

Livelihood Vulnerability to Climate Change: A Case Study of Quảng Ninh, Quảng Nam, and Cà Mau Coastal Provinces of Vietnam

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Abstract: Vietnam is one of the countries in the world suffering the most negative impacts from climate change. With a long coastline and located in the tropical monsoon belt of Southeast Asia, nowhere in Vietnam is more severely affected by climate change than the coastal zone of Vietnam. Sea level rise, hurricanes, floods, and droughts increasingly threaten the region. The main livelihoods most directly affected are fisheries, agriculture, tourism, and shipping. Based on a survey of 600 households in three coastal provinces of Quảng Ninh, Quảng Nam, and Cà Mau, this paper assesses livelihood vulnerability based on the approaches of Livelihood Vulnerability Index (LVI), Intergovernmental Panel on Climate Change (IPCC), and the five sources of capital. The research results show that Quảng Ninh province residents' livelihood is oyster farming, clams, fish, and nearshore fishing. Quảng Nam province residents' livelihood combines farming, aquaculture, nearshore and offshore fishing. The livelihood of Cà Mau province residents with forest-shrimp-crab is the most prominent feature. Livelihood diversity is the trend of choice for many households today. Members all have many different jobs to be able to ensure their lives and complement each other. A person can have many different jobs depending on climate changes.

Keywords: Climate change, coastal provinces, livelihood vulnerability, capital, Vietnam.

Subject classification: Economics.

1. Introduction

Vietnam is one of the countries in the world suffering the most negative impacts from climate change (IPCC, 2001). With a long coastline and located in the tropical monsoon belt of Southeast Asia, nowhere in Vietnam is more severely affected by climate change

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than the coastal areas of Vietnam. According to Vietnam's Hydrometeorological Law, climate change is "the change of climate over a long period due to the impact of natural conditions and human activities, manifested by global warming, sea level rise, and an increase in extreme hydrometeorological phenomena" (Vietnam National Assembly, 2015). The main livelihoods most directly affected are fisheries, agriculture, tourism, and shipping. Climate change directly affects the lives of coastal communities, increasing vulnerability, especially among people with low incomes who depend heavily on natural resources.

In response to climate change, Vietnam has developed policies and programs related to climate change from central to local levels. This process began in 1992 when Vietnam signed the United Nations Framework Convention on Climate Change. The "National Target Program to Respond to Climate Change" was developed in 2008. The National Steering Committee for the National Target Program to Respond to Climate Change was established in 2010. The 7th plenum of the Party's Central Committee of the 11th tenure on 3 June 2013 on proactively responding to climate change, strengthening natural resource management, and environmental protection issued Resolution No.24-NQ/TW. The Prime Minister issued Decision No. 2139/QĐ-TTg on 5 December 2011, approving the National Strategy on Climate Change.

In December 2021, at the 26th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP26), in Glasgow, Scotland (the United Kingdom), Vietnam, together with nearly 150 countries, committed to bringing net emissions to zero by 2050, reaffirming to maintain the goal of limiting global temperature rise to 1.5 degrees Celsius according to the Paris Agreement. This is a significant step forward for Vietnam's commitment to respond to and adapt to global climate change.

On 26 July, 2022, Deputy Prime Minister Lê Văn Thành signed Decision No.896/QĐ-TTg approving the "National Strategy on Climate Change until 2050".

In addition, Vietnam has developed the Vietnam Marine Strategy since 2007, Resolution 09, Fourth plenum of the Party's 10th Central Committee to develop the marine economy. In the eighth meeting of the Party's 12th Central Committee, the Resolution No.36-NQ/TW, dated 22 October, 2018, on the Strategy for Sustainable Development of Vietnam's Marine Economy to 2030 with a vision to 2045 was confirmed.

On 5 March, 2020, the Prime Minister issued Resolution No. 26/NQ-CP on Vietnam's Strategy for Sustainable Development of the Marine Economy to 2030, with a vision to 2045, which emphasizes that the marine economy will focus on issues such as tourism and marine services, aquaculture, and fishing. This is the most important resolution to implement issues related to the marine economy, including marine livelihoods in the context of climate change.

The increased risks from climate change are one of the pressures increasing the vulnerability of livelihoods that rely on natural resources in coastal communities in Vietnam. Moreover, the growth of the marine economy is accompanied by the problem of marine environmental pollution. The ecosystem is broken, coastal planning has not yet

involved the people, and there is a part of the coastal population that is being left behind, unable to fully participate in the activities of the marine economy due to lack of knowledge, level of education, health, and general resources. These factors are pressures that increase the vulnerability of natural resource-based livelihood activities in coastal communities.

In the context that the climate is increasingly changing abnormally and seriously affecting the livelihoods of coastal people, the guidelines and policies of the Party and the State come to life, and at the same time, promote people's initiatives in the process of responding to climate change, contribute to sustainable development. Therefore, developing a sustainable livelihood framework for coastal residents to adapt to climate change for coastal areas is an urgent need today.

This article systematically analyzes the livelihoods of coastal residents of Vietnam under the impact of climate change from 2009 to 2022 and studies the cases of Quảng Ninh, Quảng Nam, and Cà Mau provinces.

For the assessment of the impacts of climate change on coastal residents' livelihoods, the project applies the Livelihood Vulnerability Index (LVI) based on the methodology of Hahn, Riederer, and Foster (2009) and the Intergovernmental Panel on Climate Change (IPCC) (2001), at the same time integrating with the view of the five sources of capital (Human Capital; Social Capital; Physical Capital; Natural Capital; and Financial Capital) by Chambers and Conway (1992). The project uses data sets of 600 households in Quảng Ninh, Quảng Nam, and Cà Mau provinces. The LVI was measured from -1 (least vulnerable) to 1 (most vulnerable). The LVI-IPCC is measured from -1 (least vulnerable) to 1 (most vulnerable).

The components for calculating the LVI are calculated as follows: Household Profile (SDP), Livelihood Strategy (LS), Social Capital (SC), Healthcare (H), Access to Food (F), Access to Clean Water (W), Physical Capital (PC), and Natural Disasters and Climate Change (NDCC).

The five sources of capital for the analysis were integrated into the components according to the calculation formula by Hahn et al. and the IPCC, as follows:

- + Household profile and human capital: Head of household's gender, education level, health status;
- + Livelihood, financial capital, and natural capital strategies: Household economic activities, livelihood diversity, migration, borrowing, income, expenditure, land ownership, and home ownership.
- + Social capital: Households participating in state and civil mass organizations, ability to borrow credit.
- + Material capital: Fishing, cultivating, raising livestock, transportation, and communication.

+ Natural disasters and climate change: Loss of people, property, temperature changes, number of storms, tropical depressions, rainfall in the last ten years.

+ Healthcare: Access to medical facilities.

+ Access to food: The ability to buy food.

+ Access to clean water: Water sources families using for eating and living.

Each component is a source of capital consisting of subcomponents. Each component is standardized as an index based on the equation used in Formula 1 as follows:

$$indexS_{qn} = \frac{S_{qn} - S_{min}}{S_{max} - S_{min}} \quad (1)$$

S_{qn} is the component at the study site in Quảng Ninh, Quảng Nam, or Ca Mau, and s_{min} and s_{max} are the smallest and maximum values for each component determined using data from the study area. After each component is normalized, the components are averaged using Formula 2 to calculate the value of each key component:

$$M_{qn} = \frac{\sum_{i=1}^n index_{S_{qn}i}}{n} \quad (2)$$

Where M_{qn} is equal to one of the eight main components in the study area (SDP, LS, SC, H, F, W, PC, or NDCV), $index_{S_{qn}i}$ representing the subcomponents, formed from i , which make up each of the main components, and n is the number of components in each component.

After the values of the eight main components are calculated, they are averaged using Formula 3 to calculate the LVI:

$$LVI_{qn} = \frac{\sum_{i=1}^8 W_{Mi} M_{vdi}}{\sum_{i=1}^8 W_{Mi}} \quad (3)$$

LVI_{qn} is the Livelihood Vulnerability Index in the study area in the three provinces. W_{Mi} is defined by the number of subcomponents that comprise the overall LVI's main component.

Explain all the critical ingredients through Formula 4 as follows:

$$LVI_{qn} = \frac{W_{SDP}SDP_{qn} + W_{LS}LS_{qn} + W_{SC}SC_{qn} + W_H H_{qn} + W_F F_{qn} + W_W W_{qn} + W_{PC}PC_{qn} + W_{NDCV}NDCV_{qn}}{W_{SDP} + W_{LS} + W_{SC} + W_H + W_F + W_W + W_{PC} + W_{NDCV}} \quad (4)$$

In addition to the LVI, we use the IPCC index. The index structure includes *exposure* (NDCC), *adaptability* (SDP, LS, and SC), and *sensitivity* (H, F, PC, and W). Calculations for the three main components used in Formula 5:

$$CF_{qn} = \frac{\sum_{i=1}^n W_{Mi} M_{qni}}{\sum_{i=1}^n W_{Mi}} \quad (5)$$

CF_{qn} is one of the three main components contributing to the study area's IPCC (exposure, sensitivity, or adaptability). M_{qni} are the main components of the qn study area, while i is the component index. W_{Mi} is the weight of each major component, and n is the number of components in each component. After calculating each component, the three component elements are combined through *Formula 6* to obtain the IPCC index as follows:

$$IPCC_{qn} = (e_{qn} \cdot a_{qn}) * S_{qn} \quad (6)$$

In $IPCC_{qn}$, qn is the study area in Quảng Ninh, Quảng Nam, or Cà Mau provinces, e is the *exposure*(NDCC), a is *adaptability* (SPD, LS, SC), and S is the *sensitivity* (H, F, PC, and W).

2. Literature review

The world's largest organization currently specializing in research and assessment on climate change, the IPCC, regularly issues reports and warns that Vietnam is one of the 84 countries severely affected by climate change. In particular, the climate change scenario of the Government of Vietnam predicts that by 2070, this change will reduce the country's sustainable development goals, including poverty reduction.

The World Bank's *Risks of Climate Change and Adaptation in Asian Coastal Cities* (2010) showed that coastal cities such as Manila (the Philippines), Hồ Chí Minh City (Vietnam), and Bangkok (Thailand) were all severely affected by climate change flooding. As a result, these cities had all cost billions of US dollars to fix, and economic growth had slowed from 2 to 6 percent, depending on the city, over the past 30 years.

Cutter et al. (2003) showed that features of population structure could adapt well or poorly to changes in climate. Research by Dulal et al. (2010) showed that impoverished households were less resilient to the impacts of climate change due to a lack of funds. These studies argued that livelihood vulnerability was the degree to which people and systems could not cope with the negative impacts of climate change and social context (IPCC, 2014).

Hahn et al. (2009) used the LVI in Mozambique. The LVI analysis framework created by Hahn et al. derives from the use of Chambers and Conway's five capital sources and the United Nations Human Development Index (HDI) calculation technique. Hahn and colleagues also used the IPCC's analysis. The study results argued that indicators of social networks and household characteristics are most vulnerable to the impact of climate change.

Shah et al. (2013) study in Trinidad and Tobago was based on LVI and IPCC analysis and showed that characteristics of household livelihood strategies, health care, access to

clean water, and land ownership impact households' ability to adapt to climate change. Madhuri et al. (2014) study in Bihar showed that education levels, livelihood diversity, and expansion of household social networks correlate with their ability to cope with the negative impacts of climate change. Panthi et al. (2016) in Nepal pointed to livelihood strategies and access to food resources as the most important causes of hurting people under the impact of climate change. In the Ghana study, Adu et al. (2017) also showed that social networks and livelihood strategies are essential indicators that households are vulnerable to adapt to extreme weather.

In the Vietnamese context, McElwee (2010) stated that social dimensions from a gender and religious perspective adapted well to climate change, as people helped each other in situations following adverse weather events. Đặng Nguyễn Anh et al. (2015), in their report *Evaluating Evidence: Migration, Environment and Climate Change in Vietnam*, also argued that the Mekong Delta region was the hardest hit by sea level rise and very extreme weather with rainstorms and droughts. The impact of this climate change made people's livelihoods more and more complex and pushed a part of the population out of their traditional places of residence.

IMHEN and UNDP (2015) gave typical negative situations of climate change such as typhoons, floods, flash floods, urban floods, drought, cold, saltwater intrusion to assess exposure. Đặng Thị Hoa, Quyền Đình Hà (2016) showed that shrimp, clams, and fish farming has brought high income to people. Phùng Ngọc Trường et al. (2019) applied the LVI to assess the livelihood vulnerability of coastal residents of Thanh Hóa province. The results of the authors' research showed that residents still had no effective measures to adapt to climate change.

The research on livelihoods in Vietnam's climate change context is studied extensively, with diverse approaches. However, there are few studies on the five-source approach of the UK's Department for International Development (DFID), and the implementation of the content of these sources of capital is incomplete. There has not been much research on the livelihood situation of coastal residents in Vietnam today.

3. Livelihood characteristics of coastal residents in the study areas

The survey results of 600 households in the provinces of Quảng Ninh, Quảng Nam, and Cà Mau showed similarities and differences in the livelihoods of the three coastal provinces.

Firstly, fishing activities were still quite strong in the study areas. This rate was up to 19.16% in all households. In particular, this rate was the highest in Cà Mau province, at

33%. However, most of the activities were pretty small, near shore fishing. The proportion of households with members employed in fisheries decreased markedly in all three study areas. This rate was only 4.5% in all three study provinces.

More residents left the sea and moved to other occupations on shore or away from work. In Cà Mau, the proportion of households with people working far away was the highest (14.5%), while in Quảng Ninh province was less (5.5%). The main reason may be that strong economic development in Quảng Ninh and Quảng Nam provinces provides better options for people. Meanwhile, in Cà Mau province, the economy is still mainly based on forests, fisheries, and a few industrial parks. However, quite a few families still own boats or go fishing as sources of family livelihood at the study sites.

Second, the livelihood activities of Cà Mau province residents differed from those of the other two provinces. Forest-shrimp-crab livelihoods were prominent features at the research site in Cà Mau province. Therefore, the awareness of people here to protect the forest is high. For many people, the forest is the source of life for their family.

Third, about 71.5% of households had livelihood activities related to fisheries. Residents raised oysters, double-leper clams, and other kinds of fisheries in Quảng Ninh province. Cà Mau province is a model of natural shrimp-crab farming. Quảng Nam province's residents raised white, tiger, and Greasyback shrimp. In Cà Mau province, many households have the most diversity in aquaculture. 95% of households raised shrimp-crab-fish in the same area, and Cà Mau province had the most aquaculture diversity compared to the other provinces.

Fourth, cultivation and animal husbandry still developed in coastal areas. This proportion accounted for 42%. In Vân Đồn, Quảng Ninh province, arable land decreased due to people's willingness to sell land for the tourism economy. In Tam Kỳ city and Núi Thành district, Quảng Nam province, the development of marine tourism also created a trend of expectation for land sales, through which the area of arable or livestock land has also decreased markedly among households bordering the sea. In Cà Mau, many families only raised a few goats and chickens in only 5 to 6m² for the household.

Fifth, households had more family members working in industrial zones because they had benefited from the marine economic development process of the Government of Vietnam. The survey showed that up to 24.3% of households had their family members working in factories in the area. This trend was most pronounced in Quảng Ninh and Quảng Nam provinces when the Vân Đồn district has been developing in the marine economy recently, with many companies and enterprises. In Quảng Nam province, there is Chu Lai industrial park. Thus, these industrial clusters were the primary choice for residents to switch from marine occupations to those in industrial zones.

Finally, the survey results showed that households in the three study sites shared one trait: *Livelihood diversity*. In a household, all members had many jobs to earn living and complement each other. Based on the survey, 64% of households in Cà Mau province had more than two sources of livelihood, followed by Quảng Ninh (45%) and Quảng Nam (37%).

4. Comparison of livelihood vulnerability to climate change in Quảng Ninh, Quảng Nam, and Cà Mau provinces

Over the past ten years, climate change has severely impacted the three coastal provinces surveyed. Many severe typhoons hit Quảng Ninh and Quảng Nam provinces, while Cà Mau province is affected by saltwater intrusion and drought. Quảng Nam province has the most loss of people and housing. Cà Mau province is where people are most affected by livelihood activities (Table 1). Climate change significantly impacts the livelihoods of coastal residents, most commonly affected by the agriculture and fisheries of communities.

Table 1: Damage caused by natural disasters in Quảng Ninh, Quảng Nam, and Cà Mau provinces from 2010 -2019

	Quảng Ninh	Quảng Nam	Cà Mau
Human losses	62	527	243
Housing damage	11,491	101,938	9,827
Damage to agriculture and fisheries (hectares)	20,915.74	50,431.6	303,067.86
Number of natural disasters: typhoons, floods, high tides, lightning, thunderstorms, cyclones, droughts	85	194	304
The total value of the damage caused by natural disasters (VND billion)	3,357	4,358	1,706.70

Source: Authors compiled from the Steering Committee of Natural Disaster Prevention and Control and Search and Rescue of Quảng Ninh, Quảng Nam, and Cà Mau provinces from 2010 to 2019.

The survey results of 600 households in the three provinces of Quảng Ninh, Quảng Nam, and Cà Mau showed that climate change over the past several years has affected the

livelihoods of many households. Many households' perceptions showed that the temperature change in the direction of sunshine and abnormal heat was the most, 80.7%. Next was the increasing frequency of storms, 70%. Households shared this issue in Quảng Nam province and the report of the Department of Natural Resources and Environment of Quảng Nam province on climate change in recent years. In addition, households in all provinces surveyed also reported more unusual rains than in the past, causing shrimp diseases or crop damage in the harvest season - 64.3%.

Based on the methodology of Hahn, Riederer, and Foster (2009) and the IPCC (2001), integrated with the perspective of the five sources of capital by Chambers and Conway (1992), the LVI was calculated from -1 (least vulnerable) to 1 (most vulnerable) for coastal provinces Quảng Ninh, Quảng Nam and Cà Mau.

Research results based on the index of each component show that the LVI of Quảng Ninh province is relatively high, with a measurement index of 0.330; of Quảng Nam province is 0.371; and of Cà Mau province is 0.357 (Table 2). Thus, residents in Quảng Nam province are the most vulnerable compared to the other two provinces due to the impact of climate change.

Table 2: Component Values of Livelihood Vulnerability to Climate Change: Comparison of Quảng Ninh, Quảng Nam, and Cà Mau Provinces

	Quảng Ninh	Quảng Nam	Cà Mau
Household profile	0.377	0.356	0.26
Livelihood strategies	0.018	0.094	0.240
Social capital	0.220	0.305	0.180
Material, natural capital	0.577	0.393	0.917
Healthcare	0.273	0.209	0.142
Access to food	0.303	0.458	0.537
Access to water	0.411	0.351	0.367
Natural disasters and climate change	0.387	0.551	0.331
Livelihood Vulnerability Index (LVI)	0.330	0.371	0.357

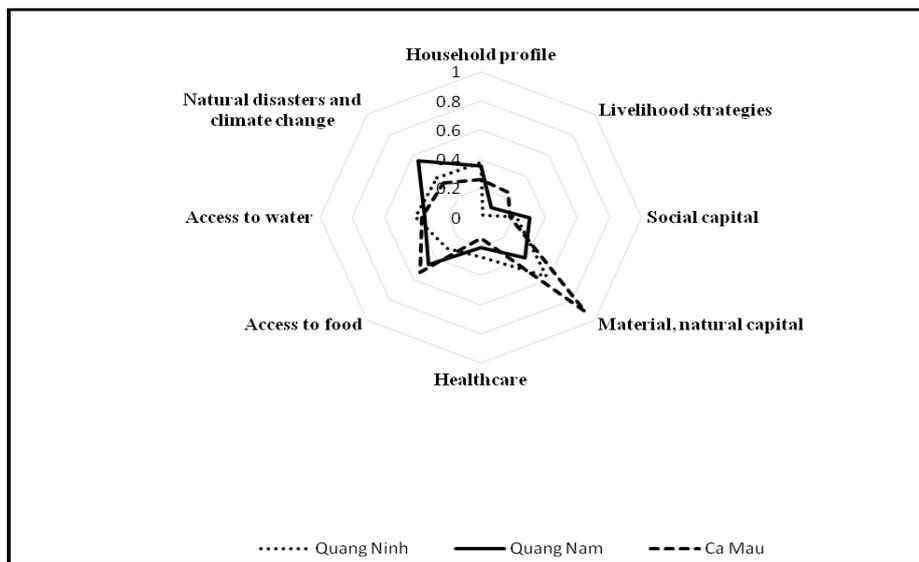
Source: Survey results.

In the more specific calculation of the livelihood vulnerability index due to climate change, material capital and natural capital in Cà Mau province are the most vulnerable (value 0.917). Access to food is also quite tricky for Cà Mau and Quảng Nam provinces in the context of climate change (values 0.537 and 0.458). This reflects the situation of

coastal residents’ livelihoods under the influence of many increasingly large storms, cyclones, floods, weighty rains, and drought conditions that have seriously hurt coastal households. In the context of climate change, households with only one Livelihood based on fishing or aquaculture are often more vulnerable than those with diverse livelihoods, especially in the Vân Đồn district, Quảng Ninh province, where people depend heavily on aquaculture (Table 2).

Graph 1 further shows the components of the Livelihood Vulnerability index for households in 3 provinces of Quảng Ninh, Quảng Nam, and Cà Mau.

Graph 1: Components of the LVI in Quảng Ninh, Quảng Nam, and Cà Mau Provinces



Source: Survey results. Note: 0: Least hurt; 1: Most vulnerable.

The IPCC’s approach also finds that the livelihood vulnerability of residents of Quảng Nam province is higher than those of the other two provinces (0.086). This result is quite similar to the assessment of the LVI index (Table 3).

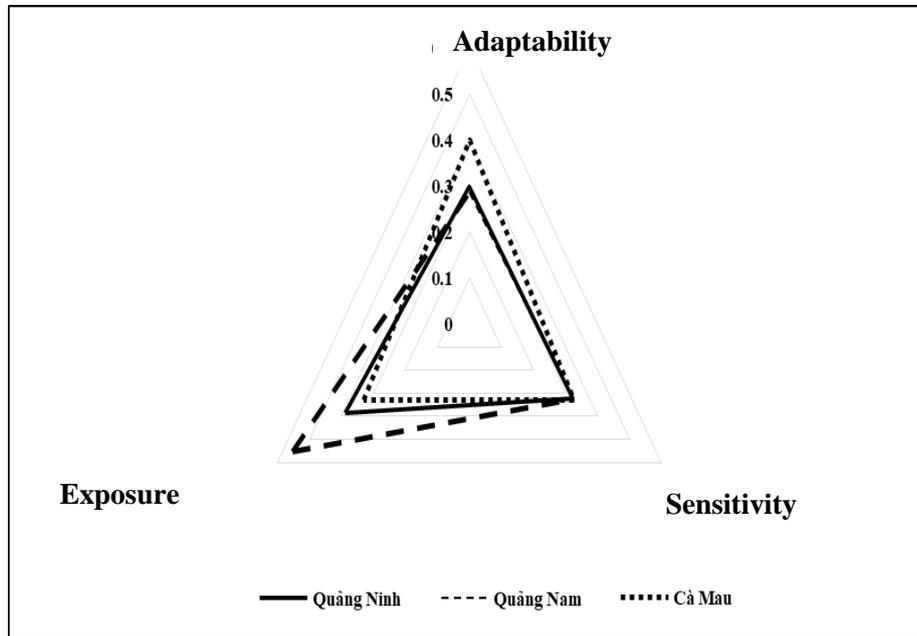
Table 3: Livelihood Vulnerability Due to Climate Change According to IPCC

	Quảng Ninh	Quảng Nam	Cà Mau
Adaptability	0.298	0.287	0.399
Sensitivity	0.323	0.326	0.328
Exposure	0.387	0.551	0.331
LVI-IPCC	0.029	0.086	-0.022

Source: Survey results. Note: -1 (least vulnerable), 1 (most vulnerable).

Graph 2 further shows the model of each component in the LVI for households in the three provinces of Quảng Ninh, Quảng Nam, and Cà Mau, according to IPCC.

Graph 2: Livelihood Vulnerability to Climate Change According to IPCC



Source: Survey results.

Thus, climate change in the past ten years has also affected some sources of capital of households in the provinces of Quảng Ninh, Quảng Nam, and Cà Mau in very different directions.

For human capital, erratic weather changes had disrupted the household members' jobs (58.3%) or even taken jobs from them (22.5%). Changing weather also made members of households more likely to get sick, affecting human health (7.3%).

For social capital, almost all households received warnings about impending adverse weather events in their localities through government agencies at all levels, newspapers, radio, and television (91.7%). However, the level of government support was often quite limited and concentrated mainly in poor and near-poor households (7.7%). Meanwhile, households desperately needed the help of local governments in accessing capital from banks to resume production and search for jobs.

However, the survey results also show that households and neighbors are likely to help each other when they are sick, or with home repairs (about 30%).

For natural capital, the problem of bank erosion and landslides in rivers, canals, and coastlines in communities was reported by most households (22.8%). In Tâm Tiến

commune, Quảng Nam province, Typhoon No. 9 (2020) caused 1.5km of coastline to be eroded and completely broken. In Tam Thanh commune, Quảng Nam province, the natural area of the commune in 1998 was 630 hectares. Now, it is only 570 hectares, a decrease of 60 hectares. The main reason for the decrease in the area was rainstorms and rising sea levels, leading to coastal disruption. Nearly 15% of households also believed that the drinking and domestic water was salty. In particular, households in Cà Mau province were the most affected, accounting for 60% of the total households in the three surveyed provinces. Thus, the project's research results were pretty close to the assessment of the Department of Natural Resources and Environment of Cà Mau province about the shortage of fresh water in the province in recent years due to the increasing drought.

As for financial resources, job disruptions and job losses, as stated above, inevitably affect the incomes of many households. Climate change also harmed the farming and aquaculture activities of households. For example, abnormal weather changes increased disease outbreaks in fisheries (48.5%); households with crop operations lost crops by 32.2% (Table 4).

In the annual summary reports of the People's Committee of Đất Mũi commune, Cà Mau province are carefully listed the climate change impacts on the cultivation, livestock, and aquaculture of people in the area, which is presented in Table 4:

Table 4: Impacts of Climate Change on Household Sources of Capital

Capital and Climate Change	Issues	Proportion (%)
Human Capital	Work interruption	58.3
	Job losses	22.5
	Diseases	7.3
	Family having members injured, missing, or dead	2.5
Social Capital	Warnings from local government	91.7
	Disaster assistance by the local government	7.7
	Households visiting neighbors when they are sick	44.8
	Households helping each other with home repairs	33.3
	Households helping each other at work	30.7
	Households receiving assistance from neighbors when sick	26.8
	Households receiving help from neighbors when repairing their homes	31.5
	Households lending money to neighbors when needed	6
Households receiving help from neighbors when lending money	1.8	

Natural capital	Shore erosion, landslides in communities	22.8
	Water sources for households contaminated with salinity	14.8
	Soil subsidence	13.8
	Traveling landslides	12.8
	Lack of domestic water	6.3
	The area of the family's business land reduced	5.8
	Lack of water for irrigation of crops	3.8
	The area of forest land reduced	3.7
Physical capital	The area for residential land reduced	4.7
	House landslides	6.2
	Home damage	45.8
	Change of residence	4.7
Financial capital	Loss of business capital	38.2
	Diseases caused to farmed aquaculture	48.5
	Crop failure due to rains, storms, floods	32.2
	Erratic sunshine and rain causing shrimp to experience temperature shock, changing water quality	31.7
	More pests than before	21.5
	Crop yield reduced	20.7
	Sick or dead cattle and poultry	16.3
Crops flooded, waterlogged	11.8	
Climate Change Identification	High temperature	80.7
	More storms	70
	Weighty rain	64.3
	Drought, increased drought	38.2
	More flooding	30.7
	Unusually high tides	30.3
	Lower, colder temperatures	28.2
More thunder	22	

Source: Survey results.

Thus, it can be concluded that the negative climate change in coastal provinces has affected the livelihoods and lives of the local communities. In Vân Đồn district, Quảng

Ninh province, weather changes have affected oyster farming. In Quảng Nam province, erratic rains and storms affected people's near shore fishing, shrimp farming, and peanut farming activities. In Đất Mũi commune, Cà Mau province, climate change significantly affects the natural capital of households.

6. Conclusion

Vietnam is a country heavily affected by climate change. The livelihoods of Vietnam's coastal residents in the context of climate change face many challenges, difficulties, and different disadvantages. Since 1996, the Party and Government of Vietnam have profoundly adjusted their leadership views on livelihoods and climate change, including response, prevention, and resilience, and added the concept of adaptation to climate change, with the determination to leave no one behind.

Prime Minister Phạm Minh Chính said at COP26: "Responding to climate change and restoring nature must be the highest priority in all development decisions, the highest ethical standards of all levels, sectors, businesses, and people. Action must be based on nature, people-centered, subject and motivation for sustainable development, leaving no one behind" (Chu Thanh Hương, 2021). Accordingly, to ensure sustainable livelihoods for coastal people, we take the people-centered approach and live in harmony with nature.

Therefore, there is a need for integrated solutions to help coastal the people strengthen their capacity to respond to and adapt to climate change, to secure sustainable livelihoods for people at the community level, to enhance resilience at all levels to mitigate the negative impacts of extreme weather, and to limit vulnerability. The solution is to have a strategy to secure marine livelihoods for coastal residents of Vietnam, along with sustainable economic exploitation and management of marine economic development closely associated with environmental protection.

Over the past ten years, negative climate change has been taking place in coastal provinces, affecting the livelihoods and livelihoods of communities. The changing weather intensifies typhoons and gradually strengthens in Quảng Ninh and Quảng Nam provinces. In Cà Mau province, the weather follows the tendencies of heat, drought, and high tides.

The study results have shown that the five sources of capital play an essential role in creating sustainable livelihoods in the context of climate change in the three coastal provinces of Quảng Ninh, Quảng Nam, and Cà Mau. In this context, the survey results of livelihood activities of households in the three provinces showed that:

Quảng Ninh province residents' livelihood is oyster farming, clams, fish, and nearshore fishing. Quảng Nam province residents' livelihood combines farming, aquaculture, near shore and offshore fishing. The livelihood of Cà Mau province residents with forest-shrimp-crab is the most prominent feature.

Fishing-based livelihoods remain strong in the study areas. However, fishing activities are primarily small and close to shore. The number of households employed in fishing decreased markedly in all the three study regions. Many residents leave their jobs and move to other occupations on shore or away from work.

Most households have livelihood activities related to fisheries, including fishing and aquaculture. Although the inhabitants live along the coast, farming and animal husbandry are still quite developed but generally small-scale. The marine economic policy over the past years of the Party and Government of Vietnam has created advantages for families to change careers and find more suitable and safer jobs. Households have more and more family members working in industrial parks, factories, and companies. Research results show that livelihood diversity is the trend of choice for many households today. A person can have many different jobs depending on changes in the weather.

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