. The third part assess adaptive capacity of local community based on primary data and local government agencies and civil society organizations self-assessment. The fourth part explores gender as a cross-cutting issue in urbanization and climate change adaptation in Truong Yen.

The assessment concludes that urbanization in Truong Yen has been driven mainly by the rapid development of the tourism industry. On the one hand, the development of tourism materialized into significant poverty reduction. Per capita income of Truong Yen increased by eightfold in a decade. On the other hand, the lack of consideration of climate adaptation in urbanization and economic transition planning has led to emerging vulnerabilities. With its close connections to the environment and climate itself, tourism is considered to be highly climate-sensitive economic sector similar to agriculture. Therefore the instability of income and the lack of social security in the tourism industry in Trang An is adversely affecting the local households (mostly women) in the commune.

The second driver of vulnerability is institutional. Local authorities lack the necessary

capacity to implement effective climate change adaptation measures. Climate change is not considered in the urbanization plan at the provincial and the commune level. The commune People's Committee relies heavily on the provincial authority for financial resources.

Facing these challenges, people in Truong Yen commune implement some good practices to adapt to local climate. For example, people are maintaining one season to rice transplant and one fish stocking season in the rainy season. This is a model that can be considered quite intelligent and flexible weather adaptation, helping people avoid the impact of flooding on production and still generate income during this period. In addition, local people have always had high adapting skills to cope with local weather conditions, typically the experience of avoiding summer heat. However, the research also considered two important factors which reduce the adaptability of local people to climate change. The first one is about finances as the percentage of local people who have a savings for emergency use is very low. The second factor is survival skills, the results of interviews showed that 100% of respondents do not know first aid, and very few have swimming skills. These two skills are especially important for survival when a problem occurs, especially during storm season and flooding.

This research concludes with recommendation that Truong Yen commune can take to enhance the community's adaptive capacity. These recommendations focus on incorporating climate change adaptation in development plans at both the provincial, district and commune level. At the same time, the local authorities should ensure just transition from agriculture to tourism and equip local residents with climate change adaption skills.

I. Introduction

Ninh Binh, a rapidly growing city in the Red River Delta of Vietnam, has been chosen as one of the eight cities for the Urban Climate Resilience in Southeast Asia Partnership (UCRSEA). Home to the beautiful karst landscape of Trang An, a UNESCO World Heritage site, Ninh Binh is undergoing a period of transformation with plans for both urban expansion and conservation-based tourism development. In 2014, the government approved a Master Plan covering the years 2030-2050 for Ninh Binh city. The area of Ninh Binh city will increase by four times its current size resulting in over 21,000 hectares; the population of Ninh Binh city is expected to reach 285,000 in 2020 and 400,000 in 2030. In addition to the Master Urban Plan, a Master Plan for Trang An scenic landscape was also approved in February 2016. Under the planning, the complex will sprawl over 12,252 hectares in the districts of Hoa Lu, Gia Vien, Nho Quan, Ninh Binh city and Tam Diep townships.

The process of transformation in urbanizing areas brings about opportunities, but it will likely cause emerging vulnerabilities to be further exacerbated by climate change. Ninh Binh, like the other seven cities in the UCRSEA network, is adversely affected by climate change. The entire province of Ninh Binh is frequently affected by flooding due to heavy rainfalls caused by combinations of monsoons and climate turbulence, such as typhoons and tropical storms (Vu & Tingsanchali, 2010). Parts of Ninh Binh province are to turn into salt-marshes due to sea level rise, which affects mangrove forests and water availability (ISPONRE, 2009). There may also be an increase in drought frequency and a rise in temperature compared to the baseline level of previous decades.

Given this background, Ninh Binh is a relevant and interesting research location to explore resilience, the dynamics of vulnerability and adaptive capacity. The Center for Environment and Community Research (CECR), as a partner of the UCRSEA network, carried out a case study of vulnerability and capacity assessment in Truong Yen commune in Trang An landscape complex, Ninh Binh. Our approach follows the Shared Learning Dialogues guideline set out in the larger UCRSEA research framework, and is highly participatory in nature. The case study that we are proposing to do will take place at the core of tourism activities in Trang An, Ninh Binh. It is therefore an important case in point, especially because tourism has been identified as the key economic driver for Ninh Binh.

Research questions:

We propose to conduct a participatory Vulnerability and Adaptive Capacity Assessment which seeks to answer the two questions:

1. What are the emerging climate vulnerabilities from the changes that have been happening in Truong Yen commune, and what are the drivers of these vulnerabilities?
2. How do local residents cope and adapt with these changes? What would enhance or limit their adaptive capacity?

Research objectives:

The objectives of this research are following:

1. To understand the key drivers of vulnerabilities that the communities, particularly women, in two villages of Truong Yen commune – a World Heritage Site - are facing in the context of urbanization and a changing climate.
2. To assess the adaptive capacity of local people to the shocks and stresses from the process of urbanization, and how this capacity might be weakened by the impacts of climate change. To identify good indigenous practices as well as gaps in the community's awareness and adaptive capacity.

II. Methodology

1. Literature review

Urbanization and Climate Change

There is an increasing realization that climate change vulnerabilities are not confined to poor areas in the world. Over the last few years, urbanization has occurred at such a rapid rate that its implications for climate change vulnerabilities cannot be undermined. On the one hand, changes in land use and infrastructure have considerable impacts on GHG emissions and other climatic parameters. On the other hand, the new way of life and the diversity of livelihoods that are associated with urbanization resulted in new institutions, new levels of income, new social roles and social relationships that altered how urban residents perceive, prepare and respond to climate risks.

Not much, however, has been written about urbanization and climate change. Among those few, many are limited to the impacts of urbanization on climate. This includes a study by Satterthwaite, D., 2009 which found that population growth produced limited impacts on GHG emission which causes climate change. Kalnay and Cai (2003) compared trends in observed surface temperature in continental United States and the corresponding reconstructed temperature trends based on analysis of global temperature. This is done to assess the impacts of land-use change on surface temperature. The study concluded that urbanization was responsible for half of the observed decrease in the diurnal temperature range. Similar studies of urbanization and urban heats include Grimmond (2007), Tayanc (1997), and Karaca (1995).

While significant in their own right, these studies have not paid attention to the intrinsic complexity in interactions of climate and society that shape vulnerability. Filling this gap, De Sherbinin et al 2007 concentrated on three coastal megacities: Mumbai, Rio de Janeiro, and Shanghai. Global cities are often concentrated in coastal areas, which also happen to be severely impacted by climate risks such as sea-level rise and natural disasters. The paper highlighted the unique “bundles” of stresses for each city which emerge from a coalescence of environmental stresses and social stresses. This research also distinguished vulnerabilities that stem from a built environment and those that stem from social conditions.

Our research contributes to the existing climate vulnerability literature to explore the complex interaction between urbanization forces and climate vulnerability. All in all, literature on climate vulnerabilities in urban areas has demonstrated that the vulnerabilities of urban communities are the result of poor urban management.

Vulnerability, overall, can be understood as the susceptibility to be harmed by a change. Vulnerability is often assessed in three aspects: exposure, sensitivity and adaptive capacity. Exposure is the frequency and degree to which a system experiences environmental stress. Sensitivity refers to how easily and heavily the concerned system is impacted by environmental stress. Adaptive capacity is the ability of a system to accommodate the environmental stress of shock (Adger 2006, Gallopin 2006, Brooks 2005).

Vulnerability to climate change has been assessed by a number of disciplines. Each one of them proposes a different interpretation of “vulnerability”. Lankao and Qin (2011) identified two common approaches to understanding urban climate vulnerability: vulnerability as impacts and inherent vulnerability. In the former approach, urban systems and agents are assessed in terms of their exposure and sensitivity to climate hazards and the resulting impacts. Inherent vulnerability seeks to understand the processes which affects the urban systems and populations’ ability to cope with socioeconomic and environmental hazards (Lankao and Qin, 2011). Similar to this perception, many scholars distinguish between ‘external’ and ‘internal’ factors of vulnerability. External factors are those that stems from outside the sphere that is being assessed; whereas internal factors are agency-oriented factors which determine the impacts of external stressors on the system. In all cases, ‘external’ and ‘internal’ factors need to be defined in relation to a certain sphere of concern. For example, national policies would be regarded as internal in a national vulnerability assessment but as external in a local assessment (Füssel, 2007). Other scholars, including United Nations (2004) categorise vulnerability factors into four groups: physical, economic, social and environmental factors. This categorization focuses mainly on the internal characteristics of the concerned system rather than external stressors.

O’Brian (2005) pointed out two contrasting ways of interpreting ‘vulnerability’’: one as an end point - representing the net impacts of climate change; and one as a starting point (vulnerability is created from an interaction of environmental and social impacts, exacerbated by climate change). Thus, corresponding to this different approach to understanding ‘vulnerability’, there are two main approaches to assess vulnerability: the risk-hazard approach and the political economy approach. The risk-hazard approach is often employed by engineer and economics. In this approach, projections and scenarios are made to infer about the impacts of climate change in the future. In this approach, adaptation determines future vulnerability.

2. Research Framework

The main purpose of this study is to gain a better understanding of the main driver of the urbanization progress in Truong Yen under the context of climate change. The Research framework reflects research subjects and relationships among them as well as the subjects’ aspects. The research framework builds in research questions and it serves as the scope of research. Tourism is the main industry in Truong Yen currently and influences institutions, infrastructures and the likelihoods of local people.

Figure 1: Vulnerability Assessment framework of Truong Yen commune

3. Research methodology

CECR employed a qualitative participatory approach for the Vulnerability Assessment research in Truong Yen commune. This framework aligns closely with the Shared Learning Dialogues approach highlighted in the UCRSEA framework for vulnerability assessment.

Currently, UCRSEA is exploring ways to combine a systems approach and a people-centered approach to the vulnerability assessment. Given the strength and resources of CECR as a local non-profit organization, we will take on a people-centered approach, and at the same time assess the critical systems within the community that can be identified (i.e. water, waste, other infrastructure), through the perspectives of the local residents and through interviews with local authorities.

In addition to the UCRSEA's handbook, we have also consulted guidelines from Vietnam Red Cross's Vulnerability and Capacity Assessment (CVA) manual (2010), and CARE International's Climate Vulnerability and Capacity Analysis (CVCA) handbook (2009). On the one hand, the CVA guidelines by Vietnam Red Cross focuses on the community level (communes), and is specific to Vietnamese context. The approach is also inclusive of non-climate stresses, even though their ultimate goal is disaster risk reduction. On the other hand, CARE International's CVCA approach chooses a climate 'lens' and considers both rapid and slow onset in its definition of "hazard". By combining these two sets of guidelines, CECR aims to conduct a vulnerability assessment that: 1) is appropriate for commune-level assessment; 2) takes into account non-climate stresses; and 3) identifies and analyzes both rapid and slow onset events.

CECR engaged local stakeholders in our Vulnerability Assessment, particularly vulnerable groups such as elderly people, people with disabilities, and the impoverished population. Participatory tools such as focus groups, mapping, historical profiling, seasonal calendar and SWOT analysis were used. In addition, we also conducted interviews with 32 households to gain more in-depth understanding of residents' experiences. We triangulated the primary

data collected from the local government, from local residents and from secondary sources to analyze and conduct our vulnerability assessment report.

CECR also interviewed with six representatives of Vietnam Union of Science and Technology Associations of Ninh Binh; Trang An Landscape Complex Management board; The Ninh Binh Center for Hydro-Meteorological Forecasting; Center For Environmental Monitoring Portal; Ninh Binh Historical Association and Ninh Binh Law Association; Department of environment of Ninh Binh. We adopted the Local Government Self-Assessment Tool (LGSAT) to focus on the interaction between institutions, agents and infrastructure within urbanizing systems. This tool provides insight into critical areas of adaptive capacity in urban development and planning as well as disaster and climate change planning and response.

III. Background information

1.Ninh Binh province

1.1 Natural conditions

*** *Geographic location:***

The geographic location of Ninh Binh province spans from 105⁰30' to 106⁰10' east and 20⁰00' to 20⁰30' North latitude, with the total natural area of 138,868 hectare. The province is bordered with Ha Nam to the north and Nam Dinh to the east, and is separated from these two provinces by Day River. To the north west, it borders Hoa Binh, and Thanh Hoa to the west and southwest, separated by Tam Diep main ridge and Can River. To the east, Ninh Binh faces East Sea. Located 90km from Hanoi, both national highways and railways run through Ninh Binh (with Ninh Binh and Tam Diep city).

In 2009, the population of Ninh Binh was 901,686 people, accounting for 5% of the population of the Red River Delta. The province has a population density of 669 persons / km². [Department of Natural Resources and Environment, 2011]

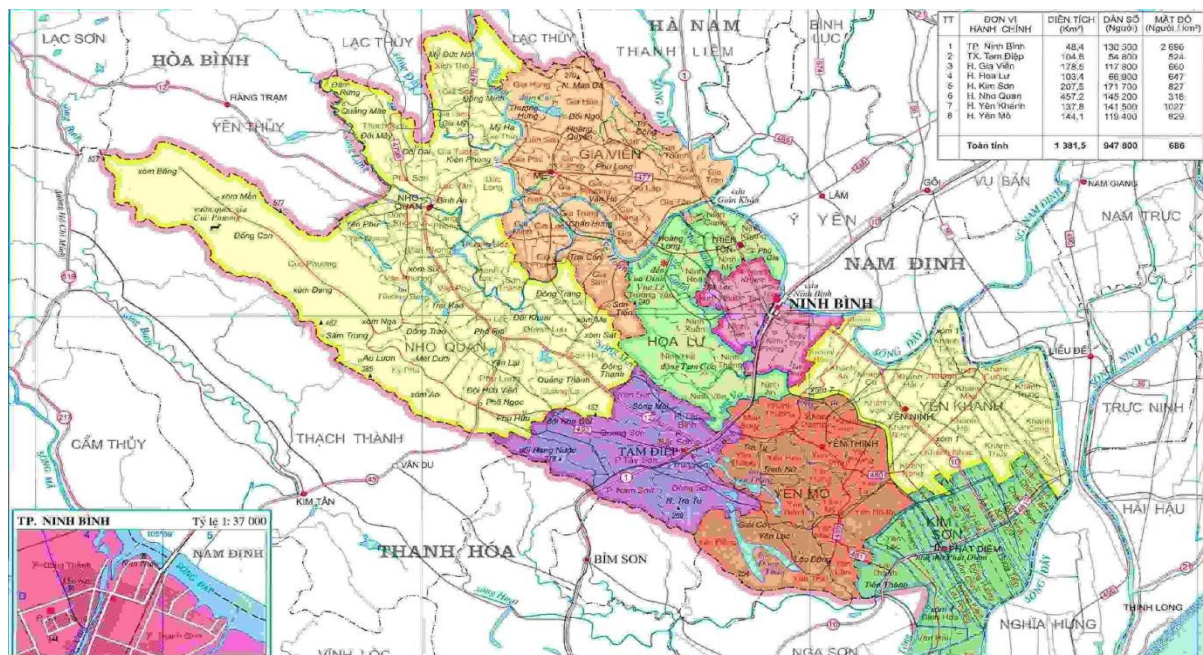


Figure 2: Ninh Binh map

*** Terrain**

Ninh Binh has three main terrain types: mountainous, midland and delta. The stratum is in the north-south-west direction on the alluvial ground of the Red River system.

- Delta: occupies 71.8% of the province's natural land area. The delta is the most populated area in the province, accounting for 90% of the province's total population. The area has a potential for agriculture: rice, vegetable and short-term industrial crops. In terms of industry, the province develops its shipbuilding and repairing industry, boats, food processing, textile and garment industry, service trade, and river port development in Ninh Binh City, Yen Khanh and Kim Son District.

- Mountainous and semi-mountainous regions: This area consists of Nho Quan, Tam Diep, West Gia Vien, Hoa Lu, and Nam Yen. The area accounts for 24% of the province's natural area. The average height is 90-120m while some rocky mountain can reach a height of 200m. As the terrains are featured by sloping hills, the increasing deforestation and uncontrolled forest exploitation leads to high risk of heavy rain and flash floods..

- Coastal area: Ninh Binh has 18km of coastline, which belongs to Kim Son district, occupying 4.2% of total natural area of the province. The land here is salinized due to the new accretion and is therefore in the renovation period. These conditions render the coastal area mainly suitable for the planting of protection forests, one-rice crop and aquaculture.

1.2 Urbanization in Ninh Binh

After the re-establishment of Ninh Binh province in 1992, urbanization accelerated. Apart from Ninh Binh and Tam Diep, a series of townships in different districts were planned. The economic structure has been strongly transformed, represented by the establishment and

expansion of industrial parks, industrial clusters, and the development of transportation, tourism, services and infrastructure.

Ninh Binh's objective is to develop the province into a first class urban area in 2030 and to become the center of cultural and historic tourism. According to Decision No. 1266 / QD-TTg dated July 28, 2014 on Ninh Binh's Master Urban Plan to 2030 -2050 vision, Ninh Binh urban area will be four times larger than the current status. The Master Plan also identifies four key areas with the envision to develop high-tech manufacturing in the southern urban areas, service in the existing city and high-tech and clean agriculture in the rural area. With this aim, the construction of transportation networks and infrastructure is being carefully considered.

The content of urban planning in Ninh Binh is as follows: Hoa Lu city will be established on the basis of upgrading Hoa Lu district and some surrounding communes to merge into Ninh Binh city. The new Hoa Lu city will become a national tourist center and an important traffic hub of the North¹. According to the plan, the entire Hoa Lu district, including Truong Yen commune, will be under the urban planning of Hoa Lu city. Truong Yen commune will become a town in Hoa Lu city by 2020

Ninh Binh's built-up area covers an area of 21,124 square kilometers (15% of the province's total area), including Ninh Binh city, Hoa Lu district, Gia Vien commune, part of Yen Son commune and Tan Binh ward (Tam Diep), Son Lai commune and part of Son Ha commune (Nho Quan), Mai Son commune (Yen Mo district), Khanh Hoa and Khanh Phu commune (Yen Khanh district).

There is a number of criteria to assess the urbanization level in Ninh Binh: transformation in economic structure, expansion of urban area, and population growth.

- Transition in economic sectors of Ninh Binh province: During the period 2003-2012, the economic structure of Ninh Binh shifted dramatically from a leading agricultural structure province to a service-oriented province. Gross agricultural product was down by 3 times its normal production (gray bar - Figure 1).

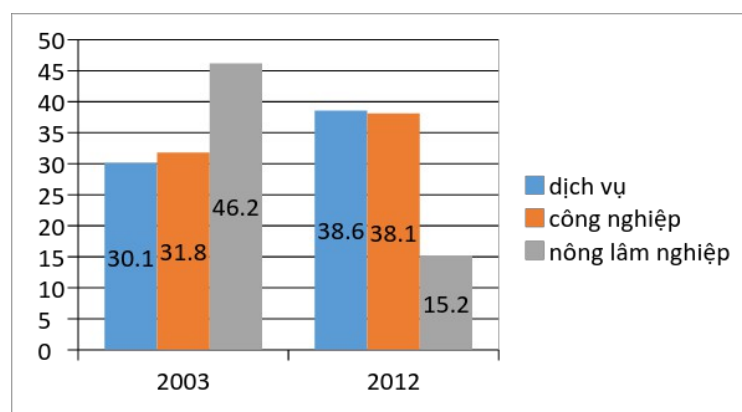


Figure 3: Ninh Binh's Economic Transition

1 Nguyen Ngoc Quynh, 2016, Urbanization and solutions to cope with climate change in Ninh Binh

The predominant industries in Ninh Binh are construction materials (cement), mechanical engineering, electricity, garment and textile, and agro-forestry processing. The agriculture sector saw an increase in commodity production (export agricultural products) over the past few years.



Figure 4: Land-use Planning in 2030
Source: Ninh Binh’s People’s Committee

According to the approved Urban plan in the period 2003-2020, the urban area of Ninh Binh will be expanded by 46.7 km² to total 211.2 km² (4.5 times).

- Urban population increased from 197,385 in 2003 to 207,655 in 2012, in which population in the inner city area increased approximately 1.5 times.
- Urban transportation: The urban transportation network has been developed in three main corridors: east-west tourism corridor, industrial corridor and urban residential corridor:
 - + East-West Tourist Corridor: The traffic link connects the center of the city to the tourist system of the West: Trang An, Bai Dinh and Tam Coc.
 - + Industrial corridors are the main routes of the urban area running through industrial parks and cottage industries (Gián Khẩu, Tam Diep, Khanh Phu)
 - + Urban residential corridors: routes through the city center, old streets, residential areas, and railway stations.

Under Ninh Binh's urban planning until 2030, Hoa Lu will see a conversion of land use purpose. Land used for agriculture will be shrunk by about 13%. Land for infrastructure

development will increase by about 45%; and residential land in urban areas will increase by nearly 200%.

2. Truong Yen commune - the research location



Figure 5: Truong Yen map

Truong Yen Commune is located in the northern part of Hoa Lu District, about 5km from the center of Hoa Lu District, and is 12km from Ninh Binh City by the 38B Road and Trang An Tourist Route no. 4. There are three waterways that are Hoang Long River, Sao Khe River, and Chanh River. There are many historic sites in the area, such as Hoa Lu Ancient Historical and Cultural Complex and Trang An World Cultural Heritage Site. To the north, Truong Yen borders Gia Vien district, to the east is Ninh Hoa commune (Hoa Lu district); and the west is Gia Sinh commune (Gia Vien district). In the South, Truong Yen borders Ninh Hai Commune, (Ninh Xuan-Hoa Lu District). The commune has a natural area of 2140.01 hectare.

Truong Yen commune has 16 hamlets and a total population of 11,787 in 3742 households².

3. Climate profile

Truong Yen commune belongs to Hoa Lu district but the nearest climate observation station is Ninh Binh station. Therefore, this report will utilize climate information and statistics from the Ninh Binh station. However, it should be noted that, as Truong Yen commune is surrounded by large mountains acting as a natural shield, the climate in Truong Yen is often said to be more temperate compared to the wider Ninh Binh province.

Ninh Binh is located in a tropical and coastal climate making it vulnerable to monsoons. The average annual temperature is about 23⁰C, the lowest average temperature (January) is 13-15⁰C and the highest is 28.5⁰C (July). The average annual rainfall is around 1.800 mm but is unevenly distributed throughout the year. 70% of rainfall concentrates in summer (May to September). Dry seasons last from November to April. On average, Ninh Binh experiences 3-4 storms per year. The high humidity influences the quality of the building, especially the wooden monuments.

3.1 Temperature

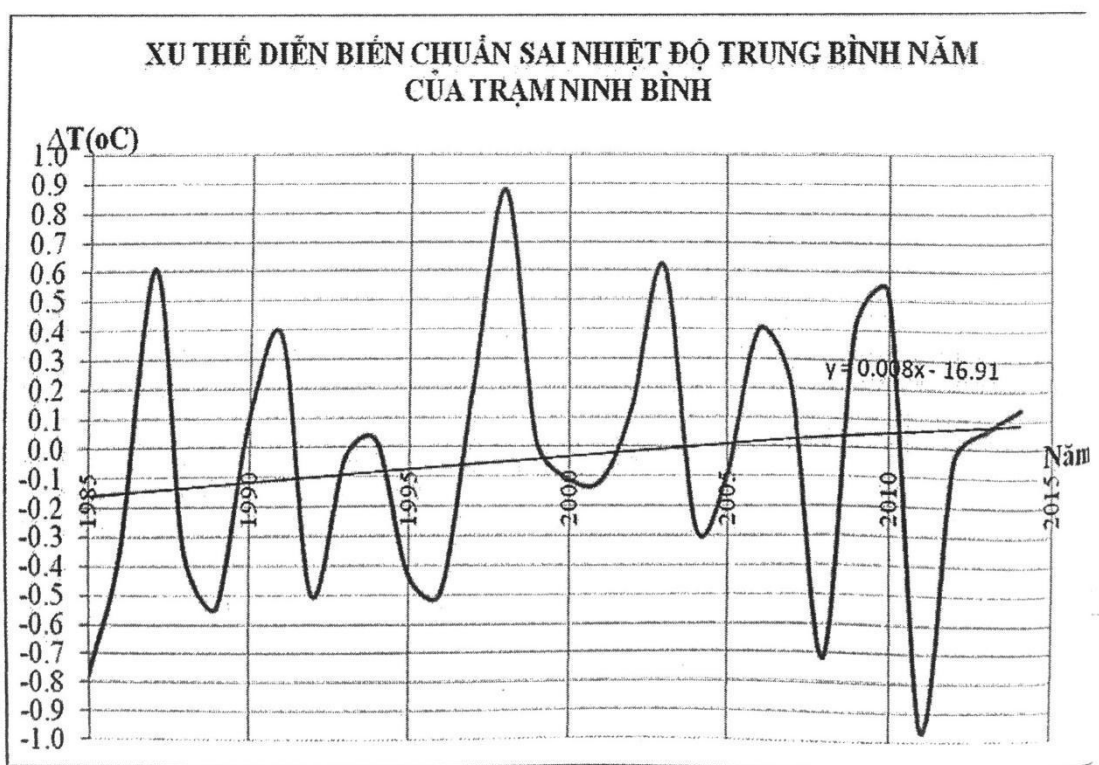
According to the statistics of the Ninh Binh Hydro-meteorological Station, over the past 30 years (from 1985 to 2014), the annual average temperature has increased by 0.08 degrees

² Final term report 2011-2016 of the People's Committee of Truong Yen.

Celsius per decade and the average annual minimum temperature has increased 0.13 degrees Celsius per decade (Figure 6).

In the last decade (from 2005 to 2014), the station recorded 119 days of cold weather (mean daily temperature values <13°C) and 209 days of hot weather (maximum temperature > 35 degrees C).

According to Ninh Binh’s Climate change action plan to 2020, Hoa Lu district’s vulnerability to climate change (assessed in term of exposure, sensitivity and adaptive capacity) is medium and lower than other districts in the west of Ninh Binh. However, under the average emission scenario, in 2050, Hoa Lu district will experience an increase in average annual temperature of 2.6 – 2.7 degrees Celcius compared to the average annual temperature of 1980 – 1999. This is one of the highest predicted increase among all districts of Ninh Binh.



Hình 3. Xu thế diễn biến chuẩn sai nhiệt độ trung bình năm của trạm Ninh Bình

Figure 6: Trends of average standard deviation of Ninh Binh station

3.2 Rainfall

The average annual rainfall in past decade 2005-2014 was 1706 mm. Compared to the previous decade 1995-2004, this represents an increase by 37mm. However it was a decrease by 56mm compared to the decade 1985-1994. It is lower than the average rainfall of 30 years (1985-2014) by 6mm.

The total rainfall in the dry season was 242 mm in the decade 2005-2014, while that of the rainy season in the same decade was 1452 mm. Thus the total rainfall in the dry season in the recent decade has decreased by 21mm compared to the previous decade and by 18mm compared with the decade 1985-1994.

In contrast, the recent decade (2005 - 2014) saw higher total rainfall in the rainy season than the previous decade. However, both rainfall in the dry and rainy season in the decade 2005 - 2014 are lower than the thirty-year average by 13mm and 12mm respectively (Table 1 and Figure 7).

Decade	Average annual rainfall (mm)	Total rainfall in the dry season (mm)	Total rainfall in the rainy season (mm)
2005 - 2014	1706	242	1452
1995 - 2004	1669	263	1408
1985 - 1994	1762	260	1532

Table 1: Annual rainfall in Ninh Binh 1985 - 2014

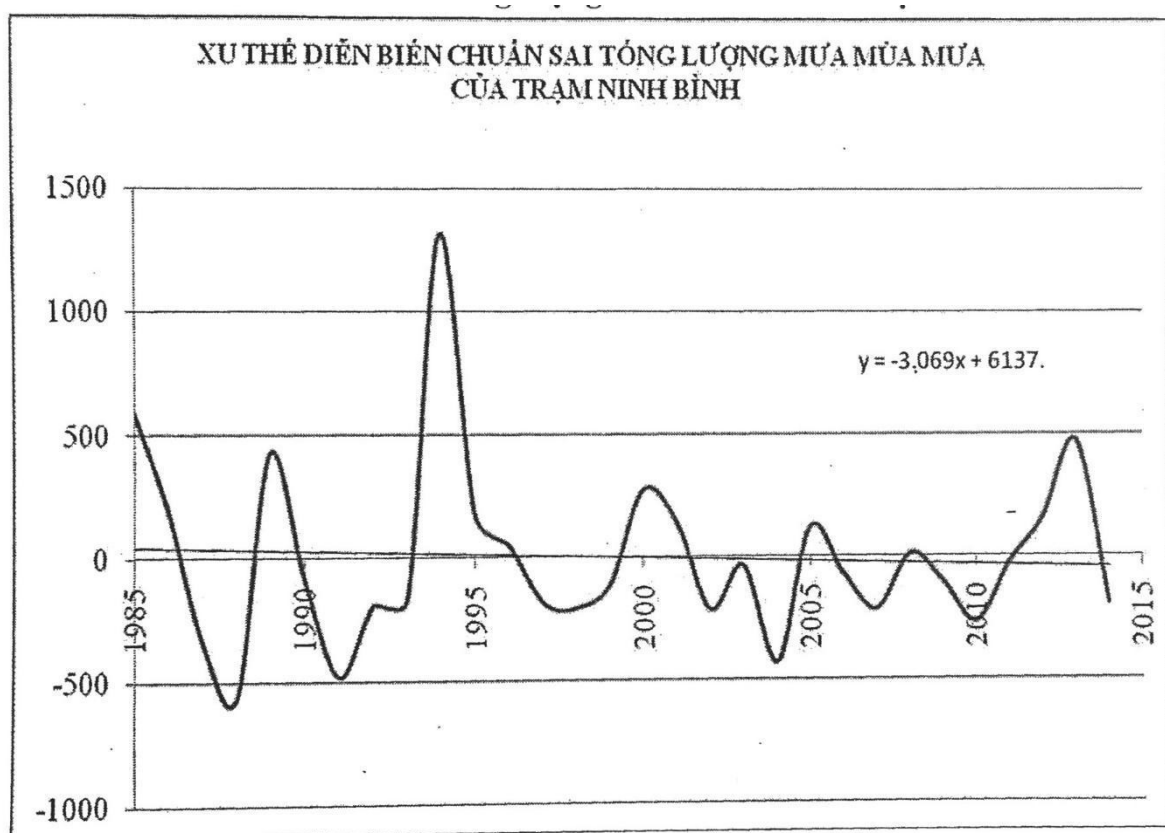


Figure 7: Tendency to correct the total rainfall of the rainy season of Ninh Binh station
Source: Ninh Binh Provincial Response Plan for Climate Change in 2016-2020.

4. Hydro-meteorological disasters

Ninh Binh is heavily exposed to hydro-meteorological disasters such as flooding, droughts, prolonged heat and typhoons. In addition, the coastal area of Kim Son district also faces rising sea levels and saline intrusion. According to the National Center for Hydrological Forecasting, in the period 1996-2004, the number of tropical cyclones decreased, but during 2004-2010 there was an upward trend in the number of cyclones in the province of Ninh Binh [Ninh Binh DoNRE, 2012].

4.1 Flooding:

The interviews with 32 households in Chi Phong reveals that 63% of respondents said that in the past 12 months they had faced flooding. Of these, 20% said that flooding occurred more frequently than five years ago, while 50% said the level was the same as five years ago, and 30% said less. In terms of severity, 20% said that the situation was more severe, 50% said it was similar, and 30% said less.

Based on the primary data from Truong Yen reports, flooding occurs in the rainy season and is concentrated from May to September. This is when the total rainfall accounts for about 70%.

In 2008, a big flood struck the Hoang Long River at the end of November. The water level in Hung Thi went up continuously and reached a peak of 15.78m at 20:00 on October 31st. Ben Dau reached a peak of 4.69m at 20h on October 31st and also 6h on November 2nd, double elongation (0.69m higher than alarm III level). The result was ruptures in Duc Long dam, Lac Khoai dam, and Gia Truong dam, and also thousands of households in Hoa Lu, Gia Vien and Nho Quan districts were flooded. Damages and loss of crop to the province was estimated at 450 billion VND.

4.2 Storms:

Every year Ninh Binh province is affected by 3-4 storms, usually from July to August. The direct effects of storms are spillage and damage to homes, public works, historic sites, trees, transport infrastructure, communications, electricity networks, crops and livelihoods of the community, and other economic activities, especially tourism. In 2007, due to the effects of typhoons No. 4 and No. 5 in October, the soybean and rice crops growing area of the commune was devastated.

According to the interviews, 72% of respondents reported to have faced with storms in the past 12 months. Commenting on the frequency of typhoons, only 25% think that it is more than five years ago and 37.5% said that the storms were currently more severe than before.

4.3 Heat

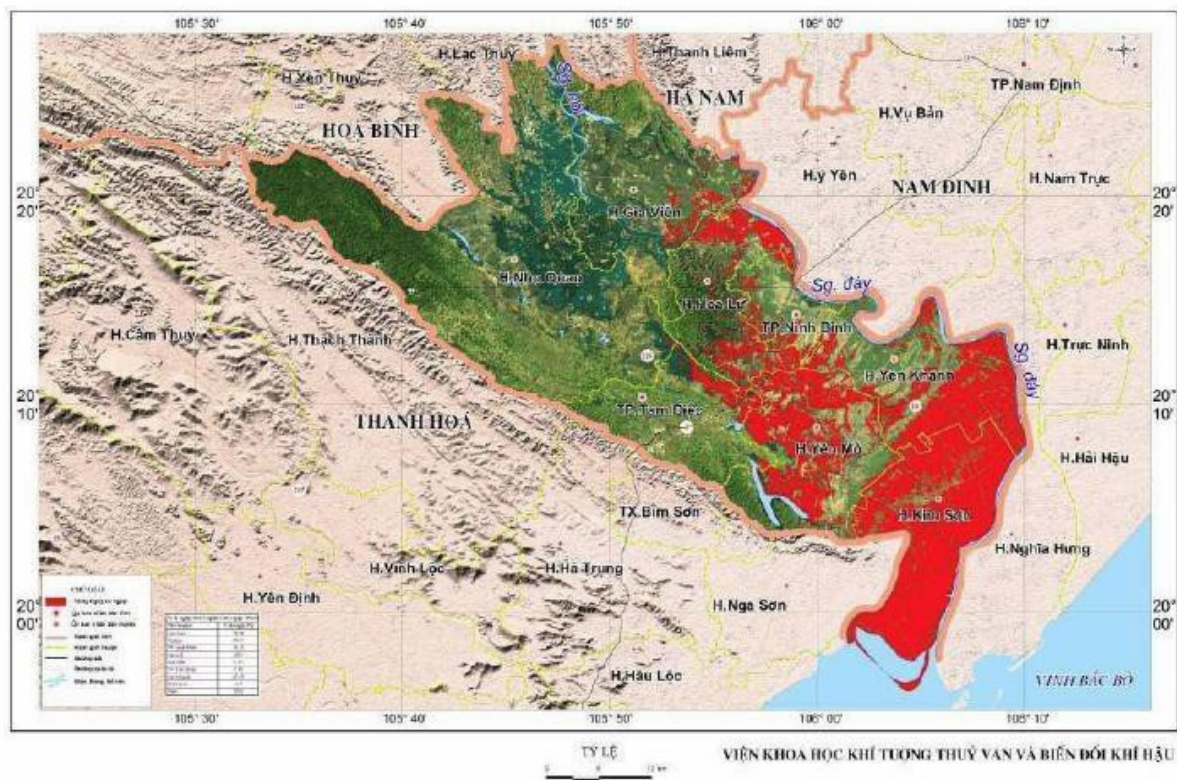
Prolonged heat appears regularly from 2013 onwards with a high temperature of over 40 degrees causing a lack of water, crop loss (especially corn), and an outbreak of locust.

4.4 Severe cold weather

In September 2006, the cold season was severe because of the northeast monsoon, which caused rice fall in lowland floodplains, hence decreased rice productivity (Truong Yen Commune 2006). In 2008, due to bad weather lasting more than 38 days in January and February, more than 50% of the seedling was killed. However, the re-planting period was dry which caused a prevalence of brown backed hoppers.

5. Sea level rise scenarios

If the water level rises by 100 centimeters³, about 23.4% of the area of Ninh Binh Province is inundated, of which Kim Son district (78.56% of the area) and Yen Khanh (46.39% of the area) are at the highest flooding risk.



Hình B5. Bản đồ nguy cơ ngập ứng với mực nước biển dâng 100 cm, tỉnh Ninh Bình

Figure 8: Map flood risk corresponding to sea level rise 100cm Ninh Binh province

Table 2: The risk of flooding the area with rising sea levels

Districts	square (hectare)	The percentage risk of flooding the area with rising sea levels					
		50 cm	60 cm	70 cm	80 cm	90 cm	100 cm
Hoa Lu	10153	6,76	9,74	13,25	17,59	22,97	28,27
Kim Son	17870	50,94	59,48	65,57	70,54	74,82	78,56
Ninh Binh city	16834	1,75	2,60	4,58	7,16	11,85	16,43
Yen Mo	45282	4,31	8,37	14,73	22,43	31,85	40,90
Gia Vien	4711	0,97	1,43	2,06	2,91	4,16	5,43
Tam Diep city	10509	1,83	3,04	4,19	5,42	6,85	7,98
Yen Khanh	14308	5,60	12,89	22,84	31,99	39,72	46,39
Nho Quan	15015	-	0,01	0,02	0,13	0,33	0,09

³ According to the Ministry of Natural Resources and Environment's Climate Change and Sea level rise Scenario for Vietnam, by the end of the 21st century, sea level is likely to rise by 100 cm.

IV: Findings

1.The urbanization process in Truong Yen

1.1 Institution

The process of urbanization in Truong Yen is closely related to the development history of Vietnam. In 968, Truong Yen was a magnificent imperial capital. The capital lies between mountains acting as natural walls protecting the capital. The capital is surrounded by Hoang Long river in the north and Day river in the east.

From a magnificent ancient capital, over time the war pushed the capital into oblivion. Truong Yen has only been noticed recently when Ninh Binh province determined to build the province's key economy as cultural and eco-tourism. In the province's Master Urban Plan, when the administrative boundaries of the city is expanded to four times the area, Truong Yen area will have the status of a town instead of a commune.

Truong Yen's economic development relies on tourism and tourist services from the tourist resort of Trang An, and the ancient tourist resort of Hoa Lu. In the Master Plan, the tourism sector will still be the focus of Truong Yen's economy, alongside development of high-tech agricultural.

1.2 Livelihoods

Two of the biggest features of urbanization are land-use and livelihood changes. In Truong Yen, over the past few years, agriculture is steadily declining and has been replaced by a rapid expansion of the tourism industry.

Truong Yen lies at the core of the world-acknowledged Trang An Heritage complex. The landscape complex spans an area of 1,961 hectares and is itself a result of human design. Agricultural lands were bought by the Xuan Truong Tourism Company from farmers and flooded to be part of the landscape complex. To compensate, on top of the land price, Xuan Truong Company guaranteed jobs in the tourism sector for the farmers. Therefore, there has been a significant increase in employment in the tourism sector. The proportion of agriculture in Truong Yen's economy structure decreased from 35% in 2005 to only 20% in 2016 (Table 3), while tourism and other services increased from 65% to 80% in the same period.

Accompanying this restructuring is a change in land-use. According to Hoa Lu District's Land-use Planning, agricultural land will decrease by 12.6% in 2020, compared to that of 2010. Truong Yen commune will also witness a decline of 35.73 hectare in agricultural land from 2015 to 2017, and an increase in non-agricultural land of 44.6 ha in the same period.

Table 3: Truong Yen's economy structure 2005 – 2016:

Source: Term review 2011-2016 of the People's Committee of Truong Yen

Sectors by years	2005	2006	2007	2008	2011	2016
Agriculture	35%	35%	30%	28,50%	22,00%	20%

Tourism and services	65%	65%	70%	71,50%	78,00%	80%
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As the amount of agricultural land is decreasing, many households juggle between growing crops and participating in the service industry or other part time jobs. This diversity and instability of livelihoods both mitigates and contributes to the vulnerability to climate risks of people in Truong Yen.

Income

The expansion of the tourism industry in Truong Yen, with the core being Trang An landscape complex, opened up many new opportunities for the community. Tourism contributes more than 80% of Truong Yen commune's GDP despite employing just 20% of labour. In contrast, while employing about 60% of labour, agriculture accounts for only 20% of total GDP.

In just more than ten years from 2005 to 2016, per capita income increased nearly eight-folds to reach 31 million VND/year in 2016 (Table 4). This has made it possible for a rapid reduction of poor households by 11.33% from 2010 to 2015. For each former farmer, jobs in Xuan Truong company get them 2-4 million VND per month –considerably higher than their traditional farming jobs. Moreover, the selling of agricultural land to Xuan Truong company provided households with some cash. This could be invested in acquiring additional skills to further improve their overall income. Other households chose to save or purchase farming equipment.

Table 4: Income change after Trang An scenic tourism established

Income change after Trang An scenic tourism established	2005	2006	2007	2008	2011	2012	2013	2014	2015	2016
Total production value (VND billion)	45	45	-	75,3	95	117	177	255,2	342	367
Average income per capita (million VND / year)	4	4,3	5	6,5	8	-	-	-	29	31

Source: Report on the socio-economic performance of Truong Yen commune in 2005; 2006; 2007; 2008; and 2016.

In contrast, farming production in Truong Yen commune has been heavily impacted by extreme weather. In-depth interviews with households revealed some major changes in the climate conditions. In the past, the weather in Truong Yen was characterised by a lack of rain and temperate winter. In recent years, the area experienced several floodings towards the end of the year and heavy droughts during summer. In 2005, 22 hectares of rice paddy in Chi Phong could not be harvested due to the 4 storms that impacted the area that year. The yield therefore only reached 50% compared to the average. The low quality of the soil and frequent droughts in recent years render low agricultural productivity.

Nonetheless, urbanization and the development of tourism in Truong Yen is not without downsides, which are complicated because of climatic changes. On the one hand, the loss of agricultural land along with the large influx of tourists means that food becomes less affordable to the local residents. Food and necessity price in Truong Yen is further pushed up by the influx of tourists. On the other hand, working in the tourism industry does not mean local people have escaped the influence of climate and weather variability. There are two peak seasons corresponding to the changes in seasons throughout the year. From April to June, the number of tourists can reach as much as 35,000 and the commune draws in more than 2 billion VND (equivalent to 88,000 USD). From June to September, the number of tourists quickly decreases by nearly 75% as this is the rainy season causing inundation of karst caves. Towards the end of the year, the number of tourists increases gradually but less significant compared to April-June due to the cold weather.

Table 5: Travel business figures in the Trang An Scenic Complex The tourist business data in the Trang An Scenic Complex

Content						
	2010	2011	Year	2013	2014	6/2015
No. of tourists	2.141.170	2.478.280	3.214.426	3.647.003	3.514.457	3.464.166
International	258.217	269.730	574.676	434.331	423.155	218.839
Domestic	1.882.953	2.208.550	2.639.750	3.212.672	3.091.302	3.245.327

Source: Trang An landscape complex Management Board, 2015.

Women dominate the tourism labour force in Truong Yen, most of them run the 2,600 tourist boats that the Xuan Truong Company owns. As the number of tourists fluctuated according to the weather, their income changes too. During peak season, each boat rider may get two rounds of Trang An tour and attain 150,000VND (6.60USD) in salary (compared to 800,000 – 1,200,000 VND of revenue for each round). Out of peak season, it is common that riders may wait for several days without getting a tour. During this period of no boat riding jobs, they resort to informal jobs such as day labour construction jobs. Added to this instability is the insecurity of tourism jobs. Besides the 6.60 USD each boat rider gets for one tour, they receive no social benefits or insurance, even though many of them have worked for the company for nearly ten years.

Table 6: Business results of Trang An complex tourist in 2009

Month	No. of tourists (people)	Revenue (million VND)
1	11920	715200
2	23600	1416000
3	32701	1962060

4	45801	2748066
5	31602	1896120
6	35181	2110860
7	29016	1740960
8	8324	499440
9	9072	544320
10	21180	1270800
11	29382	1762920
12	25194	1511640

Source: Department of Culture, Sports and Tourism, 2010



Figure 9: Women as boatrider for Xuan Truong company in Trang An

In Truong Yen, the new urbanised way of life is characterised by the instability and insecurity of livelihoods. This has also resulted in migration of mostly men and young people out of the commune, as in the case of Ms Nguyen Thi Nhien, whose husband left for jobs in Nam Dinh city and is rarely home. The migration of family member to the city, on the one hand, generates additional streams of income for the households. On the other hand, old people, women and children are left behind to continue farming work and to look after the house. Hence, it is these groups of people that have to directly cope with the impact of climate-related risks.

Table 7: Livelihood SWOT analysis conducted by Truong Yen commune People's Committee

<p>Strengths</p> <p>There are two planting seasons in one year, which start in January and June.</p> <p>Three main rivers - Chanh River, Hoang Long River and Sao Khe River – provide sufficient and quality water for irrigation in the commune.</p>	<p>Weaknesses</p> <p>Despite the diversity of livelihoods and the supports in place, the biggest downside of decreasing agricultural land is that 90% of people are now freelance labour without employment contracts and social security. Those people who still have land grow only</p>
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<p>Domestic water is supplied by three water supplying plant (1 plant supplying water for 12 villages, the other 2 plants provide water for the remaining 2 villages of Truong Yen).</p> <p>The local farming cooperatives and Hoa Lu's Office of Agriculture supports agriculture production by organizing agriculture trainings for farmers.</p> <p>Financial support is also provided directly to poor households from Social Policy Bank. This will help pay for clean water and sanitation for households.</p> <p>The authorities have put in place trainings for local people on tourism services. This includes vocational trainings organized at the district and provincial level.</p>	<p>rice.</p>
<p>Opportunities</p> <p>The development of the tourism industry in Truong Yen has led to significant improvements in living conditions and infrastructure for the local people. 3,310/3,600 households have access to clean water.</p> <p>In an area where tourism plays a central economic role, local residents are well-informed of the commune's tourism development plan.</p>	<p>Threats</p> <p>Truong Yen has higher price level than other parts of Ninh Binh because of tourists.</p> <p>The large influx of tourists every year introduces germs and diseases to the area. The environment is degraded.</p> <p>Other businesses and service sectors still lag behind. Truong Yen commune has not been successful in attracting outside investment in potential business sectors. Local authority is not informed about public investment in infrastructure in the commune.</p> <p>Recently, Hoa Lu district authority cut back on the tourism revenue earmarked for Truong Yen commune.</p>

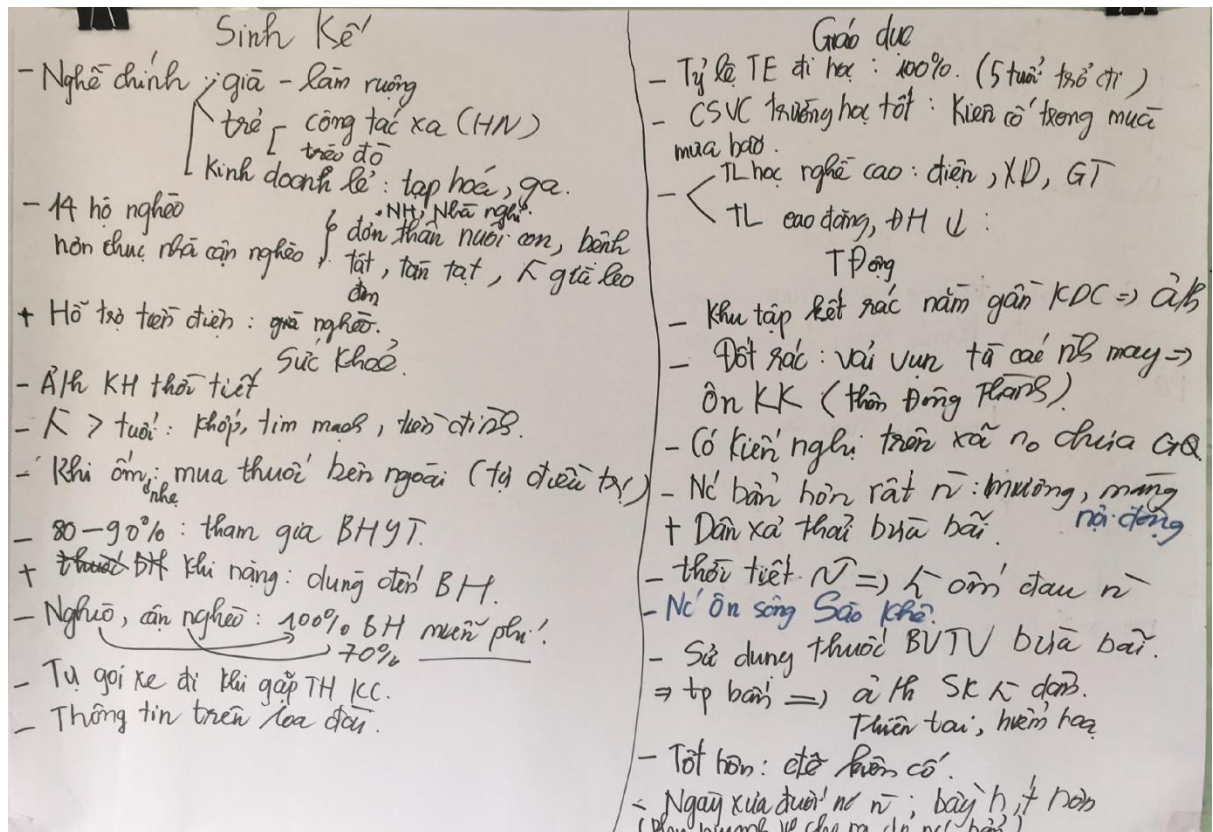


Figure 10: Livelihood analysis in Truong Yen commune

1.3 Infrastructure

The Commune People's Committee has developed a master plan for the development of commune infrastructure in accordance with Vietnam's new rural standards. The result has been that local community has improved access to critical urban infrastructure.

The total number of roads in the commune is 57.75 km, 100% of which is solidified. The length of the canal that was solidified is 18.91 km (89.24% of total canal length).

There are four electricity transmitting stations, 28,962 km of low voltage lines; and 8 km of medium voltage line for production and daily use of people.

Regarding schoolings, there are kindergartens, elementary schools and secondary schools. All have reached national standard. There is no temporary house, dilapidated house. From 2010 to 2015, 345 new houses were built, 1,000 houses renovated and 2 temporary houses were removed.

2. Assess local people's awareness of climate change

2.1 The experience of local people about local weather and climate

The results of interviews with villagers from Chi Phong and Dong Thanh villages show that local weather and climate experiences vary from age level, with older people arguing that

local weather is as old as the weather. So, the middle and young people said that the weather has changed.

87% of interviewed people think that the weather and climate in the locality are now changing a lot and describe it as "the weather is not as cold but it lasts longer and there is little rain, in May it rains heavily causing flooding; Last year it was colder, the summer season was very hot until 3-4pm, but still very hot and cannot working in the field ... "and people also said that climate change has caused a disturbance in living, production "The weather is hotter, the arid soil makes it difficult for plants to grow; It's Making people feel tired, mostly the elderly".

Elderly people over 70 years old said that "the weather and climate in the local area is still so harsh because of its mountainous region. In the years before it was even harsher because the mountains had no trees, but now the summer is cooler because trees grow up due to the ban on rock mining".

2.2. Understanding, awareness of climate change

Most people interviewed expressed very limited knowledge of climate change. With the question of understanding about climate change, only 30 % respondents say that they hear about climate change through radio. They understand that climate change is a sudden change in weather, such as abnormal heat or an increase in floods. Up to 30 % of respondents said that environmental sanitation issues such as clean homes, village roads, clean alleys and cases of bird flu were scattered, and 25 % respondents were unaware of climate change.

3. Adaptive capacity:

3.1 Endowments.

While the expansion of tourism in Truong Yen commune has significantly improved the average income, it has not materialized into greater climate adaptive capacity of the whole community. Firstly, as discussed in the first section, the increased gross income masks the insecurity and instability of the jobs. Facing such instability, only 25% of the interviewees reported to have savings. For those that reported to have savings, the median saving amount is around 40 million VND. In such situations, financial supports from the local authority is imperative. In the aftermath of recent severe storms in the area, the commune provided each affected households 800,000 - 1,000,000 VND.

3.2 Direct Coping

Climate change has never been a priority problem for the people in Truong Yen. Firstly, local people have the perception that they are less impacted by climate-related risks. This is due to the distinct climatic conditions of Truong Yen Commune. Surrounded by high mountains, Truong Yen is shielded from climatic factors that cause heavy rain in Ninh Binh city. Therefore, historically the weather in Truong Yen has been more temperate with shorter winters and fewer storms compared to the greater Ninh Binh. The lack of early warning system, coupled with the local overconfidence in the likelihood and severity of climatic risks, renders the community vulnerable to the impacts of climate change. In 2015, for example, Truong Yen experienced a severe storm that not only resulted in the premature-harvesting

of rice, but also led to damages for many households. This storm had been forecasted coming but the severity had been much underestimated.

Adaptive capacity to climate change is also undermined by the low proportion of interviewees reporting to have swimming and first-aid skills. Only 12.5% of people interviewed said they knew how to react in case of emergency. Almost 100% said they had never participated in any trainings on emergency reaction.

3.3 Institution

3.1.1 Institutions, policies and support mechanism to climate change adaptation.

Having identified the province's spearhead economic sector as tourism, Ninh Binh local authorities have strengthened the organizational system for better management of the environment. Relevant policy documents, regulations, and plans have been developed and implemented quite synchronously. Responsibilities of stakeholders are clearly defined.

When it comes to adapting to climate change, there is a steering committee and inter-sectoral expert group established at the provincial level, but at the commune level, there are only commune steering committees for flood prevention. When it comes to climate change, state management is more in favour of disaster management. Regarding the formulation and implementation of relevant policies: The provincial climate change response plan has been formulated from 2012 to 2020, but at the district and commune levels there is no plan for adaptation to climate change.

Attention has been paid to the implementation of policies, especially post-disaster support and recovery policies. However, according to the local people's assessment of the prevention of storms, the benefits of such plan have not been deployed to the people, nearly 90% of interviewees said "they do not know about the disaster risk reduction plan in Truong Yen."

However, local mass organizations play a very active role in disseminating and informing people on policy directions as well as supporting people during and after the disaster. According to the LG-SAT survey, the organization's competence rating is 3.7 / 5 that is above average.

3.1.2 Financial resources:

Financial resources for adaptation to climate change are limited, and is mainly through the state budget or contributions from businesses for environmental activities in the area. However, now the commune authorities are no longer able to use the company's contribution, as the source has been channelled to the province since January 2017. The availability of microfinance, cash assistance, loans at low interest rates ... to help affected households to recover after disasters is still very limited. According to LGSAT, the financial resource score is only 2.7 / 5 and is below the average.

According to interviews with villagers and group discussions and statistics, Chi Phong village has the highest percentage of poor households in the commune and has a higher proportion of elderly people and people with disabilities than other villages in the commune. The

topography of the ward compared to the commune is lower and often flooded, so in this area people only cultivate one season, and the main livelihood is agriculture.

3.1.3 Alert capability, database quality and information sharing mechanism:

At present, there are 02 hydro-meteorological observation stations: one lies in Nho Quan and the other in Ninh Binh city. Truong Yen has its own sub-climate due to its unique geographic location surrounded by natural mountains and two large rivers. However, there is no meteorological observation station in Truong Yen.

The income and information management system of the commune is very loose and there is not a synchronous database.

The mechanism for sharing information with people is not good. The commune has maps of land use planning and transportation. However, these maps are left in the Commune People's Committee where people only come to work, so the villagers often do not understand the planning.

The capacity of local government is assessed based on interview through Local Government Self-Assessment Tool (LGSAT) with three main essentials about Agent Capacity, Financial Capacity, and capacity to provide and collect data. The description of progress level for overall ranking of each question

1- Low: achievements are minor and there are few signs of planning or forward action to improve the situation

2-Below Average: Achievements have been made but are incomplete, and while improvements are planned, the commitment and capacities are limited

3-Average: There is some institutional commitments and capacities to achieving DRR but progress is not comprehensive or substantial.

4- Medium-High: Substantial achievement has been attained, but with some recognized deficiencies in commitment, financial resources or operational capacities.

5-High: Comprehensive achievement have been attained, with the commitment and capacities to sustain efforts at all levels.

Essential	Question		Score	Average
Organizational Capacity	1	How well are local organizations (including local government) equipped with capacities (knowledge, experience official mandate) for disaster risk reduction and climate change adaptation?	3,75	3,68
		Justification: <ul style="list-style-type: none"> - The province has issued resolutions to cope with and adapt to climate change: Ninh Binh's People Committee has issued action plan to adapt to climate change with a vision to 2030. - At the beginning of each year, Truong Yen's Party Committee and local authorities issue disaster preparation plan. - At the commune level, the People Committee organises regular trainings for the governmental officers and members of local mass organisations on disaster risk reduction. 		
	2	How much does the local government support vulnerable local communities (particularly, women, elderly, infirmed, children) to actively participate in risk reduction decision-making, policy making, planning and implementation processes?	3,8	
		Justification <ul style="list-style-type: none"> - There are preferential loans for vulnerable groups, such as poor households which would help them to solidify houses and prepare for disasters. - As most residents are members of certain local mass organisations, disaster risk reduction policies are discussed and disseminated in these organisations' meeting. - Disaster risk reduction information are also publised on the provincial People's Committee website. 		
		To what extent does the local government participate in the national disaster risk reduction planning?		
3	Justification The local government is informed and consulted in the national disaster risk reduction planning.	3,5		
Financial Capacity	1	How far does the local government have access to adequate financial resources to carry out risk reduction activities?	2,6	
		Justification <ul style="list-style-type: none"> - Financial resources allocation to the local government is decided at the central level, the commune and provincial level have limited say. 		

	2	To what degree does the local government allocate sufficient financial resources to carry out Disaster Risk Reduction activities, including effective disaster response and recovery?	2,6	
		Justification <ul style="list-style-type: none"> - When there is a lack of governmental funding, it is necessary to mobilize from private sources. - The funding disbursement process is often very slow, and lag behind 50% of the disaster risk reduction activities. 		
		What is the scope of financial services (e.g saving and credit schemes, macro and micro-insurance) available to vulnerable and marginalized households for pre-disaster times?	3,3	
	3	Justification <ul style="list-style-type: none"> - Preferential loans are available for vulnerable groups, such as poor households which would help them to solidify houses and prepare for disasters. - However the loans processing time is long, thus financial aid to vulnerable groups are not timely. - The local government can intervene through documents however the efficiency has not been significantly improved. 		
		To what extent are microfinance, cash, aid, soft loans, loan guarantees, etc. available to affected households after disasters to restart livelihoods?		
4	Justification <ul style="list-style-type: none"> - There are emergency recovery aid provided by financial institutions for households severely affected by disasters. - However, financial support for households with less severe damage from disasters are still very limited. 	2,8		
5	How well establish are economic incentives for investing in disaster risk reduction for households and businesses (e.g reduced insurance premiums for households, text holiday for businesses)?	3		
Capacity to provide and collect	1	To what degree does the local government conduct thorough disaster risk assessments for key vulnerable development sectors in your local authority?	3,5	3,6
		Justification <ul style="list-style-type: none"> - There are some subjective preliminary assessment however there is still a lack of scientific and 		

data		comprehensive disaster risk assessments with feasible recommendations tailored to the commune.		
	2	To what extent are these risk assessments regularly updated, e.g annually or on a bi-annual basis?	3,9	
		Justification - These activities are unclear and hard to measure.		
	3	How regularly does the local government communicate to the community information on local hazard trends and risk reduction measures (e.g using a Risk Communications Plan), including early warning or likely hazard impact?	3,75	
		Justification - Very frequently, through meetings and trainings, the loudspeakers system and the People's Committee website.		
	4	How well are local government risk assessments linked to, and supportive of, risk assessments from neighbouring local authorities and state or provincial government risk management plans?	3,1	
		Justification - There are linkages in term of planning, however there is limited synchrony in implementation between neighbouring provinces.		
	5	How well are disaster risk assessments incorporated into all relevant local development planning on a consistent basic?	3,75	
		Justification - There are difficulties in the collaboration between governmental departments, therefore disaster risks are not completed incorporated.		

Overall, Ninh Binh has relatively high score on organizational capacity and the capacity to assimilate or collect data for disaster reduction (3.6/5). This is due to fact that the province has its own climate change adaptation and disaster reduction plan. At the province and the commune level, there is a committee to prevent and respond to extreme events, who often conduct trainings on disaster preparation for the commune officials and local communities.

However Truong Yen's score for financial capacity is relatively low (2.8/5). Local authority in Truong Yen is not informed about public investment carried out by the province in infrastructure in the commune. Recently, Hoa Lu district authority also cut back on the tourism revenue earmarked for Truong Yen commune. Therefore Truong Yen People Committee lacks the financial autonomy and resources to cope with disaster in a timely and effective manner. Moreover, even though special financial services are available for poor and vulnerable households in the commune, the lengthy procedure and low efficiency still make them hard to access for households.

When it comes to the local authority's capacity to assimilate and collect data for disaster reduction, Truong Yen did well on informing local community about disasters and disaster preparation plans. It does so through various meetings between local mass organisations and households. Interviews with households also confirmed this as many households reported that they participate very closely with these organisations and would call on them in case of disasters. However, synchronising in disaster reduction efforts between different localities and with the national level is still very poor.

To improve disaster risk reduction, at the provincial level, Ninh Binh has developed a climate change vulnerability map for all areas in the province. The province issued climate change adaptation plan for each economic sector. The province also seeks to mainstream climate change adaptation and disaster risk reduction in socioeconomic planning. However, at the commune level, endeavours to reduce disaster risks are unclear. In addition, Truong Yen commune's financial weakness is unlikely to be resolved soon, as financial decisions are made centralised at the province level, with limited participation of the commune level.

3.4 Infrastructure

Summing up the results of the group discussions with the People's Committee of Truong Yen Commune, the Women's Union of Dong Thanh village and more than 110 interviews with the Chi Phong Villagers, the following will present an analysis of strengths, weaknesses, opportunities, and threats to local infrastructure.

<p>Strength:</p> <p>The commune has dyke dam systems, pumps to cope with floods quite well, the system is regularly checked and overhauled.</p> <p>Electric systems, roads are invested that are resistant to natural disasters.</p> <p>The system of schools (kindergarten, primary school, secondary school, high school) is solidly built.</p> <p>Commune health stations are built solidly, fully equipped medical equipment to be able to take care of the original health of the people.</p> <p>There are irrigation canals, sewers for drainage.</p> <p>There are a number of flood control projects for the Hoang Long River.</p> <p>There is a loudspeaker system to communicate when a storm or flood occurs.</p> <p>12 out of 14 villages already have clean water supply systems.</p> <p>There is a clear planning requirement: Due to the conservation area, households are not allowed to build houses above 8m.</p>	<p>Weaknesses</p> <p>There is no warning system for drowning.</p> <p>The commune has collected waste, but rubbish is often gathered near the residential area, and just once a week the garbage trucks from the district come to collect, which leads to pollute the surrounding environment. In some villages there are frequent incidents of burning air pollution.</p> <p>Local dehydration often occurs due to degraded water supply</p>
<p>Opportunity</p> <p>The new rural program helps speed up the completion of infrastructure such as electricity, roads, schools, health stations ...</p> <p>Localities in the heritage site, conservation should receive the attention of the district and province level</p>	<p>Threats</p> <p>Water pollution in Sao Khe River due to local people throwing waste into the river. In additionally, the time to carry out the project Dredging of Sao Khue River has been overtime, thus affecting the living environment of the people.</p> <p>In addition, some in-field canals of the commune are severely polluted by household wastewater</p> <p>Waste generated more due to the increase in tourist arrivals</p>

It can be seen that the items of infrastructure in the new rural criteria such as electricity, roads, schools and health stations in Truong Yen commune have been invested and built solidly. The significant drive behind this improvement is tourism and heritage, which attracted investment from the district and the province. Xuan Truong tourism company invested significantly in the roads system, while public fundings are used to pay for dredging project, embankment construction, and landscape preservation of Sao Khe river; the project to upgrade the Hoang Long dyke and Day river dyke combined traffic from Cuc Phuong to Kim Son for tourism development.

Three water pumping stations were included in the development planning of Trang An heritage complex and have been built. These irrigation system and pumping stations play a

considerable role in regulating the water level in Truong Yen and helps to mitigate flooding. River systems and draining canals are also regularly maintained and there are many rehabilitations to help drain water during the flood season.

Tourism development also boosted the local community's access to water. In 2005 when the Trang An complex was established, a water supply station with a capacity of 2000 cubic meter per day was planned to be built. Until present, 12 out of 14 villages already have clean water. Nonetheless the progress of some of publicly funded tourism-cum-infrastructure projects is very slow, leading to adverse impacts on the local community's capacity to cope with climate risks.

As the commune is part of a tourist conservation zone, households in the Commune are not allowed to build houses more than 8 meters high, which is a favourable point to adapt to climate change. Around the four sides are limestone karst, so when the storm occurs, this area is very likely to have cyclones, so the control of tall buildings construction will help limit the impact of storms.

In addition to the strengths, the communal infrastructure is facing several challenges: The biggest challenge in Truong Yen is the municipal solid waste problem. The rapid urbanization and tourism development has caused the amount of municipal solid waste generated in Commune to increase each year. Garbage in the commune is now collected to the local Tam Diep landfill weekly by garbage trucks, but due to less frequency and the large amounts of garbage there is an accumulation of waste. The accumulation of this waste is very dangerous, as flooding occurs, all of this waste can be swept away by the flow of water that radically influences the quality of the water source.

Apart from domestic waste and waste generated from tourists, in Truong Yen, livestock waste is also a significant contributor to the solid waste management issue and is closely linked with water pollution. Alongside Sao Khe River (a tributary of Hoang Long River) which flows through the commune, households built livestock barns right next to the river. Livestock waste and wastewater are discharged into the river directly without treatment. Therefore, Sao Khe river is heavily polluted of organic waste. Whereas the whole of tourism in the locality entirely depends on whether the water source is clean or not. This can happen because Truong Yen has been flooded in the past, and this is a region with a rather different climate, so that weather events are more complicated. Hence, development plans need to take this into account, but in practice waste management is not a well-regarded item in local development plans.

In addition, intra-field canal system plays the role of irrigation while also acting as drainage in flood season with many polluted points and congestion caused by waste and livestock waste. In addition, the project of dredging Sao Khe River (one of the main drainage channels of the commune) lasted for many years, affecting flow and environmental quality. This situation, if heavy rain and floods happen, will affect to the local tourism industry.

To address the water quality issue, the local community in Truong Yen, mostly members of Truong Yen Women's Union, have organised several clean-ups in Sao Khe river and around

the Trang An heritage complex. Nonetheless, due to the lack of financial fundings and lack of capacity, these activities remain fragmented and low impact.

4. Gender issue in the urbanization in Truong Yen

The main driver of urbanization in Truong Yen is based on the development and expansion of tourism side and service.

According to some boatpeople at the Trang An tourist resort, there are now more than 2,500 boats at the Trang An tourist site, which means that there are more than 2500 boatwomen currently working for Trang Ecotourism Resort.

Since the establishment of the Trang An tourism complex combined with the tourism economic development strategy of Ninh Binh province, Truong Yen Commune has been invested to develop from an agricultural commune and a forgotten capital into a cultural tourist landmark.

People in the communes which have land seized for the construction of Trang An tourist site will be given priority in ferryboat. The people lost their land, but they got a higher-paid job than they did in the past.

Tourism has had an effect on the entire commune in some aspects as follow:

- Change in livelihood

Those whose land was acquired have a new job of boat rowing, or Vietnamese language tour guide. Many families have opened up new businesses, such as opening cafes (restaurants, souvenir shops, car shops, water shops). Families with better economic conditions open houses, hotels or homestay.

- Cultural change:

In the past, Truong Yen people had the habit of paddling with their feet, however, when they went to work in the tourist area, people are no longer allowed to paddle with their feet in order to keep their civilization respect to tourists.

- Study the history of Truong Yen

In the past there were a few people who know the history of Truong Yen - the ancient capital of Hoa Lu, now one can just talk to boatwomen to know the history of this area.

- Attention to the environment:

In Truong Yen, as preserving the landscapes is intrinsically associated with people's livelihoods, the awareness of people in environmental conservation is very high.

Additionally, Sao Khe River is the current line to bring tourists to visit the beauty of Trang An so keeping the water source for the Sao Khe River is something that the management is concerned about.

V. Conclusion and recommendation

Our research focusing on Truong Yen commune, Ninh Binh, has shown that, the local authority has failed to consider climate vulnerabilities and failed to incorporate climate resilience strategy in the urbanisation planning process. This is, however, not their own fault.

The centralised management in Vietnam explains that authorities at the commune levels often lack autonomy and resources to implement timely and effective planning action. At the same time, although the rapid expansion of tourism has accelerated the urbanisation process in Truong Yen, many existing infrastructures and institutions still have the characteristics of a rural area. The case study of Truong Yen, therefore will be a case of climate vulnerabilities in a transitioning area - which are often much less focused on.

1. Key driver of vulnerability in Truong Yen

The main drivers of vulnerability in Truong Yen is coming from new livelihood which is tourism services. Tourism is the main economic drive in Truong Yen, it transforms a rural area into a peri-urban one with many tourism services such as boat riding, homestay, hotel, restaurants, construction, taxi drivers, souvenir sellers, etc. Tourism brings a lot of advantages in term of poverty reduction, green economy, a lot of jobs especially for women in Truong Yen (nearly 50% boat riders are from Truong Yen commune). Tourism industry helps the commune increase their income nearly eight-fold compared with ten years ago. However, this new livelihood also has potential vulnerability. With its close connections to the environment and climate itself, tourism is considered to be highly climate-sensitive economic sector similar to agriculture. Climate is a principal resource for tourism, it is principal driver of seasonality in tourism demand. In Truong Yen because of climate the peak season for tourism is during spring from January to April. During the raining season from May to September, there are fewer visitors coming to Trang An because of heavy rain, storm and heat. The weather is sometime difficult to predict in Trang An because of its location which is very special and create a microclimate, and Trang An has not have a meteorological dory to forecast the weather there yet. In short, tourism industry tool land of the farmers but provide them a job to do but under impact of climate, the job is unsustainable and put people in precarious situation.

Trang An has been established since 2005 but there are not many services beside that, so normally visitors just come to visit Trang An during the day and do not stay. So in average people come to Trang An just spend only on the ticket to visit the world natural heritage. So the income from tourism is not frequent and people who sold land for the corporation have to find other part-time job to earn more income.

The second driver of vulnerability is institutional. Local institution brings good things for the area, however right now the institution has brought more advantage for the corporation than for the residents there. They took the land to build the Trang An complex, which became privilege and natural heritage, but the compensation for the seized land (transferred to the company) was very low. Additionally, they still keep the money and have not distributed all the compensation for the farmers and residents report that they have lost their trust in the government. The financial resource to help resident resettle their livelihood is still lacking.

2. Adaptability to climate change of local people:

The results showed that people in Truong Yen commune have good practices to adapt to local climate. For example, in terms of livelihoods, due to unfavorable natural conditions to cultivate two

rice crops, people are now maintaining one season to rice transplant and one fish stocking season in the rainy season. This is a model that can be considered quite intelligent and flexible weather adaptation, helping people avoid the impact of flooding on production and still generate income during this period. In addition, local people have always had high adapting skills to cope with local weather conditions, typically the experience of avoiding summer heat, when the local weather is too hot, villager often have habits into the cave to rest, this experience has existed for ages now and still apply in the present time.

In addition to the good practices of the people's Truong Yen, there are also factors that enhance their adaptability to climate change, including:

- The first element in every family in the commune is to own a solid house to limit the impact of storms;
- The second element of language: Nearly 100% of people in the commune are literate and have no language barrier so they have easy access to information on natural disaster risk prevention;
- Next to having a good social capital: Nearly every local resident participates in a local association such as the Women's Union, the Farmer's Association, the Elderly Association. Participation in these associations will help people get more information, as well as receive support from members when the disaster occurs.

In addition to the intrinsic elements that the people themselves possess, external factors such as the infrastructure system for electricity, roads, health stations and schools in the locality are invested and built, and all of villages in commune have internet connection also contribute to enhancing people's liking for climate change.

Research also considered that two important factors reduce the adaptability of local people to climate change. The first one is about finances, the percentage of local people who have a savings for emergency use is very small. Failure to have the savings to cope with an emergency can put people in a very passive state of restoring their livelihoods and livelihoods after a disaster. The second factor is survival skills, the results of interviews showed that 100% of respondents do not know first aid, and very few have swimming skills. These two skills are especially important for survival when a problem occurs, especially during storm season and flooding. Especially while the local terrain has many ponds and lakes alternating in residential area.

3. Recommendations

Increased dialogue between provincial and local authorities on climate change adaptation. Hoa Lu district and Truong Yen commune should incorporate climate change adaptation in their development plans.

On the one hand, although climate change adaptation plans have been carried out at the provincial levels, yet they are not often communicated effectively to district and commune level. This has caused inconsistencies and confusion when implementing climate adaptation measures at the local levels. In addition, the capacity of district and commune authorities to implement adaptive measures is very low. On the other hand, climate change adaptation is more than technical measure such as dyke buildings. It means a holistic climate adaptive approach to economic development, livelihood, land-use planning and infrastructure. Thus, the research recommends that the central and provincial authorities should build up capacity for districts and communes to develop and implement climate change adaptation plan. This includes not only better trainings for local-level officials but also

increased financial resources and autonomy for the district and commune to actively devise adaptive measures tailored to their own locality.

Moreover, climate change adaptation should not be seen as a side issue. The authorities should recognise that economic and urbanisation planning has deep implication for climate vulnerability and vice versa. Thus climate-resilience should be a principle upon which all economic and urbanisation-related plans are built.

Complete the early warning system for Truong Yen.

The key to better preparedness for climate-risks is good early warning system. A meteorological station should be installed for Truong Yen. This is especially important for Truong Yen which has its own climatic characteristics distinct from the rest of Ninh Binh province. This will also important for the tourism sector which Truong Yen relies heavily on.

Ensure just transition from agriculture to tourism by enhancing skills and social security.

The expansion of the tourism sector has undoubtedly brought many benefits for Truong Yen commune. It led to improved infrastructure and income for the community. Yet this is achieved not without downsides. Most of the tourism benefits has mostly concentrated in tourism corporation benefits. At the lower end of the tourism value chain are former-farmers who lost their land and reluctantly became boat-riders. Without proper social supports and skills to transition to the tourist services, poor people will

Thus, in the short term, to improve the livelihood of the local community, skills training should be organised for tourism employees. In the longer term, this should be done as a result of a comprehensive tourism value -chain analysis to identify key actors in Truong Yen's tourism sector, revenue flow, blockages and ways to enhance the benefits to poor people.

Commune's Urban Planning and Disaster Preparation plan should include urban solid waste management.

The importance of climate change adaptation is widely acknowledged by authorities at the central to the local levels. However, climate change, when understood merely as the increased in the frequency and severity of natural disasters, often leads to unidirectional adaptation measures such as dike buildings. The forces of urbanisation will pose new environmental challenges, one of them being solid waste management. This intrinsic challenge posed by urbanisation will be complicated by climatic risks. Yet, solid waste management has been completely left out of the commune's urban planning and disaster preparation plan.

Equip local residents with skills for their self-adaptation.

Natural disasters preparation and recovery in Truong Yen commune has mostly relied on a core group of local officials to help affected households post-disasters. Local authorities need to recognise that if local residents have better knowledge and skills to actively adapt to climate change impacts, this would reduce the resources the authority needs to provide for local households. Thus, trainings on disaster-preparedness skills should be available to all local residents, not just heads of mass organisations.

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