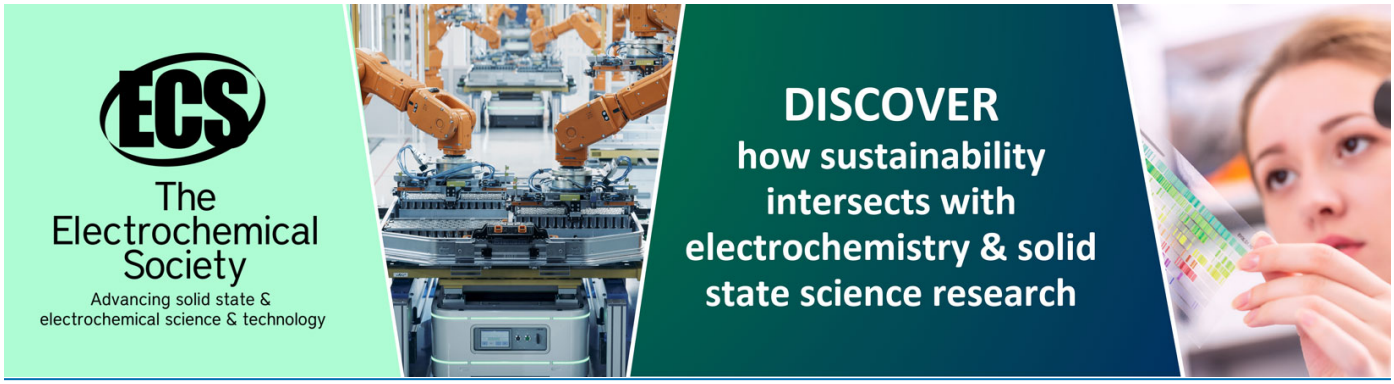
Farmer's Perception of Climate Change and the Impacts on Livelihood in South Sulawesi



Farmer's Perception of Climate Change and the Impacts on Livelihood in South Sulawesi

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Abstract. Climate change and variability have affected people, especially in developing countries whose livelihood depends upon agriculture. Smallholder farmers in South Sulawesi are identified as particularly vulnerable with climate change impact and have limited knowledge on how to make production decisions in uncertain environment. The farmer's perception and the impact of climate change are crucial factors that affect farm productivity and adaptation strategy. This study investigates the perceptions of farmers towards climate change and the impacts. Therefore, a cross-sectional survey was conducted with a random sample of 120 smallholders' farmers that were distributed into 4 districts in South Sulawesi. It was discovered that the majority of the respondents believed that climate change is real and about 83 percent of them acclaimed this phenomenon had caused negative effect on their livelihood. Some indications of the impact of climate change include increasing temperatures, and long dry seasons that had reduced rain-fed rice production. The results also indicate that pests and plant diseases had elevated in several places due to uncertain weather. In addition, climate change had influenced the availability of water sources. Hence, policy implications are that appropriate strategies are crucial to help farmers make adaptation choices in this situation.

1. Introduction

Indonesia as an agricultural country is largely influenced by climate change, considering that the majority of Indonesians depend on the practice of farming and fisheries. Climate change and variations will disturb crop production, reduce agricultural yields and affect the livelihood of farmers, especially the resource-poor rural households [1]. The effectiveness of adaptation strategies highly depends on an understanding of the people's perception of climate change in order to reduce their vulnerability and increase resilience [2], [3]. Therefore, the aims of this paper is to determine people's perceptions of climate change and its impacts in South Sulawesi.

Several studies have shown the importance of understanding farmers' perceptions of climate variability and its factors to generate adaptive behavior [4]–[8]. The previous research hypothesized that farmers who have knowledge about climate change impact are more likely to believe the potential risks and consequently are willing to adopt adaptation practices [9]. Farmers in South Africa had experienced higher temperatures, drought and lower crop yields due to changed weather condition over time [8]. A study in Italy identified that climate change beliefs and past experiences with crop production losses are critical to farmers perception [5]. Subsequently, farmers adapted climate change

impacts by using various strategies that combines indigenous knowledge and experience with scientific, such as planting drought tolerant varieties, the use of insurance and an efficient irrigation systems [8], [10].

2. Methodology

The study was conducted in South Sulawesi by selecting 4 districts/cities, namely: Makassar, Bulukumba, Bone, and Tana Toraja. It is a qualitative descriptive study, which seeks to analyze, discover, and explain precisely the characteristics of individuals, symptomatic states, or certain groups in society [11]. A number of 100 farm households were randomly selected for interviews by using semi-structured questionnaires to investigate the perceptions of changes in rainfall and temperature. Furthermore, the causes and impacts of climate change were equally investigated. The qualitative data were analyzed descriptively with steps consisting of collection, reduction, demonstration, verification, and conclusion [11].

3. Results and discussion

The results are presented in two parts: the farmers' perceptions of climate change, and its impacts.

3.1. Farmers' perceptions of climate change

The people of South Sulawesi experience the effects of climate change such as rising temperatures and changes in the rainy season. As many as 89% of respondents in 4 regions stated that surface temperature with longer dry season majorly lead to climatic change, and Bone as well as Makassar are the most affected areas. Additionally, Makassar is struggling to obtain clean water due to the long dry season, as the runoff from the Bili-Bili Dam, has significantly decreased. On the contrary, the people of Bone suffer from crop failure. The farmers' perception about the impact of climate change on uncertainty of the season, weather and extreme events are felt to be very real, are also perceived by farmers in Denmark, Africa and China[8], [12], [13]. Most farmers have the perception that erosion and flooding are not the real impacts of climate change. This implicitly implies that only a small proportion of respondents directly experienced these two extreme events, because individual experience will shape the perception of something[14].

Tana Toraja has not experienced the impact of climate change considering its geographical conditions at high altitude. Conversely, the effects of an increase in air temperature are only felt in certain areas. However, the Tana Toraja residents experience changes in the rainy season schedule since they perceive similar conditions as in previous years. In addition, the fishing communities in Bulukumba district believe that the trend of changes in temperature and the shift in the rainy season schedule changed slightly between the present and previous years (very insignificant to be able to remember the changes). For example, changes in the upcoming rainy season only shifted a few tens of days compared to the previous year.

a. Temperature change

Nearly 90% of respondents in several districts and 3 tribes in South Sulawesi have experienced changes in temperature over the past three years. Furthermore, it was reported that the temperature usually become warmer every year. This is consistent with the results of data observations showing that the average air temperature for the period January 1971 to December 2006 was generally a 0.5 ° C. The maximum air temperature increased by 0.7 C, while the minimum was increased by 1.2 C [9]. Even the IPCC asserts that global temperatures may rise between 1.8 to 2.9 degrees by 2100 with increased emissions and decreased absorption of greenhouse gases from the atmosphere [10].

Respondents gave various comments about changes in temperature. The Makassar and Bugis tribes explained that the change was caused by the decrease of trees on the earth's surface,. Furthermore, many rice fields and gardens were converted into housing or shops. The decline in trees reduced, the air quality, and even though it rains, the temperature sometimes feels hot. This is caused by the prestige culture of rural communities that prefer to sell their rice fields or gardens and then earn a living in the city as manual laborers or migrate to Malaysia rather than farming in the village.

An increase in temperature causes impacts on several aspects, such as the health sector, reduced groundwater sources, and the loss of several bird species. The rural communities in the four study locations reported that rising air temperatures caused children to suffer skin diseases, flu, and fever since the surrounding becomes extremely hot. In addition, the residents find it difficult to obtain clean water, especially in places like Makassar, Bulukumba, and Bone. They obtain clean water by walking over a long distance to fetch with buckets or other water containers. Even in Makassar, people have to queue for hours to obtain rations of water supplied to residents' housing complexes using PDAM cars.

b. Changing seasonal patterns

Another impact of climate change is the changing seasons and rainfall. Farmers and fishermen in all study locations spoke of the abnormal season. The plan of farmers and fishermen regarding natural signs to see the beginning of the planting season has been confused by climate change. During the data collection period at Bone Regency, a farmer started sowing sesame seeds and peanuts following the appearance of the certain star on the western horizon, which people believe as an indication of the coming rainy season. However, it turned out that the rain did not fall until a few days after the interview. Therefore, this results in losses for farmers that need rainwater to grow sesame and peanut seeds, which have already been spread.

The uncertainty of weather conditions may cause changes in rainfall and temperature patterns. These changes are perceived by farmers to lead to the occurrence of prolonged dry seasons or unpredictable excessive rainfall and are often associated with a risk of decreasing crop productivity. The results of previous empirical research have explained about the issues about some activities that contribute to climate change, such as burning of crop or household waste, use of firewood for cooking and use of excess agricultural chemical inputs [4].

Furthermore, fishermen in Makassar City and Bulukumba Regency also feel the impact of changing seasons and rainfall on fishing activities as well as the catches number. Due to unpredictable season events, farmers and fishermen change their plan even though they haven't reached their daily target. For example, sudden rainfalls accompanied by strong winds cause fishermen to give up on their intention to go to sea. When there is a sudden rainfall and fishermen are already in the middle of the sea, they need to return to land even though the catch is not satisfactory.

The shift in the rainy and the length of dry season have caused rainfed lowland rice farmers to start the planting season late due to the absence or reduced rainfall. At the time of data collection (late October), farmers were just starting to plow their fields. Meanwhile, this activity was several weeks late compared to the previous year due to the shift in the arrival of the long dry and rainy seasons. The most recent serious incident was the failure to harvest rice in several regions of Bone Regency due to the long dry season.

3.2 Climate change impact on community lives in South Sulawesi

a. The yield decreased or even the crop failure

The transition from one season to another has seriously confused about determining the right time to start planting, make a seedbed, or harvest crops. Furthermore, local farmers also experience temporary or false rain, which may stop after the seedling starts, and this will decrease crop production. The impact of a long drought and low rainfall has caused thousands of hectares of rainfed rice fields in Bone Regency were failure to harvest. However, some may still harvest but their production is not optimal. Such farmers expressed their gratitude even though production has declined by 25 percent.

b. Plant pest disturbance

Rice pests and diseases were found in several places in Bone Regency, and according to respondents, rat infestation has increased since last year. Therefore, farmers suffer millions of rupiah during the harvest season due to crop failure. Some farmers reported that the rat-infested plants were still young and they were not able to do anything in the face of the rodents. Furthermore, the occurrence of seasonal anomalies, such as the presence of rain in the dry season can also stimulate OPT (Plant Pest Organisms) attacks. Unsynchronized planting time and dangerous weather conditions

can also lead to a pest infestation. These results were in line with a study by Saptutyningsih that one of the impacts of climate change is increasing risk of pest attacks [15].

3.3 Drinking water shortage

The long dry season has made the residents of Makassar run out of clean water. This crisis on several occasions has caused drought to occur in various parts of Makassar City. The most affected places were located in the North, and they include Ujung Tanah, Bontoala, Wajo, and Panakkukang sub-Districts, as well as East Makassar City such as Tamalanrea, Biringkanayya, and Sudiang sub-Districts. To anticipate this condition, some residents buy water and use well water for their daily needs. However, the amount of water they obtain is very limited because residents use the same well. Additionally, the PDAM (Drinking Water Company) has also prepared 16 units of water tankers, specifically to serve needy residents. In terms of long dry season, most people in Bangladesh also reported that they use pond and contaminated tube-well waters for drinking without any physical and chemical treatment because of lack of treatment facility [16].

4 Conclusion

The results showed that farmers are exposed to climate change and extreme weather events, especially abnormal rainfall, which may have a serious effect on yields. High temperatures and prolonged dry season have damaged crops and yields resulting in increased vulnerability. Furthermore, high climate risk and an urgent need to reduce community vulnerability are fundamentally necessary for the sustainability of farmers. An appropriate adaptation strategy policy may act as a key instrument to address critical climate change by providing information and planning at the household level.

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