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ADAPTATION AND MITIGATION OF CLIMATE CHANGE IN MAINTAINING FOOD SECURITY BY TRADITIONAL COMMUNITIES

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Abstract

Ongoing climate change has affected individuals' lives in different parts of the world including the traditional communities. The accessibility of natural resources regularly utilized as a wellspring of occupation is so vulnerable against climate change. Alongside the event of an unnatural weather change that brought about outrageous climate change, different regular marvels that happen presently isn't the same any longer. Traditional communities may not comprehend the ideas of a global warming and climate change, yet they watch and feel their impact. Different saw impacts, for example, diminished precipitation, increment in air temperature, expanding the force of the sun and precipitation which isn't balanced out. Mostly food production is declining alongside different climatic changes. In a few simulation of climate change demonstrates of synthetic manure utilization, heat stress and water shortage can prompt a decrease in rice production up to 3.8% in Asia toward the finish of the 21st century. Adjustment and relief to climate change are done with different acclimations to decrease vulnerability or increase resilience to the climate change. Oblivious adaptation and mitigation practices of climate change have been honed by traditional communities through the cultivating frameworks they work. Different systems are completed not exclusively to address nourishment issues and to support their lives. Different discoveries demonstrate that the conventional cultivating framework keep running by the group is plainly ready to keep up their food security in the midst of the danger of dry season, heat stress and different interruptions caused by climate change.

Key words**:** *climate change, farming system, food security, traditional communities*

INTRODUCTION

Over the last few decades, human activities in meeting the needs of life have caused many emissions and trigger the occurrence of warming in all parts of the world. A variety of gases from anthropocentric activity are emitted into the air to form a thick layer called a greenhouse gas layer. The layers that are formed because the difficulty of the sun reflected by the earth's surface is passed back into space. The sunlight returns to the surface of the earth and causes intense warming and results in global temperature rise. The incident caused various new phenomena such as melting ice sheets in various parts of the world, rising sea levels to extreme climate change.

Recent climate change has had an impact on people's lives in various parts of the world including traditional societies. Heating and drought trends along with intense extreme climatic changes such as storms, floods, and hailstorms are prevalent throughout the world, especially the Asia and Pacific region in recent decades. This region is very important because it has the highest number of poor people in the world, whose poverty is closely linked to repeated exposure to climate change risks [24].

More than 60 percent of the population in the Asia and Pacific region depends on the natural resources that surround them. The availability of natural resources commonly used as a source of livelihood is so vulnerable to climate change. The community's dependence on these natural resources poses a threat to the sustainability of available natural resources as well as the livelihoods of these communities.

One of the most alarming threats is food security and the sustainability of agricultural practices in the community. Climate change leads to various failures in agricultural systems that have been used. Extreme changes

in rainfall, seasonal periods and other things create uncertainty so that agricultural systems used tend to be counter-productive. Crop failures and declining agricultural production are widespread along with the current extreme climate change.

However, these failures do not occur in some indigenous or traditional communities who still maintain the agricultural system they have been using for so long. Traditional farming systems adhered to by indigenous peoples have proven to adapt to various climatic changes and it is possible to be applied as a mitigation strategy for climate change in maintaining food security in the community.

MATERIALS AND METHODS

In writing this article, there were used important published articles and textbooks as mentioned in the list of references. A critical approach was managed by authors based on the collected information.

RESULTS AND DISCUSSIONS

Traditional Communities, Local Wisdom, And Climate Change

Traditional societies are often assumed to be people living in rural areas or close to natural resources. Meanwhile, in Indonesia, there is also known as indigenous peoples who are indigenous peoples who inhabit an area where bound by a rule known as customary law. Meanwhile, according to the AMAN (Alliance of Indigenous Peoples of the Archipelago) at the First Congress of 1999, the indigenous peoples are: Communities that live on the basis of ancestral origins on an indigenous territory, which has sovereignty over land and natural resources, socio-cultural life that is governed by customary law and adat institutions that manage the sustainability of community life.

Indigenous or traditional peoples largely inhabit economically and politically marginalized areas, whereas indigenous or traditional peoples have a very high dependence on natural resources. Various existing limitations encourage people's thinking ability to create local knowledge and knowledge in identifying various issues. Local knowledge is a unique, traditional, long-standing empirical knowledge in a given geographical area [7].

Local decisions about daily needs such as hunting and gathering, fisheries, agriculture, animal husbandry, water conservation, health and other activities are based on local knowledge owned by the community [21]. The knowledge they have is solely used to meet their basic needs equally within the limits set by the tradition including the management of natural resources around them.

Local knowledge on natural resource management is largely derived from the habit of observing the various activities that occur around them. Environmental changes are observed through various natural phenomena captured through the presence of certain bird species, breeding season of animals or flowering of certain plants that serve as a marker for time and season changes that are well understood by traditional societies. The various markers are also linked to the right time in utilizing natural resources including running an agricultural system.

But along with the occurrence of global warming that resulted in extreme climate change, various natural phenomena that occur now is not the same anymore. Traditional societies may not understand the concepts of global warming and climate change, but they observe and feel their influence. Various perceived effects such as decreased rainfall, increase in air temperature, increasing the intensity of the sun and rainfall is not stabilized. This caused a change in the natural phenomenon that has been used as a marker by traditional society. Traditional societies are therefore required to continue to identify changes and adapt to those changes [8].

Climate Change Impacts on Agricultural Practices

Agriculture is one of the important sectors in food security as it relates to the provision, access, and absorption of food. The agricultural sector is also a sector that is particularly vulnerable to various disruptions including climate change. To always maintain

food security, an agricultural system that can adapt to various disruptions including climate change so that availability, access to food absorption in the community can be guaranteed.

Since the green revolution, increased agricultural production through the intensification of many agricultural systems is enforced. Agricultural intensification has done a lot to change the traditional farming system done by the community. The monoculture system used in agricultural intensification also tends to exclude the diversity of crop varieties, especially the rice varieties owned by the community. Increased use of chemical fertilizers and land exploitation also occur to support agricultural intensification.

Unfortunately, the intensification of agriculture carried out leads to a decrease in environmental quality. Forests and a variety of cultivated land including sloping hills convert functions into agricultural lands and plantations that lead to an increase in the rate of soil erosion. Intensive farming practices also pose many problems to water and soil quality [19]. These problems threaten the sustainability of agricultural practices undertaken by the community. Meanwhile, other threats such as population increase, global warming, and extreme climate change are also a new nuisance to the sustainability of agricultural practices.

The impacts of climate change and extreme events that occur, shows the results of agricultural production in many Asian countries decline, partly influenced by the increase in temperature and extreme weather events. Production of rice, maize, and wheat in recent decades has shown a decline in most of Asia, due to rising water pressure, rising temperatures, increasing El Nino frequencies and decreasing rainfall [25][1][10][6][22][23]. [16] mentioned that rice yields decreased by 10% for every minimum temperature rise of 1°C at each growing season. The frequency of diseases triggered by climate change and heat stress in central, eastern, southern and South-eastern Asia has increased with increasing temperatures and rainfall variations.

Most food production is declining along with various climatic changes. In some simulations, climate change shows a combination of chemical fertilizer use, heat stress, and water scarcity can lead to a decline in rice production up to 3.8% in Asia at the end of the 21st century. Meanwhile, with the extreme climate change occurring, it is estimated that by 2050 rice and wheat production in Bangladesh has decreased by 8% and 32% [5]. The threat of this production decline not only affects agriculture with modern systems but also affects agricultural land run by traditional farming systems.

Traditional agricultural land with rain-fed irrigation threatened to decrease production in line with the global temperature rise that occurred. The rise in global temperatures up to 0.5 ° C proved to decrease 0.45 tons per hectare of wheat yield in India. Other simulations in South Asia show that a 2.5 ° C temperature rise could trigger a decrease in net rice and rainfed rice production by 9-25% [11]. Meanwhile, in China, a 2 ° C temperature increase could decrease rain-fed rice production by 5-12% [12]. Therefore, appropriate adaptation and mitigation strategies are needed in the face of extreme temperatures and climate changes that occur to avoid a decline in food production that threaten food security and the practices of sustainable agriculture.

Adaptation and Mitigation Traditional Communities towards Climate Change in Improving Food Security

The climate change adaptation and mitigation were carried out by reducing vulnerability or increasing the resilience towards the occurring climate change. Adaptation and mitigation can be done individually or planned with the impetus of policy determination. For individuals usually conducted by private or non-governmental parties for planned adaptation and mitigation is made through government-planned, conscious decision-making to reduce the negative or disproportionate impacts of climate change [18].

Improved adaptation and mitigation capabilities to climate change can be undertaken in line with modifications to agricultural systems, increased crop and livestock production through nurseries and

investments in new technologies and infrastructure. One example of adaptation is that of grassland management with actual environmental conditions where grazing rotation systems are carried out to maintain the sustainability of grassland resources. In addition, adaptation is also done by establishing irrigation systems and breeding of new rice varieties to minimize the risk of serious harvest failures caused by climate change [9].

Another way to improve adaptation to climate change is to make changes to the farming system and integrate it with other activities. This is similar to an integrated farming system by traditional societies. One example is integration of rice planting with fish ponds or agroforestry by combining livestock practices with planting food crops and tree planting. Agroforestry has shown positive results by utilizing forest land for activities that produce both food crops and livestock among forest crops and multipurpose tree species. Besides, the community can develop their cultivation technology with their local wisdom. Some local wisdom applied include the development of garden plants, gardens, maintenance of secondary forests and protected areas around the village to protect the water system and manage forest products by utilizing non-timber forest products such as sap, honey, agarwood [2].

In addition to the integration of agricultural systems with other activities through agroforestry, traditional societies always prioritize diversity in their cropping systems. The diversity of plant species to rotation patterns used can also play a role in climate change mitigation as it is expected to increase resilience to various impending disruptions including extreme climate change [14]. For example, farmers can plant two types of rice at the same time that are resistant to drought and flood resistant species. This is expected to reduce the risk of a greater loss of harvest failure if done with a monoculture system.

The mechanisms of adaptation and mitigation of climate change through traditional farming systems on a diversity basis are well known in local knowledge shared by communities. As traditional societies in the African Sahel have long practiced the mitigation of change through reducing carbon emissions by organic farming practices that do not use chemical fertilizers, maximizing pesticides and natural predators and conservation of C on the ground through the utilization of straw and foliage [20][15]. Mitigation and adaptation to drought conditions is also carried out by traditional communities in Ghana through the conservation of water resources and rotation of planting patterns. The prolonged drought that forms the traditional society has a habit of saving water. In addition, to maintain the water source there is also a gray for the community when approaching the river that became a source of irrigation from their farm. Farmers can predict well when rain comes and how to plan their growing season to coincide with rain. As a mechanism for adaptation to drought and water scarcity, farmers change the types of crops they cultivate such as replacing cacao plants with cassava that are more resistant to drought [8].

Unconscious adaptation and mitigation practices of climate change have been practiced by traditional societies through the farming systems they operate. Various mechanisms are carried out not only to meet food needs and to sustain their lives. Various findings prove that the traditional farming system run by the community is clearly able to maintain their food security amid the threat of drought, heat stress and various disruptions caused by climate change.

Mitigation and Adaptation towards Climate Change by Indigenous Peoples of Kasepuhan Ciptagelar, in Maintaining Food Security

Indigenous Peoples of Kasepuhan Ciptagelar, Sirna Resmi Village, District Cisolok, Sukabumi Regency which is one of the indigenous peoples who inhabit the area of Mount Halimun Salak National Park. The Sirna Resmi Village is a village geographically located between 106 ° 27 '- 106 ° 33' east longitude and 6 ° 52 '- 6 ° 44' LS. Sirna Resmi Village has an area of 4,917 ha with a height of 600-1,200 m above sea level, with hilly and mountainous topography characteristics. The average temperature in the dry season ranges from 28 °C while in the

rainy season around 21 - 25 °C. Sirna Resmi Village has rainfall that varies between 2120 - 3250 mm / year with 84% air humidity.

Ciptagelar's indigenous peoples are traditional communities with sustainable agricultural practices. Since 1386, the community has avoided crop failure by planting more than 125 local rice varieties [3]. Local rice planting can be spelled out longer than 4-9 months so it only allows harvesting once a year. To fill the grace period, rice cultivation is replaced by the cultivation of secondary crops, also known as traditional way to keep rice resistant to pests by using biopesticide [17]. These agricultural practices have proven to be synonymous with organic farming practices that allow agricultural systems to be adapted to climate change and sustainably [4]. This allows the land to produce optimally so that no overexploitation results in decreasing soil quality. In addition to the many varieties of rice with variations of planting patterns that do show mitigation is done to prevent the occurrence of various disorders including climate change.

The community also utilizes the hillsides by planting various types of woody plants, cloves, and coffee. In addition to reducing the movement of land, tree planting is also useful as a backup of firewood because the community is still required to cook with firewood and indirectly provide additional income. Although the whole community has a livelihood as a farmer, yet almost every community has other income from penetrating the forest. Non-timber forest products greatly assist the livelihood of communities through their roles as food, fuelwood, and other income supplements.

In addition, other mitigation behaviours are manifested in rules requiring storing one bundle of rice in a communal barn, so that each farmer has a reserve of rice stored in a barn for at least two years [13]. The rule indicates that the indigenous community of Kasepuhan, Ciptagelar has a mitigation mechanism to maintain food security and is proven by climate change in the present time that indigenous peoples can survive.

The role of Abah Anom as the leader of indigenous peoples Kasepuhan, Ciptagelar in maintaining various local wisdom inherited from the ancestors is still very strong. To deal with the extreme climatic changes that have taken place, Abah Anom allows modernization practices to be carried out so long as they do not clash with what their ancestors inherited. Acculturation of modernization is an adaptation mechanism that is done to avoid the emergence of changes that lead to the loss of local wisdom that led to environmental damage. It is also manifested in various aspects including agricultural systems by accepting various modern farming systems such as the use of organic fertilizers as necessary as long as it does not damage the existing agricultural system and interfere with the food security of indigenous peoples Ciptagelar [26].

Ciptagelar's indigenous peoples clearly demonstrate the mechanisms of mitigation and adaptation to climate change. The diversity of varieties and patterns of planting and storage of rice in communal barns is a mitigation that is done in addressing various threats of food security resulting from climate change. The diversity of agricultural crops, especially rice, shows the resilience of agricultural systems to various disruptions, both pests, and seasonal changes. Traditional agricultural systems with accurate acculturation of modern agricultural systems based on the principle of diversity are appropriate adaptation strategies and proven to sustain food security owned by indigenous Kasepuhan, Ciptagelar people in the midst of an era of climate change.

CONCLUSIONS

Traditional agricultural systems used for generations have proven to be effective as adaptation and mitigation strategies of climate change and can maintain food security from traditional communities that use them. However, given the recent extreme climate change, further studies on traditional farming systems are in place to enable a new, more powerful technology to cope with the potential climate change threats. The acculturation of traditional farming systems and modern technology are needed to

strengthen the adaptation and mitigation towards potential climate change threat so that food security can be maintained.

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