

IMPACTS OF CLIMATE VARIABILITY ON LIVELIHOOD ACTIVITIES OF VIETNAM COASTAL FISHERS COMMUNITY TODAY*

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Abstract

Currently, climate variability is taking place on a global scale and has profound impacts on human life. Vietnam is considered as one of the countries most affected by climate change, especially for the livelihoods of fishing communities in coastal areas. The main content of the article clarifies the concept of climate change, the manifestations of climate change, on that basis, analyzes the impacts of climate change on the livelihoods of fishermen in coastal fishing community in Vietnam today in aquaculture, exploitation and supply of fisheries products.

Keywords: *Climate variability; livelihoods; coastal fisher.*

1. Introduction

Climate variability is a global issue, posing many challenges to countries, especially developing countries like Vietnam. According to international organizations, Vietnam is one of the countries heavily affected by climate variability. This has had a great impact on the livelihoods of people, especially fishermen in coastal areas. Climate variability causes floods, sea level rise, saltwater intrusion..., has seriously affected the livelihoods of coastal fishermen in aquaculture, exploitation and provision of aquatic services. Therefore, research on climate variability and its impact on the livelihoods of coastal fishing communities is an urgent issue today.

2. Method

On the basis of using methods of analysis, synthesis, systematization and generalization of relevant documents on climate variability, livelihoods, coastal fishing communities combined with actual surveys, sociological investigations in some coastal localities. The article clarifies the concept of climate variability, its manifestations and its

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causes; explain the impact of climate variability on the livelihood activities of coastal fishing communities in Vietnam today in three aspects: aquaculture, exploitation and provision of fisheries services.

3. Results

3.1. The concept of climate variability

The term climate variability first appeared in the United States in 1968, referred to in a report by the Stanford Research Institute, USA (SRI) titled "Resources, Redundancy and Fate of gases that pollute the environment" to the American Petroleum Institute (API), a trade organization involved in the fossil energy industry. The report was assessed by scientists from the Center for International Environmental Law as the first alarm to alert the world about the harmful effects of excessive CO₂ in the air. In the study, scientists from Stanford University said that if the amount of CO₂ is not controlled, it will cause "climate variability " through specific manifestations such as increasing temperatures, melting ice at the poles and rising sea levels.

Following the phrase "climate variability " in 1968, the world appeared the term "global warming". "Global warming" was first used in a scientific journal by geochemist Wallace Broecker from the Lamont-Doherty Geological Observatory at Columbia University, USA. This article is titled "Climate variability: Are we on the brink of a climate variability?".

In 1988, the famous NASA scientist - James Hansen convinced the US Congress that climate variability had begun despite the suspicions of many other scientists. Hansen said that Earth's temperature in the first five months of 1988 was the warmest in 130 years since scientists started recording annual temperatures. Hansen asserts with 99% certainty that the cause of climate variability is not natural but man-made. Since then, the world has begun to pay more attention to climate variability.

Some achievements to date can be mentioned such as the Kyoto Protocol signed in 1997 and came into effect in 2005 and later the Paris Agreement within the framework of the United Nations Framework Convention on Climate Change (UNFCCC) governs CO₂ reduction measures from 2020.

Currently, the concept of climate change has many different views:

According to the definition of the United Nations Framework Convention (UNFCCC): Climate change is a change in climate, which is directly or indirectly caused by human activities that change the composition of the atmosphere, and contribute further to the observed natural climate variability over comparable time periods.

According to researchers from the Vietnam Administration of Seas and Islands: Climate variability is a change of weather that normally occurs in a certain place. It can be

the variation in rainfall in a year, or it can be the variation in temperature in a month or in a season. Climate variability is also a change in the earth's climate. It could be a variation of the usual temperature of the earth. Or it could be the variation of rain and snowfall on the earth [5].

Climate variability is a change in climate and related components including the oceans, land, Earth's surface, and the cryosphere, such as increasing temperatures, melting ice, and rising sea levels. Previously, climate change occurred over a long period of time due to the impact of natural conditions, however, recently, climate change occurs due to the impact of human activities such as the use of natural resources. use fossil fuels in transportation and industrial production, emit greenhouse gases (eg CO₂) [6].

Climate variability is changes in the physical or biological environment that cause significant adverse effects on the composition, resilience or reproduction of natural ecosystems or on the functioning of natural ecosystems. socio-economic system or to human health and welfare [7].

Climate variability is adverse changes in natural physical or biological environments that have harmful effects on the living things on earth with specific and direct effects on weather, all The manifestation of the weather becoming more severe is due to the adverse effects of the climate. As a result, the climate situation also develops in a more extreme direction, and at the same time brings about bad manifestations that the whole world is facing such as floods, natural disasters, tsunamis or heat and drought... [8].

3.2. Manifestations of climate variability and its causes.

3.2.1. Manifestations of climate variability

- The greenhouse effect and global warming.

The greenhouse effect is the effect that makes the earth's atmosphere warm because the shortwave radiation of the Sun can penetrate the atmosphere and reach the ground; The absorption ground heats up, creating long wave radiation into the atmosphere for CO₂ to absorb, making the air warmer. The CO₂ in the atmosphere is like a thick layer of glass covering the Earth, making the earth no different from a large greenhouse. According to calculations, without the atmosphere, the average temperature at the earth's surface layer would drop to -23 degrees Celsius, but the actual average temperature is 15 degrees Celsius, which means that the greenhouse effect has made for the earth to warm up to 38 degrees Celsius. In addition to CO₂, there are also methane, ozone, halogens and water vapour, which also have an important effect on the greenhouse effect. Along with population and industrial development at an increasing rate, CO₂ emissions into the atmosphere also increase. The forest is over-cut, CO₂ should be absorbed by the forest, but the forest area is cut down, so the amount of CO₂ is increasing, the greenhouse effect is increasing

continuously. According to analysis in the past 200 years, the concentration of CO₂ has increased by 25%, the average temperature of the Earth has increased by 0.5 degrees Celsius. It is estimated that by the middle of the next century, the Earth's surface will be hotter by 1.5 more. - 4.5 degrees Celsius; in which the temperature in middle and high latitudes increases more and more [9].

According to the 2nd National Notice of the Ministry of Natural Resources and Environment: From 1958 to 2007, the average annual temperature in Vietnam increased by about 0.5 - 0.7 degrees Celsius. Winter temperatures increased. faster than summer temperatures, and temperatures in the northern regions rise faster than those in the south. Specifically, in 2007, the average annual temperature in Hanoi, Ho Chi Minh City and Da Nang was 0.8 - 1.3 degrees Celsius higher than the average of the decade 1931-1940; higher than the decade 1990 - 2000 is 0.4-0.5 degrees Celsius [10].

- Increasing temperature, hot weather, and drought appear more.

According to experts, the recent warming phenomenon in many parts of the world is the result of huge hot air masses "swirling" around the northern half of the planet, leading to the phenomenon of heat, heat, and heat. growth in the Americas, Europe and Asia.

In Vietnam, according to hydrometeorological experts, the ongoing heat wave has caused temperatures in some areas to exceed the highest levels in history (in 2019). According to statistics from meteorological and hydrological centers across the country, the hottest area is the North Central region with a temperature of up to 43 degrees Celsius (previously, the highest temperature in this locality at the same time was also the highest in the central region). only reach 41 to 42 degrees Celsius). Even an area with a cool climate like the Northwest also recorded a record temperature increase of 40 to 43 degrees Celsius [11].

- Sea level rise.

A worrying manifestation of climate change is that sea level rise has been causing widespread flooding, salinization of water sources, great impacts on agricultural production, and risks to industry and ecosystems. future socio-economic system. Observational data at Vietnam's coastal hydrographic stations show that the current average sea level rise rate is 3mm/year, equivalent to the average growth rate in the world. Over the past 50 years, sea level at Hon Dau Hai Van Station has increased by about 20cm [10]. Global climate change is causing global warming every day, resulting in countless consequences such as melting ice, rising sea levels... Only in the past decade, the rate of increase has increased. of sea level has almost tripled over the last century.

According to United Nations statistics, due to the direct impact of climate *variability*, sea level in the global ocean has increased by 15-20cm since 1900 [12]. Until recently, sea level rise was due to increased water volume due to higher temperatures. Today, the

phenomenon of melting glaciers, especially the ice sheets at the top of Greenland in the North Atlantic and Antarctica, have become the main cause of rapid sea level rise.

Around the world, many countries have had to warn about sea level rise or people have to evacuate because sea water has submerged coastal areas. In Vietnam, according to 2018 data, if the sea level rises 1m, there will be about 40% of the Mekong Delta area, about 10-12% of Vietnam's population will be directly affected, and about 10 % GDP. Recently, forecasts have also confirmed that our country's sea level may increase by 33.3cm in 2050 and 45cm in 2070, about 1m in 2100 [13]. If this scenario plays out, many coastal land areas and low-lying areas will be submerged. Some areas will even be permanently flooded.

Sea level rise not only shrinks the land area, but also salinizes some freshwater sources, adversely affecting agricultural production, threatening people's lives. The most affected area is the Mekong Delta. Accordingly, it is forecasted that by 2030, about 45% of this area will be locally saline and cause heavy damage to the crop industry (about 17 billion USD) as well as the water supply system in the low-lying areas of the South [12].

- The phenomenon of saline intrusion.

The most obvious impact of climate variability is to greatly change the flow regime on most rivers and streams, causing many rivers and streams to have their flow severely reduced, in many places to reach record lows and increase increasing the situation of floods, pipe floods, flash floods, riverbank and stream erosion in many localities across the country. Its consequences are leading to drought, water shortage, saltwater intrusion, especially lack of clean water for people's living purposes in many localities as we have seen in recent times.

- Present flash floods and landslides.

Flash floods and landslides are clearly seen in the mountainous terrain of Vietnam. Climate change is likely to make natural disasters more severe and potentially catastrophic, posing great risks to economic and social development or erasing many years of development gains. The regions and areas that are expected to be most affected by negative climate phenomena are the Central Coast, the Northern and North Central Highlands, the Northern Delta and the Mekong River Delta.

According to the Central Hydro-meteorological Forecasting Center, the main impacts of climate change on the factors causing floods, flash floods and landslides are very large; it changes precipitation in the seasonal, spatial distribution; increase the intensity of rain in most situations of floods, flash floods, landslides; increased evaporation and decreased soil moisture. In addition, it causes changes in the vegetation cover due to changes in temperature and precipitation; increased inundation and loss of coastal wetlands due to sea level rise.

According to climate change scenarios, for the Northern mountainous region, the impact of climate change will cause summer rainfall to increase, spring rainfall to decrease; The rainy season as well as the dry season becomes more irregular: starting and ending can be too early or too late, rain is more intense in the peak months of the rainy season and drier in the last months of the season. dried.

In particular, in recent years, flash floods and landslides with unexpected, fast, and devastating characteristics often occur in small and medium-sized basins in the high mountains of the North, Central and West regions. Original. According to experts, flash floods and landslides are increasing in frequency and intensity.

Flash floods and landslides occur in river basins of the Northern and North Central mountainous regions with favorable features for formation: Dissected topography, large slopes of basins and streams, and high degree of elevation. The stability of the topsoil is weak due to strong weathering and the climate seasons of the year are sharply contrasted, the vegetation cover is strongly destroyed, and water concentrates rapidly when there is heavy rain.

3.2.2. Causes of climate variability.

There are many reasons leading to climate variability, but basically it can be reduced to the following two causes:

- Objective causes (due to natural variations), including: changes in solar activity, changes in the earth's orbit, changes in the position and size of the continents, the changes in ocean currents, and circulation within the atmospheric system.

Natural causes of climate variability include changes in the intensity of the sun's brightness, the appearance of sunspots (Sunspots), volcanic activity, ocean changes, and changes in the Earth's orbit.

The change in the intensity of the sun's light causes the energy reaching the ground to change, thereby changing the temperature of the earth's surface. Specifically, since the formation of the Sun until now, nearly 4.5 billion years the intensity of the Sun's brightness has increased by more than 30%. Thus, it can be seen that for such a long time, the change in sunlight intensity does not significantly affect climate change.

Volcanic eruption - When a volcano erupts, it releases into the atmosphere an extremely large amount of sulfur dioxide (SO₂), water vapor, dust, and ash into the atmosphere. Large volumes of gas and ash can affect the climate for many years. Small particles called aerosols are ejected by volcanoes, aerosols reflect solar radiation (energy) back into space so they have the effect of reducing the temperature of the earth's surface layer.

Oceans Today - The oceans are a major component of the climate system. Ocean currents move large amounts of heat across the planet. Changes in ocean circulation can affect climate through the movement of CO₂ into the atmosphere.

Change the orbit of the earth - the earth revolves around the sun with one orbit. The axis of rotation has an inclination angle of 23.5°. Changing the tilt of the Earth's orbit can lead to small changes. The rate of change is extremely small, can take into account the time of billions of years, so it can be said that it does not have a big impact on climate change.

It can be seen that the causes of climate change due to natural factors contribute a very small part to climate change and are cyclical from the past to the present. According to research results and published from the Intergovernmental Panel on Climate Change, the cause of climate variability is mainly due to human activities. Invite readers to follow the next article on the causes of climate variability due to human activities.

- Subjective causes (due to human impacts) stem from the change in land and water use purposes and the increase in emissions of CO₂ and other greenhouse gases from human activities.

Thus, climate change is not only a consequence of the greenhouse effect (warming of the earth) but also of many other causes. However, there is a lot of scientific evidence to show that there is a relationship between the increase in earth's temperature and the increase in the concentration of CO₂ and other greenhouse gases in the atmosphere, especially in the industrial era. . During the nearly 1 million years before the industrial revolution, the concentration of CO₂ in the atmosphere ranged from 170 to 280 parts per million (ppm). It is now much higher at 387 ppm and will continue to grow at an even faster rate. Therefore, an increase in the concentration of CO₂ in the atmosphere will cause the earth's temperature to increase and the cause of climate change is because the earth cannot absorb all the CO₂ and other gases, causes the greenhouse effect and other effects due to an excess of gases in the atmosphere.

Since pre-industrial times (circa 1750), humans have used more and more energy, mainly from fossil fuel sources (coal, oil, gas), which have been released into the atmosphere. increasing greenhouse gases of the atmosphere, leading to an increase in the temperature of the earth.

Atmospheric CO₂ data determined from ice cores drilled in Greenland and Antarctica show that, during glacial and thaw cycles (about 18,000 years ago), CO₂ levels in the atmosphere the atmosphere is only about 180 -200ppm (parts per million), which is only about 70% of the pre-industrial period (280ppm). From around 1,800, the CO₂ content started to increase, surpassing 300ppm and reaching 379ppm in 2005, which is about 31% increase over pre-industrial times, outstripping natural CO₂ levels by about 650 thousand past year.

Concentrations of other greenhouse gases such as methane (CH₄), nitrous oxide (N₂O) also increased from 715ppb (parts per billion) and 270ppb in pre-industrial times to 1774ppb (151%) and 319ppb (17%). 2005. Particularly, chlorofluorocarbons (CFCs) are both a greenhouse gas with a global warming potential many times greater than CO₂, as well as a stratospheric ozone-depleting substance, which has only been found in the atmosphere produced by humans since the development of refrigeration and cosmetics industries.

The scientific assessment of the Intergovernmental Panel on Climate Change (IPCC) shows that the energy consumption due to burning fossil fuels in energy production, industry, transportation, construction... contributes about approx. half (46%) to global warming, tropical deforestation contributes about 18%, agricultural production about 9% chemical manufacturing industries (CFC, HCFC) about 24%, the rest (3%) is from other operations.

Between 1840 and 2004, the total CO₂ emissions of rich countries accounted for 70% of total global CO₂ emissions, of which the United States and Great Britain emitted an average of 1,100 tons per person, about 17 times more than in China and 48 times in India.

In 2004 alone, US CO₂ emissions were 6 billion tons, about 20% of total global CO₂ emissions. China is the second largest emitter with 5 billion tons of CO₂, followed by Russia 1.5 billion tons, India 1.3 billion tons, Japan 1.2 billion tons, Germany 800 million tons, Canada 600 million tons, UK 580 million tons. Developing countries emit a total of 12 billion tons of CO₂, accounting for 42% of total global emissions compared to 7 billion tons in 1990 (29% of total global emissions), which shows the rate of emissions. The CO₂ emissions of these countries have increased quite rapidly over the past 15 years. Some developed countries rely on it to require developing countries to also commit under the Climate Change Convention.

In 1990, Vietnam emitted 21.4 million tons of CO₂. In 2004, emissions of 98.6 million tons of CO₂, an increase of nearly 5 times, per capita 1.2 tons/year (world average is 4.5 tons/year, Singapore 12.4 tons, Malaysia 7). 5 tons, Thailand 4.2 tons, China 3.8 tons, Indonesia 1.7 tons, Philippines 1.0 tons, Myanmar 0.2 tons, Laos 0.2 tons).

Thus, Vietnam's CO₂ emissions have increased quite rapidly over the past 15 years, but are still low compared to the global average and many countries in the region. It is estimated that Vietnam's total greenhouse gas emissions will reach 233.3 million tons of CO₂ equivalent in 2020, an increase of 93% compared to 1998 [14].

However, it is worth noting that, while rich countries account for only 15% of the world's population, their total emissions account for 45% of total global emissions; African and sub-Saharan countries with 11% of the world's population emit only 2%, and the least developed countries with a third of the world's population emit only 7% of total global emissions. That is what developing countries raised about equality and human rights at the negotiations on the Climate Convention and the Kyoto Protocol.

Therefore, a fundamental principle, first enshrined in the United Nations Framework Convention on Climate Change, is: Parties must protect the climate system for the benefit of present and future generations of mankind, on the basis of equity, in accordance with common responsibilities, developed countries must take the lead in combating climate change and its harmful effects.

3.3. Impact of climate variability on livelihoods of coastal fishing communities

Livelihood is the activity of making a living of people through the use of resources (human, natural, material, financial, social...) managed by organizations, institutions, and policies [4].

Vietnam currently has about 480,000 people directly involved in fishing; 100,000 people work in the seafood processing industry and about 2,140,000 people are engaged in fisheries services [15]. Fishery livelihoods, including fishing and aquaculture, which depend on water availability and the abundance of coastal resources, should be among the most sensitive and vulnerable to impact of CC. The survey results of the Ministry of labour, Invalids and Social Affairs in 2011 showed that the surveyed localities had a high percentage of workers working in the aquaculture sector, the number ranging from over 50 % to 90% of the workforce. Due to limited investment capital and knowledge/technique, people's aquaculture activities are almost dependent on the natural environment, weather, etc. Losses in aquaculture tend to increase increase in recent years due to the influence of sea level rise, drought, saline intrusion, unseasonal rains and floods, changes in water environment. The loss of aquaculture production in some provinces, such as Bac Lieu, Ben Tre, Ca Mau, etc. has increased by 30-40%/year.

Climate variability has negatively impacted the livelihoods of coastal fishermen in our country in the following ways:

Firstly, the impact of climate change on livelihood activities of coastal fishing communities in aquaculture.

Climate variability causes sea water temperature to increase, which is detrimental to the habitat of some aquatic products; The faster process of mineralization and decomposition affects the organism's food source, making it more expendable in respiration and other activities. The oxygen content in the water decreases rapidly, slowing the growth of aquatic products, creating unfavorable conditions for aquatic organisms that have adapted to the aquatic environment so far, reducing the amount of food for fisheries species.

Climate variability causes changes in the position and intensity of tidal currents and upwelling areas and increases the frequency and intensity of storms and small vortices. The changing hydrological and hydrological conditions have affected the quality of life and the growth rate of aquatic resources. Inundation due to sea level rise will lead to loss of arable

land for agriculture. If sea level rises by 1m, it is estimated that about 40% of the Mekong Delta and 3% of other coastal provinces will be inundated [16]. Flooding will cause loss of arable land in coastal agricultural and fisheries areas of Vietnam, especially in the Mekong Delta and Central Coast. On a national scale, Vietnam will lose more than 2 million hectares of agricultural land (about 50%) if the sea level rises by 1m.

Due to limited investment capital and knowledge and technology, people's aquaculture activities are almost dependent on the natural environment, weather, etc. Damages in aquaculture tend to increase increased in recent years due to the influence of sea level rise, drought, saline intrusion, unseasonal rains and floods, changes in water environment. Losses in aquaculture production have increased markedly in recent years.

Second, the impact of climate variability on livelihood activities of coastal fishing communities in fishing.

Climate variability not only negatively affects aquaculture activities in terms of both scale and output, but also negatively impacts fishing activities. Climate variability with the erratic changes of weather at sea (heavy rain, big storms, rising sea level...) has caused many difficulties and dangers for fishermen's ships going out to sea to exploit fishery products. In addition, the time to sail for fishermen is longer and farther from the shore due to the reduction of fishery output, which has a significant impact on human costs and costs incurred in the fishing process of fishermen, affecting the lives and livelihoods of fishermen. In general, climate change tends to change the habitats of aquatic species, leading to changes in the stock of aquatic species due to migration or deterioration of habitat quality; thereby narrowing the fishing ground, catch and aquaculture output.

Third, the impact of climate variability on livelihood activities of coastal fishing communities in the provision of aquatic services.

Aquaculture - exploitation - services in aquaculture are three closely linked stages. Therefore, the negative impacts of climate change on aquaculture and fishing activities have also negatively impacted on aquaculture service provision.

Climate variability also has a direct impact on the activities of aquaculture, because the complicated and erratic changes of the weather have made transportation services from the place of exploitation to the place of processing and consumption meet. many difficulties, especially in the cross-regional and cross-border supply services facing many interruptions. This not only affects the quality of the product, but also the economic efficiency of the product, because the additional costs from providing services increase, but sometimes the product price decreases due to disadvantages of climate variability.

In addition, due to climate change leading to more and more negative weather phenomena (rainstorms, floods, droughts...) Service equipment is increasing, the cost of

repairing, maintaining and rebuilding wharves, fishing ports, ships... has greatly affected the livelihoods of fishermen.

4. Conclusion

Currently, climate variability has been causing the greenhouse effect and global warming; temperature increases, heat and drought appear more; sea level rise; saltwater intrusion; flash floods and landslides are becoming more and more complicated. This has had a negative impact on people's livelihood activities, especially on the livelihoods of coastal fishing communities in aquaculture, exploitation and provision of aquatic services. This is a hindrance and a big problem in achieving the goal of stabilizing and improving the lives of fishermen in coastal areas. Faced with that reality, it is required that the Party, State and authorities at grassroots levels have quick response measures in order to minimize negative impacts and adapt to climate variability, and improve the quality of life for fishermen in coastal areas.

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