

Perception of rainfed farmers on the impact of climate variability in Bengkulu Province, Indonesia

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Abstract. This paper considers how farmers perceive to climate variability impacts, and suggests that perception these impact responses is as important as understanding responses to climate variability impacts. Based on a survey of 215 rainfed farmers in Bengkulu Province, we tested two hypotheses regarding climate variability impacts: (1) that climate variability has negative impacts on rainfed farming based on farmer's perception, (2) that age, formal education, farming experience, land area, and participation in farmer groups will influence farmer's climate variability perceptions. Using a multiple weighted score analysis and linier regression model we found support for the two hypotheses and furthermore showed that most of the farmers agreed that climate variability has a negative impact on rainfed farming. Farmers' formal education and participation in farmer groups influence farmers' perceptions on the impact of climate variability. With farmer groups, farmers can discuss various problems that arise due to climate variability.

1 Introduction

The agricultural sector is very vulnerable to climate change [1] and is experiencing the most serious impacts due to climate change [2]. Climate change affects production [3, 4], production systems [1] and the sustainability of agricultural production [5]. Climate change causes changes in rainfall, evaporation, water runoff, and soil moisture which will affect agricultural productivity. Soil fertility will decrease by 2-8 percent in the long run, which will result in a decrease in annual production [6]. According to [5], the influence of climate change on the agricultural sector is multidimensional, starting from resources, agricultural infrastructure, and agricultural production systems, to aspects of food security and independence, as well as the welfare of farmers and the community.

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Climate change often has a negative impact on rainfed rice farming. Climate change causes the growing season to change so it is difficult for farmers to predict the planting season, increases in pests and diseases, decreases and failures in production, decreases in yield quality, decreases income and increases the risk of crop failure and farming losses. The impact of climate change on farming varies among farmers. The majority of farmers also do not know about climate change [7].

Climate change is felt by farmers through climate indicators. Farmers perceive climate change because: 1) changes in temperature and precipitation [8, 9, 10]; 2) wind changes [11,12,13]; 3) extreme climate events in the form of floods and droughts [11,14]; 4) seasonal shifts [7]. The indicators of climate change that are most felt by farmers are rainfall and temperature. Other climatic elements such as wind are felt unchanged by farmers [7]. Farmers know about climate change through various ways such as feeling rising temperatures, erratic rainfall, warmer and stronger winds over the past few years. [15] stated that farmers perceive climate change more to the conditions felt by farmers such as drought, very hot air, changing rain patterns, strong winds, late start of the rainy season, quick end of the rainy season and very hot sun are indications of climate change. Based on this background, the aims of this study were 1) to analyze perception of rainfed farmers on the impact of climate variability, 2) to analyze the factors that influence farmers' perceptions on the impact of climate variability.

2 Methodology

This research was conducted in Bengkulu Tengah and Seluma Regencies, Bengkulu Province, Indonesia (Figure 1). In this research, the analysis unit is rainfed farmers who have their land as key informants to get information about their perceptions or knowledge on the impact of climate variability. The method used in determining the respondents is purposive random sampling, with a total of 215 farmers selected. The questionnaire was carefully designed to get information on socio-economic characteristics and perceptions on the impacts of climate variability selected by farmers based on their knowledge, understanding, and experience.

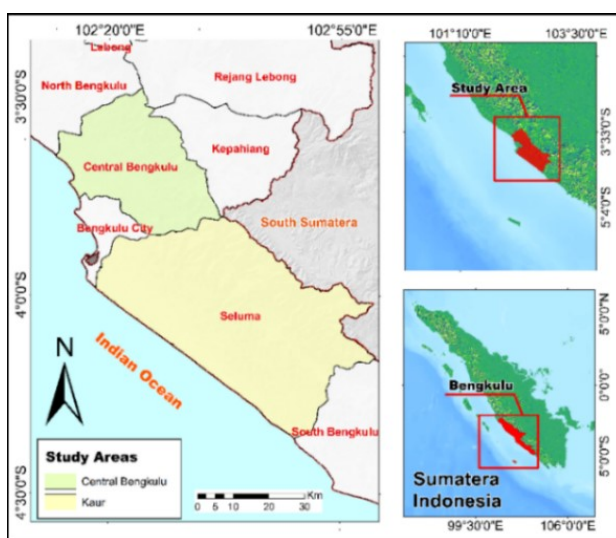


Fig. 1. Research area.

Analysis of climate variability was assessed from a social perspective, namely farmers' perceptions of climate variability that has an impact on rice farming [16]. Data analysis was

performed using descriptive statistics and ranking method using multiple weighted for a set of parameters/factors impacting climate variability [17]. Logit analysis is used to determine the factors that influence farmers' perceptions on the impact of climate variability by involving various independent variables based on previous studies.

3 Results and discussion

3.1 Characteristics of rainfed farmers

This research was conducted on rainfed farmers who were vulnerable to affected by climate variability. There are several characteristics of farmers in Bengkulu province which include age, formal education, farming experience, land area and household size. The age of farmers is closely related to the experience and readiness of farmers in farming. The age of a farmer affects his physical abilities and reaction to new things in running. Based on Table 1, the average age of farmers is in the productive category. According to [18] older farmers generally have less physical ability, but have more work experience which is better. Meanwhile, young farmers are willing to take risks, so they are generally more physically fit and open to new things that are recommended.

Table 1. Characteristic of rainfed farmers.

Characteristics	Min.	Max	Mean	Std. Dev.
Age (years)	21.00	76.00	48.34	11.10
Formal education (years)	0.00	18.00	9.37	3.72
Farming experience (years)	3.00	55.00	22.44	11.10
Land area (Hectare)	0.20	1.50	0.50	0.29
Household size (Person)	0.00	8.00	3.47	1.49

Source : Primary data is processed, 2023

In general, education affects the way of thinking of farmers. Farmers who have higher education will more easily accept new things and changes in how to work. Based on the results of the study (Table 1) it shows that the average level of formal education of farmers is in the category of graduating from junior high school. [19] explains that the more educated farmers, the better the knowledge of farmers about the phenomenon of climate change. This is because farmers with higher education (college or high school) have a better ability to understand new information.

The results of the study (Table 1) also show that rice farmers in Bengkulu province are categorized as experienced in conducting farming activities. This means that farmers are good at considering what is done for the development of the success of their farming. Rice farmers also have an average land area that is not too broad. Based on Table 1 shows that rice farmers in Bengkulu Province have an average number of family dependents of 3 people. The more the number of family dependents owned, the more contribution in decision making and also the more diverse knowledge that will be obtained [20].

3.2 Perception on the impact of climate variability

Climate variability is a symptom arising from climate change. Climate variability causes fluctuations in rainfall to be unpredictable and tend to be erratic, thus often causing droughts and floods. The results of the study (Table 2) show that most of the farmers have an obvious perception that hot temperature pressure which causes decreasing rice quality. In addition, farmers also significantly perceive that climate variability increases the risk of crop failure and the risk of farming losses which of course has a direct effect on the sustainability of rainfed rice farming.

Based on the results of the interviews, the farmers said that the impact of climate uncertainty was causing the dry season to get longer. This has a detrimental impact on farming productivity which can increase the risk of crop failure. Reduced productivity continuously makes many farmers must have other jobs to cover losses from decreased production. Many of the farmers are also confused about the sustainability of the farming in the future. This is in line with [16] that most farmers perceive that there are three impacts of climate change on their farming business, namely the higher the risk of crop failure, the effect on farming sustainability and higher farming losses and high temperatures which can cause increases and new pests appear. In addition, research conducted by [21] said that the impact of climate change would be very detrimental to farmers due to crop failure. Most farmers rely on trade and other occupations such as raising cattle to provide for their families.

Table 2. Farmers' perception of climate variability impacts on rainfed farming.

Climate variability impacts	Not obvious		Somewhat obvious		Obvious	
	Σ	%	Σ	%	Σ	%
Earlier harvesting date	98	46.01	32	15.02	83	38.97
Hot temperature pressure that causes decreasing product quality	52	24.41	23	10.80	138	64.79
Increasing cost of irrigation both in long dry season – buying extra water, and in long wet season – adjusting drainage	101	47.42	14	6.57	98	46.01
Changes in cultural practices that tend to demand more intensive use of input – increasing cost of production	170	79.81	6	2.82	37	17.37
Higher air temperature that causes the increase of pests/diseases incidence and the emergence of new pests and diseases	25	11.74	31	14.55	157	73.71
Extremely long dry or wet season that causes yield decrease	35	16.43	42	19.72	136	63.85
Increasing pot-harvest and marketing cost per unit product	162	76.06	14	6.57	37	17.37
Higher risks of crop failure	17	7.98	20	9.39	176	82.63
Increasing loss-risk in farming business that may directly affect farm sustainability	7	3.29	38	17.84	165	77.46

Source : Primary data is processed, 2023

The impacts of climate variability whose significance occupies the three highest orders are (a) Increasing loss-risk in farming business that may directly affect farm sustainability, (b) Higher risks of crop failure, and (c) Higher air temperature that causes the increase of pests/diseases incidence and the emergence of new pests and diseases (Table 3). [22] explained that risks in agriculture include losses and profits where the level of risk is determined before action is taken based on farmers' expectations or assumptions as a decision. The risk of loss and the sustainability of farming in uncertain climatic conditions is an important aspect of farming activities. The dynamics of weather conditions can cause changes in rainfall patterns, temperature patterns, and wind. Farmers perceive these changes to lead to prolonged dry seasons or unforeseen excessive rainfall and are often associated with risks of reduced crop productivity and farm income. This line of thinking tends to be consistent with the results of previous empirical research [23, 24].

Table 3. Rank of importance of climate variability impacts on rainfed farming.

Climate variability impacts	Average of rank value	Rank
Earlier harvesting date	1.9296	VII
Hot temperature pressure that causes decreasing product quality	2.4038	V
Increasing cost of irrigation both in long dry season – buying extra water, and in long wet season – adjusting drainage	1.9812	VI
Changes in cultural practices that tend to demand more intensive use of input – increasing cost of production	1.3756	IX
Higher air temperature that causes the increase of pests/diseases incidence and the emergence of new pests and diseases	2.6197	III
Extremely long dry or wet season that causes yield decrease	2.4742	IV
Increasing post-harvest and marketing cost per unit product	1.4131	VIII
Higher risks of crop failure	2.7465	II
Increasing loss-risk in farming business that may directly affect farm sustainability	2.7512	I

Source : Primary data is processed, 2023

3.3 Determinants of rainfed farmers’ perception

The results of the study (Table 4) show that the level of formal education of farmers and the participation of farmers in farmer groups have a significant and positive effect on farmers' perceptions of the impact of climate variability on rainfed farming. Increasing the understanding of rainfed farmers in Bengkulu province on climate variability can be done by increasing knowledge of climate variability and agriculture through increasing public education. High knowledge can be obtained through formal education and informal education such as counseling and training. Thus, education can increase the empowerment of farmer groups and can open farmers' access to information about climate change [25].

Table 4. Result estimation

Variable	B	t	Sig
Constant	15.718	13.630	0.000
Age	0.043	1.221	0.224
Formal education	0.199	3.376	0.001*
Farming experience	-0.056	-1.481	0.140
Land area	-0.113	-0.167	0.867
Membership of farming group	1.669	3.443	0.001*
F = 9.426			
Sig. = 0.000			
R-square = 0.185			

Source : Primary data is processed, 2023

*significance at $\alpha = 1\%$

Farmer groups have an influence in providing knowledge about climate variability, which is a place for farmers to learn, discuss, and exchange information. Farmers who are active in farmer groups have a positive and real relationship with the level of ability of farmers to manage their farming, management in dealing with climate change for example [26]. [27] also said that the activeness of farmers in farmer groups influences farmers' understanding of

climate variability and farmers' decisions in implementing adaptation strategies to deal with climate variability.

4 Conclusion

This research was conducted on rainfed farmers who are susceptible to climate variability. The majority of farmers stated that the impact of climate variability was felt obvious to threaten farming, namely higher risks of crop failure, increasing loss-risk in farming business that may directly affect farm sustainability, and higher air temperature that causes the increase of pests/diseases incidence and the emergence of new pests and diseases. The formal education level of farmers and the participation of farmers in farmer groups have a significant and positive effect on farmers' perceptions of the impact of climate variability on rainfed rice farming. It is important to increase farmers' understanding of the impact of climate variability and one way that can be done is through strengthening farmer groups as a forum for farmers to learn, discuss and exchange information.

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