Livelihood strategies of farmer households in the face of changing weather patterns: a case study from Sangiran Region

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Abstract. Java Island is the region where agriculture plays an important role in the economic activity of Indonesia. Nevertheless, the changing weather pattern in Sangiran has affect the cropping patterns, time of planting, production, and quality of the agriculture. Climate change affects the agricultural production loss between 5 - 20 %, while the long-term impact is the absence of farmers working on dry land. This sort of thing recently happens in Sangiran region which is a granary in Central Java because of the adaptation of the community. The purpose of this study was to determine the household livelihood strategies of farmers in the face a changing weather pattern in the Sangiran region. This research uses descriptive quantitative and qualitative approaches (mix method) in Sangiran region with multi-stage random sampling technique. The results of the research show that farmer households in Sangiran region face a changing weather pattern. Coping strategies that the farmers do while their facing changes in rainfall patterns are selling assets or property, money loan, reduce daily consumption, and change jobs. Strategies that the farmer households do to cope with the loss of assets are applying for a loan to a financial institution and working for someone else.

1. Introduction

Climate change causes changes in rainfall patterns, frequency of extreme climatological phenomenon occurrence, the increase in air temperature and sea-level [1]. The most affected sectors are agriculture which is the main commodity for people in Sangiran region. This research focuses on the study of the influence of climate on agriculture. Nowadays, climate change and global warming have tended to be a negative impact on agriculture [2]. The agricultural sector in Indonesia is vulnerable to climate change due to the cropping patterns, time of planting, production, and quality of agricultural products [3]. The decadence of the rainfall intensity is the greatest reason for declining productivity in dryland [4]. Sangiran certainly not just dwell on the museum, but also the condition and form in the surrounding region. Residents in this region mostly work in the agricultural sector, such as farming, gardening, and managing livestock.

Moreover, the soil is fertile due to a large river named Solo River that passed through this region makes the agricultural sector here have the potential to grow because of the availability of water from the river. Farmers are aware of climate change and its impact on crop production [5]. They have been able to develop livelihood strategies, as well as their continuous adaptation to cope with the effects of climate change. The community must have its is resilience, including inserting the role of technology
to their daily lives, to face the current era and the pressure of the climate in the future [6]. The role of technology in the present is also necessary to anticipate the impact of climate change.

2. Methods
This research uses descriptive quantitative and qualitative approaches (mix method) in Sangiran region. Primary data collected by surveys and interviews with domestic farmers and in-depth interviews with government agencies, while secondary data obtained from the Central Bureau of Statistics (BPS). The sampling technique is a multi-stage random sampling where the first thing to do is by divide the study area based on their administration border and pick up the sampling data in random. The sample size of this research is 144 respondents where the households are scattered in seven villages in Sangiran region. The study area of this research is shown in Figure 1. The population in this study is the farmer households in Sangiran region without gender limitation. In-depth interviews conducted with several institutions and public figures such as Development Planning Agency (Bappeda) in Sragen and Karanganyar, Department of Agriculture in Sragen and Karanganyar, and Farmer Groups (Gapoktan). This research analyses using a framework that is based on the theory of sustainable livelihood framework. Sustainable Livelihood Framework (SLF) is a framework that emphasizes the mapping of the potential that the region has [7]. SLF method has five major components, namely: the context of vulnerability or reduce vulnerability, livelihood assets how individuals acquire and use social and economic assets, changing the structure and processes to reduce the risk, livelihood strategies and livelihood outcomes.

Figure 1. Study Area

3. Results and Discussions
Climate change is a condition characterized by changing climate patterns worldwide causing erratic weather phenomena. Climate change happens due to the change tendency of climate elements in a long period [8]. The impact will not occur immediately, but the results of the accumulation a few years
later will feel the impact. Climate change became the most important challenges for the government and the communities where climate change is showing symptoms that indicate a threat to the sustainability of food production in Indonesia. Developing strategies to meet the food needs of farmers must be carried out to meet food needs. One of the ways to adapt the agricultural sector to changes is through reinvestment of the potential and characteristics of natural and land resources, agricultural and agricultural infrastructure, development and distribution systems using cropping patterns, cropping patterns, and types of plants and varieties.

3.1. Climate Change at Sangiran
Climate change may be in the form of three events, namely: changes in rainfall patterns, floods, and droughts. After all, flooding never happened in the Sangiran region, even though it occurred only in regions close to the river. Flooding occurs because the river overflowed during the rainy season while wetland is a land type that requires a puddle in this case, the major commodities in Sangiran is paddy [9]. However, based on the interview, the number of complaints because of changing rainfall pattern can be seen in Figure 2 and drought was felt by households of farmers can be seen in Figure 3.

A total of 74.4% of farmer communities in Sangiran sense changes in rainfall patterns occurred in the period 2014-2018. These five years period, 2015 and 2016 is the year in which the farm community feels the least changing rainfall patterns, which is about 4.2%, while the year in which farmer community feels the rain pattern changes most is in 2018, as many as 47.9%. In 2018 the incidence of changing rainfall patterns is the most severe. The percentage of farmers who feel the drought less when compared with changes in rainfall patterns. As many as 57% of farming communities in Sangiran stated that there was a drought in Sangiran region in the period 2014-2019. The figure indicates that the incidence of drought is not felt by all farm households so instead of being a natural disaster the drought itself is considered as a local phenomenon. From the period 2014 to 2019, the year in which the farm community feels the least drought is in 2015, which is about 0.7%. In 2018 is the year where most of the community feel the drought, which is 39.6%. In 2018 the incidence of drought is felt most severely.
Farmer defines drought as increasing temperature and decreasing the volume of water so that the farmland becomes drier. Drought in Sangiran region is not severe, declared from the farmer perspective so that water is still provided but only the availability is not as much as usual. The drought is still closely associated with changes in rainfall patterns. Both drought and changes in rainfall patterns occur only seasonally, do not occur throughout the year. Thus, the farmer households in Sangiran do not feel climate change, but more into a change in weather patterns, indirectly because of the global climate change phenomenon. However, the farmer in Sangiran has not been wise up to the fact that it causes by climate change.

3.2. Community strategies to climate change at Sangiran
Farmers in Region sangiran sense changes in natural conditions, which are characterized by changes in weather patterns that cause susceptibility to encourage action on adaptation. Small farming communities tend to try new things to overcome the inhibiting factors so that crops can continue to grow [10]. The characteristics of these small farmers produce a variety of household livelihood strategies in the face of changing weather patterns. In this research, adaptation strategies differentiated based on drought or rainfall patterns. Adaptation strategies observed in this study is an adaptation strategy in the socio-economic aspects. The observation process focuses on household livelihood strategies of farmers in Sangiran. Various strategic actions taken by farmer households in the face of drought can be seen in Figure 4.

![Figure 4. Public Strategies against Drought Impact](image)

Household strategies that they do to cope with the effects of drought are selling their asset (18%), money loan (20%), reducing the consumption (20%), add family member to work (2%), changing main job (13%), others (7%), and who do not take any action (20%). Money loan is one of the strategies for a quarter of farmer households in Sangiran region when facing a critical condition because of drought. Drought phenomenon makes their income go down and need additional income for the next planting period. A quarter of other farmer households prefer to reduce their household consumption so that they do not need to do a money loan. Reducing household consumption is a fairly ideal strategy because this strategy has a lower risk in terms of long-term economics were to balance the financial circulation where when income is reduced then the action that must be taken is to reduce expenditure.

The strategy that also pretty much chosen by household farmers in Sangiran region is by not doing any specific action or, more specifically, when drought then no adaptation to do. The purpose of not taking any action can also by some farm households defined as not cultivate land during the drought. It is also due to the high cost of land when the drought adaptation processing such as renting a pump to pump water to irrigate the fields. Some other farmer households also allow their land (bero conditions) during the dry season so the land can rest. Selling assets is another strategy chosen by some farmer households, the assets sold are livestock such as chickens, ducks, cows, and goats which are then made for the farming capital.

Changing jobs such as a trader, carpentry, tailor, mechanic become their preference to overcome with their trouble of being a farmer. This job is generally temporary for some households only during drought. Moreover, the farmer also performs some other strategies such as changing crop variety,
stretching the distance between plants (Legowo), and so forth. Legowo planting system is about the way that the farmer place the rice seedlings in the straight line pattern with space between one or more rows of rice plants with a blank line [11]. Farmer households in Sangiran have various strategies in the face of drought, however, strategies undertaken in the face of changing rainfall patterns differ slightly. Adaptation strategies impact of changes in rainfall patterns can be seen in Figure 5.

Strategy conducted by farmer households in Sangiran to deal with changes in rainfall patterns are done by several things such as selling assets (8%), money loan (6%), reducing the consumption (8%), changing jobs (22%), others (20%), and that does not do anything (36%). The strategy most preferred by farmers' households are not doing anything. This strategy found mostly in farmer who already has side jobs. It caused most households to prefer not to cultivate the land when it doesn't rain. Some households choose to change jobs when there is a change in rainfall patterns in order to keep earning revenue. Another strategy carried out by farmer households in Sangiran is to increase pesticides to eradicate planthopper pests when changes in rain patterns occur. The activity of selling assets is also chosen as a strategy for some farmer households, such as selling livestock owned. In addition, a strategy by reducing consumption was also selected by several farmer households in Sangiran to overcome the lack of income due to changes in the pattern of rain. The rest of the farmer households in Sangiran conduct money loans for capital and special land treatment when there is a change in rainfall patterns, especially for the purchase of pesticides.

As a result of droughts and changes in the pattern of rain, farmer households in the Sangiran Region overcame the economic crisis with various actions as can be seen in Figure 6. The most common way for these people to do is to apply for money loans to financial institutions from all respondents. It is found that 42% of farmer households overcome the loss of assets in this way. By applying for money loans, the community can fulfill their needs or can buy back their assets. Submitting loan money to financial institutions is an option for farmers because it is easy to do, 93% of farmer households state that the required conditions and interest are not large so that the majority of farmer households are brave in lending money to financial institutions to meet their needs and returned their lost items.
The second way chosen by the farmer households in overcoming the loss of assets is to work to another person to seek additional revenue to meet the needs for their daily living. There are 29% of households that do these activities to cope with the loss of assets. The types of work that is usually chosen are builder, factory workers, maid, and cotter. But not a few households (8%) who are not taking any action to overcome their loss of assets but they still do farming with the capital they have or previously owned savings.

3.3. Sustainable Livelihood Analysis
Household livelihoods strategies of farmers in Sangiran is motivated by the issue of global climate change which is considered to be a social and economic influence in the region that the majority sangiran livelihood as farmers. Under the framework of "Sustainable Livelihood", the vulnerability context experienced in Sangiran is categorized as a “seasonal”. However, the research resulted that the seasonal trend to have a dry season that is slightly longer than usual and changing rainfall patterns are perceived by farmer households in 2018. Human vulnerability aspect state that 76.4% of farmer households in Sangiran do not understand the meaning of climate change. This led to the assumption of an understanding of climate change is still very low and leads to vulnerability. Lack of knowledge is motivated by recent education predominantly only elementary school. Furthermore, the natural assets affected by seasonal vulnerability are drought and changing rainfall patterns experienced by farm households. Despite declaring drought and changes in rainfall patterns.

Financial assets greatly affected by the change in season because the population still relies on agriculture fields. A total of 60.4% of households consume their own production and as much as 39.6% of households selling their production. Yields for personal consumption dominate because the land owned by farmer households in Sangiran is only sufficient for their household needs, while a small in Sangiportion of theran mer has a very large land that is still sufficient for sale. However, the yield of maize and peanuts is generally sold entirely so that uncertain seasons clearly affect the finances of farmer households.

Farmers in Sangiran need to improve their land processing skills so that the yields produced can be more optimal. The condition of human assets and nature affected by seasonal changes also has an effect on physical conditions. Farming households in Sangiran need assistance to increase the quantity and quality in their agriculture, namely: capital, agricultural equipment, production facilities, and market access. Based on the interview with Sugeng Setyanto as Planning and Finance section of Agricultural Agency Staff in Sragen Region, it was stated that farmers in Sragen received seeds and urea fertilizer (chemical & organic), agricultural assistance in the form of tractors and agricultural infrastructure in the form of infrastructure reservoirs and DAM as facility support to farmers.

The assistance is expected to be able to overcome vulnerability to physical assets. Other than in terms of physical assets, social assets are affected by seasonal vulnerabilities, namely fertilizers, seeds, and equitable assistance. This inequality of assistance is influenced by social factors. The households of farmers who can obtain assistance are only 27%. This is caused by the condition of receiving assistance, which is farmers who are included in the farmer group, while those in the farmer group must have land with a minimum conditional region. This causes social inequality where those who have narrow land are not included in the farmer group so they do not get help.

4. Conclusion
Adaptation strategies that the farmer’s face of changing weather patterns both drought and changes in rainfall patterns are selling assets or property, money loan, reduce consumption, and change jobs. Strategies that the farmer households do to cope with the loss of assets are applying for a loan to a financial institution and working for someone else. There are still more farmer households who did not received help from the government (73%) than the one who received (27% households) in the form of money, agricultural equipment, and infrastructure.
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