

COMMUNITY ADAPTATION MODEL OF FOOD SECURITY DUE TO GLOBAL WARMING IN KULON PROGO

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ABSTRACT

Global warming is the increase in the average temperature of the Earth's surface. According to the IPCC (Intergovernmental Panel on Climate Change) average temperature of the Earth's surface was 0.74 ± 0.18 °C (1.33 ± 0.32 F) over the last hundred years. The impact of rising temperatures is the climate change effect on agricultural production. If the community does not craft made adaptation to global warming will have an impact on food security. This research aims to know the society's adaptation to food security as a result of global warming and to know the influence of global warming on food security. The research was carried out based on survey methods. The influence of global warming on food security is identified with a share of household food expenditure and the identification of rainfall. Sampling was done by random sampling. The Data used are the primary and secondary data. Primary Data obtained through structured interviews and depth interview using a questionnaire while the secondary data retrieved from publication data of the Central Bureau Statistics B(BPS), Department of Agriculture and Climatology Meteorology and Geophysics (BMKG). The expected results of the study is to know variations of food security due to global warming in Kulon Progo Regency. Comprehensive knowledge through community participation and related Government increased food security that is used as the basis for drafting the model society's adaptation to the impacts of global warming.

Keyword: Adaptation, Food Security, Global Warming

Background

Global warming is one of the topics in the world where some researchers or other parties are doing a lot of observation or research related to the topic. Global warming will affect climate change and make directly or indirectly impact to an environment or ecosystem. There is an dynamic interaction that occurs in environment or ecosystem between the bio geophysics environment with humans that will lead to the production, processing, distribution, preparation and consumption of food so it created the food system that supports food security (Abogidi 2011;

Tirado et al. 2010). Food systems that would be created would be able to support food security in a region. In the event of climate change, it will be able to threaten the availability of food in a variety of areas. The U.N. Food Organization (FAO) is concerned about the impact of climate change on food crops that will directly affect food security in many areas. This can occur because food crops depends greatly with climatic conditions. So when it came to climate change, it will affect the growth of these types of food crops. Climate change is occurring characterized by the presence of changes in patterns of rainfall and temperature. In Indonesia, these changes can be seen through the phenomenon of El Nino and La-Nina. The El-Nino phenomenon will cause the onset of the dry season which is characterized by the existence of a tribe of the extreme changes (increased temperature) as well as a decrease in the intensity of precipitation that occurs while on the phenomenon of El-Nino will cause the onset of the rainy season which is characterized by an extreme temperature change (decrease of air temperature) as well as an increase in the intensity of rain (Effendy, 2001).

According to Country Director Hakan Bjorkman, UNDP, stated that changes in rainfall patterns that occur will reduce the availability of water for irrigation. Decrease in the amount of precipitation that occurs in some parts of Indonesia, especially in Java island will prolong the dry season, where the seasons change that occurs is very extreme. The rainy season is going to be very wet and dry season will be very dry and long. Besides the rain, temperature also affects agricultural production. According to the Intergovernmental Panel for Climate Change (IPCC) 2007 stated that an increase in temperature of 2⁰C can reduce agricultural production in some countries such as China, Bangladesh and Indonesia which experienced a drop in production of about 30%.

In developing countries particularly in Indonesia is the main topic of food security because the area is experiencing a significant population increase. The

special region of Yogyakarta (DIY) is one of the province's population has increased significantly. One of the leading sectors in the agricultural sector is DIY. In 2012 the agricultural sector contributes 12,99% in GDP. However, the occurrence of climate change will affect the decline in agricultural production and affect food security in DIY, one of Kulon Progo Regency.

Formulation Of The Problem

The agricultural sector is one of the most affected sector due to climate change, particularly food crops. Climate change will cause an increase in temperatures, floods, drought, disease and pests attack intensity as well as a decline in the quality of agricultural output. An increase in temperature of 1-3 instead of C will lower rice yield of 6,1 - 40,2%. On a local scale, the report shows that production of rice BPS in the DIY decline from 946.224 tons in the year 2012 be 891.137 tons by 2013. The existing problems of the emerging questions are:

- a. What happened to climate change due to global warming in Kulon Progo Regency?
- b. How the influence of global warming with food security in Kulon Progo Regency?
- c. How the adaptation model in Kulon Progo Regency?

Purpose

The purpose of this study is:

1. Identify the occurrence of climate change due to global warming in Kulon Progo Regency.
2. Identify food security in Kulon Progo Regency.
3. Know the effects of global warming on food security in Kulon Progo Regency.
4. Know the adaptation model of food security as a result of global warming.

Base Of The Theory

Many methods can be used in the analysis of food security include qualitative and quantitative methods, methods of estimation of Two Stage Least Square (2SLS), basic descriptive analytical methods as well as the determination of food security index. Qualitative research methods are methods using data published by the office of origin or related research. While the method of qualitative research methods is by doing the interview.

Two Stage Estimation method of Least Square (2SLS) can be done using primary data, i.e. data obtained through interviews and analyzed using the analysis model of simultaneous equations. Research on food security can also be done with descriptive analytical method, which in this sampling method determined by purposive or stratified random sampling. In addition to this research can also be done using the determination of food security index. Where in the preparation of food security index is done through a program that can be used as a computer-based information system for processing and presenting data. The Program used is DSS program (Decision Support System). Using the program is packed will be used as an instrument to conduct the identification as well as provide data/information on the food security situation at regular intervals which can be displayed in the form indexes and categories which can then be mapped (Erniati, 2012).

According to Karini (2013) over the function of farming land being awakened caused by changes in the economic structure, improving infrastructure and increasing population will affect food security. Although the effect did not occur directly. Land area will affect production and productivity if it ignores the intensification of agriculture and agricultural technology that would increase the amount of production and productivity in agriculture. Research conducted by Karini (2013) are in line with the results of research conducted by Novia (2012) to the effect that food security is affected by the level of production. Both of the above research results different from

results obtained from research Natin (2012) stating that application of the intensification of farmer will have an effect on production, income, consumption of food and non food but this farmer intensification does not affect food security. While the research generated by the Goddess (2012) the level of food security is more influenced by the factor the number of household members and income. The research on food security the Government can undertake monitoring expected situations/conditions of the area periodically so it won't happen food insecurity in a region (Erniati, 2012)

Adaptation

Adaptation according Karta Sapoetra has two meanings, the first is autoplatic (auto means self, plastic meaning form) adjustment and the second is allow static (allow means the other, plastic meaning form) adjustment. The two meanings of the Karta Sapoetra divided into passive adaptation where the individual activities are determined by the environment and active adaptation that shows that individual activities affect the environment (Sapoetra Karta, 1987: 50). While according to Gerungan (1991) adaptation is the adjustment it self against the environment.

Adaptation is in fact a process to meet the basic requirements for retained an interest in life. The basic requirements according to Suparlan (1993) includes:

1. Basic Terms-natural biology, in which humans need to eat and drink in order to maintain the stability of its body.
2. basic psychiatric Terms, where the man in need of tranquility.
3. the basic social Conditions where people need relationships.

Adaptation or conformity according to Aminuddin (2000) has several objectives, including:

- a. Overcoming impediments from the environment
- b. Disbursing social tension

- c. establish an imperishable or units of social
- d. survival

The adaptation referred to in this research is the society's adaptation to the impacts of global warming, climate change solution specifically conceived. Adaptation to climate change, according to Murdiyarno (2001) is one way of adjustment carried out spontaneously or planned to give a reaction to climate change. This type of adaptation is carried out varies from one region to the other. Adaptation is also affected by several factors such as the economy, technology, information, infrastructure and so on. Where the area that has economic, technological information, infrastructure, low then adaptation to climate change too low.

Food Security

Definition of food security refers to the definition of the World Bank (1986) and Maxwell S Frankenberger (1992), is access to all people at all times on the food sufficient for healthy living. Some definitions of food security which is often referenced are:

1. Food Law No. 7 of 1996

The food needs to satisfy conditions of households reflected the availability of food is quite good, as well as of the amount of quality, are safe, equitable and affordable.

2. USAID (1992)

A condition when all people at all times have physical and economic access to obtain the needs to live healthy and productive.

3. FAO (1997)

A situation in which all households have access to either physical or economic in order to obtain food for the whole family, where households are not at risk of having lost both such access.

4. the FIVIMS (2005)

The condition when all people at all times for the physical, economic, and social has access to food is sufficient, safe and nutritious for the fulfillment of the needs of consumption and conform to his taste (food preferences) for active and healthy life.

5. Mercy Corps (2007)

Circumstances when all people at all times have access to the physical, social and economics of food sufficiency, safe and nutritious foods for nutritional needs according to his taste to live productive and healthy.

Based on this definition can be drawn the conclusion that food security has 5 elements that must be met:

1. oriented households and individuals
2. the dimensions of the food available at any time and accessible
3. emphasis on food access of households and individuals, both physical, economic and social
4. nutritional fulfillment-oriented
5. Intended to live healthy and productive

From understanding food security according to the law No. 7 of 1996, realizing food security can be understood as follows:

- a. Satisfy food with enough availability conditions, food availability was interpreted in the broad sense, includes food that comes from plants, livestock, and fish to meet the needs of carbohydrates, proteins, fats, vitamins and minerals as well as their derivatives, which is beneficial to the growth of human health.
- b. Satisfy conditions with food that is safe, free from impurities constitute a biological, chemical, and other objects that may interfere with, harm, and harm to human health, as well as safe from religious rule.

- c. Satisfy the condition with food grains, refers to food that must be available at all times and evenly distributed across the country.
- d. food with reasonable conditions be met, interpreted as food stuff is easy retrieved households at an affordable price.

Global Warming

The climate is the physical condition of the air at a given location and the accumulated time is compiled and calculated in the form of average weather conditions in a certain period (Winarso, 2003). Trenberth, Houghton and Filho (1995) in Hidayati (2001) making sense of climate change is a change that is affected by human activity, either directly or indirectly, that would change the composition of the atmosphere for a long time. The climate has always been changing globally and locally. Climate change occurs due to several factors, including the amount of variation 1) solar radiation to the Earth, the Earth's relative position 2) against Sun, 3) position relative to the equator of the Mainland, 4) continental drift or plate tectonic and 5) the chemical composition of the atmosphere (Bayong, 1999; Desonie, 2008; Kabat and Bates, 2009).

Since 4,55 billion years ago the amount of solar radiation gradually increased, and the current intensity of radiation is 20-30% higher. The existence of the black point or the Sun sunspot affect the amount of solar radiation received by the Earth. Milankovitch cycles developed by a Serbian Geophysicist describes the relative position of the Earth towards the Sun in the form of eccentricity, obliquity and precession.

Movement of the continent called the theory of Plate Tectonic cause changes in the Earth's shape and size that will provide a long-term impact on the Earth's climate. If the whole continent is moving into one the super continent, such as 225 million years ago, then most of the land will be far from the ocean, the climate of the

continent is hard to dominate. But if a separate continent as now, ocean currents can distribute the heat better due to the Earth's surface which is adjacent to the sea. There will be built a little extreme global climate and regional climate as a result. Tectonic plate movement also led to the eruption of the volcano's effect on climate in a short time or a long time. Aerosols generated by the eruption of Mount Pinatubo in the Philippines (1991) reducing global insolation of 5% and lowering the temperature of the global average of 0, 5⁰C in the following year.

The Intergovernmental Panel on Climate Change (2001) revealed an increase in the temperature of Earth's most aggressive the last 50 years. Even rank among the top 10 hottest atmospheric temperatures, 60% occurred during the last 10 years (NASA), and in 2005 as the warmest year on record and in the 1990 the Decade of hottest. The report also stated that there has been an increase in global air temperature near the surface of 0, 6⁰C since 1900 and increasing sea level of 1-2 mm/year have also occurred. The report also mentions an increase in air temperature over the past 4 decades occurred at an altitude of 8 km in the layer of the atmosphere, the thinning of the lining and the closure of the snow, and sea water has increased. The attached instrument recorded an increase of surface precipitation (rain, snow, and hail) reaches 0.5-1% over the last decade in the middle latitudes and the northern hemisphere.

UNFCCC (the United Nation Framework Convention Climate Change) based on the phenomenon of climate change in recent years, defines climate change as the climate changes that relate directly or indirectly to human activity that changes the composition of the global atmosphere and is an additional phenomenon of natural climate variability observed over comparable time periods. As for the climate variability climate value is the distance from a specific region can take overtime. Or in other words climate variability is an inherent traits of the natural climate system. Climate variability and extreme climate events will be worse off as a result of global warming.

The impact caused from climate change according to Effendy (2001) is a phenomenon of El-Nino and La-Nina. The El-nino phenomenon resulting in the amount of rainfall that fell and were far below normal precipitation so that drought can occur. While La-nina phenomenon resulting in the amount of precipitation that falls high and were far above normal and rainfall can cause the occurrence of floods.

Method

The basic method in this research is quantitative research. The determination of the location of the research done on a purposive in four sub districts in the Regency of Kulon Progo, Nanggulan, Sentolo, Galur, and Temon. The Fourth District is a region in Kulon Progo which has a flagship sector of agriculture. Act of determining sample by using the method of Stratified Random Sampling to determine household farmers and non-farmers. Types of data used in this research is the primary data and secondary data. The identification of climate change based on changes in the intensity of rain and rain with patterns of distribution method using Isohyet. Identification of food security is determined using indicators the proportion of Food Expenditure against Household's shopping. The proportion of food expenditures can be calculated using the formula (Smith and Subandoro,2005):

$$\% \text{ expenditure for the food} = \frac{(\text{food Expenses})}{(\text{Total Expenses})} \times 100$$

Community resilience: status indicator

1. food insecurity: If the percentage of food expenditure $> 60\%$
2. hold the food, if the percentage of food expenditure $\leq 60\%$

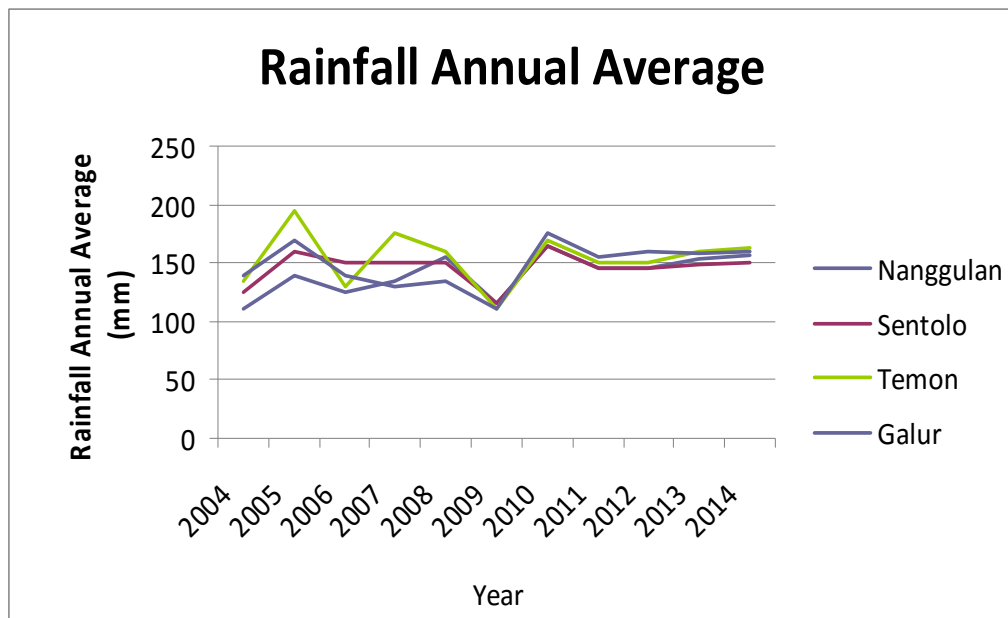
Identification of the influence of climate change on food security carried out using regression.

Discussion

Climate Change Due To Global Warming

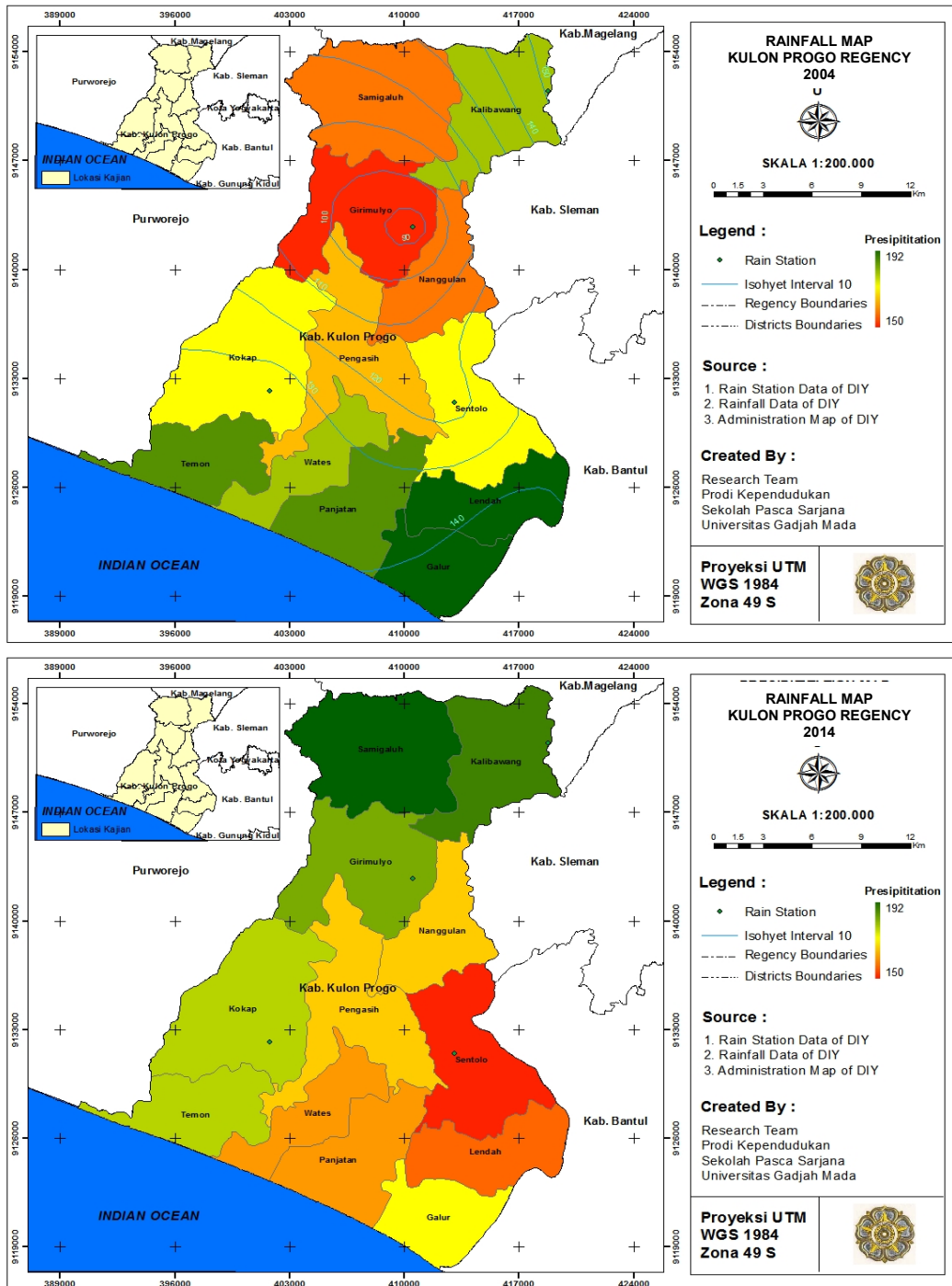
Research conducted in Kulon Progo Regency is a case study in four districts that Nanggulan, Sentolo, Galur and Temon. Where the fourth sub district is a sub district in the Regency of Kulon Progo, which has the highest agricultural production. Agricultural system in district Nanggulan, Sentolo and Galur using agricultural irrigation system, while the system of agriculture in Temon district is largely agricultural system using rainwater. So the existence of Global warming cause climate changes that affect the amount of rainfall received in an area. Good on agriculture irrigation and rainwater irrigation, climate change is giving bad Impact towards a decrease in agricultural production. If it continues to remain so the impact will extend towards food security.

Figure 4.1
Rainfall Annual Average



Source: Secondary Data Processing

Figure 4.2
Rainfall Annual Average Map



Source: Secondary Data Processing

Kulon Progo Regency in 2004 and 2014

The existence of Global Warming is causing the season happened erratically. From Graph 4.1 looks that rainfall annual average in the four districts are also experiencing fluctuations, fluctuations in rainfall annual average that occurs due to the rainy season and the dry season is not necessarily. A prolonged drought has resulted in decreased production of rice harvest failed because there is even a rice field acreage cannot be planted with rice due to lack of water for agriculture. Crop failures also occur in crops because at the time of the supposed dry season instead of rain as a result of plant crops such as soy, red onion, and others a lot of spoilage so that farmers suffered losses. This is because the area of the rice fields submerged by water, where the soil in Kulon Progo Regency is a type of soil clays that are difficult to get water.

Food Security

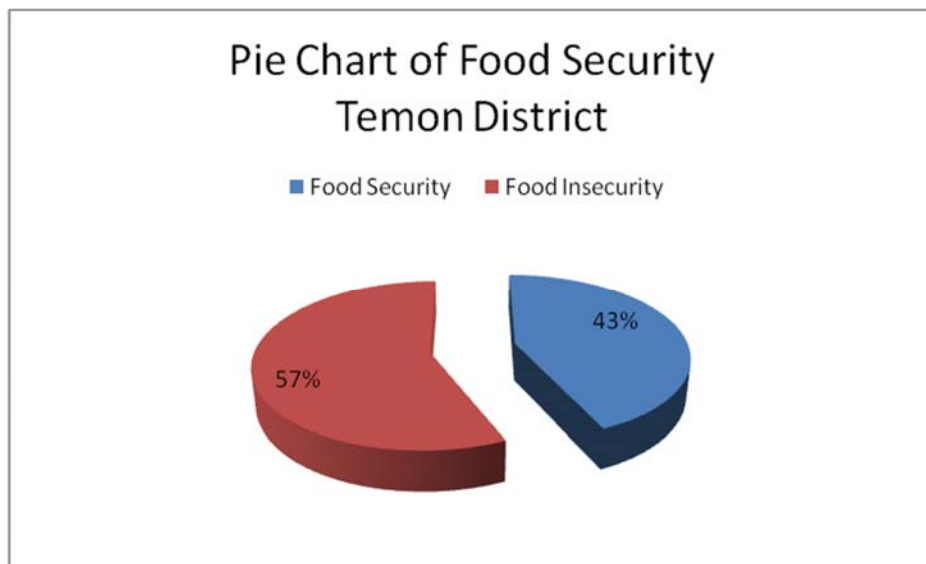
The concept of farmer household food security is the ability to gain access to sufficient food for a healthy and productive life and takes place from the time of time. The resilience of household will be disturbed when there is decline in the purchasing power of households, the rate of production and limited availability.

Food insecurity at household scale include disruption of eating patterns and participate in the inability to follow cultural traditions and rituals, based victuals. Household food security is affected by many factors and varies between one household with another household. Possession of the land which is supported with the appropriate climate, coupled with a good human resources, will be able to guarantee the availability of food at regular intervals. Policies in the agricultural sector in particular food determined the existence of a market in providing sufficient food. While the food was only able to access occurs when a household has sufficient income or have the purchasing power to reach.

Determination of food security analysis of this time use a percentage of food expenditure in total expenditure by households. Community food security

classification in Temon district which is included in the categories of food are resistant 46,67%. This indicates that the farm household in Temon district as much as 46,67% have the ability to gain access to sufficient food for a healthy and productive life.

Farmer households in Temon district included in the categories of food insecurity by 53.33%. This shows that as much as 53.33% farmer households in Temon District does not have the ability to gain access to sufficient food for a healthy and productive life and take place from time to time.



Source : secondary data processing

Figure 4.3

Pie Chart Of Food Security In Temon District 2014

Results of calculation show that the average household in Temon District have yet to hold food. This is because the geographical location of Temon district It self which sits on the coast and is located in the headwaters of Bogowonto frequently hit by flood and cause of farmland inundated and experiencing failed harvest.

Adaptation

Nevertheless in Temon district community and Government have done a variety of efforts to increase agricultural production to increase food security. One of them is with the farmers groups. With a group of farmers that the Government can more easily provide guidance to address agricultural extension. In addition to the existence of a group of farmers were also able to lend capital to purchases. Food security improvement efforts conducted by other farmers to plant crops and horticulture is at the time of the dry season, because at the moment the dry season in this area will not get water because the area is largely agricultural region of rainwater.

When the planting season /second rice planting season, farmers in the irrigating Temon district prosperity by using water that is taken on the well bio diesel wear. This is certainly increasing production costs that must be incurred by farmers given that diesel fuel is gasoline.

In district Nanggulan and Sentolo farmers trying to increase production results by doing the spraying of the crops so as to avoid pests, fertilizing is done in addition to crop using either chemical fertilizer and organic fertilizer. Another form of business conducted Nanggulan society is the existence of "gropyokan" catching rats in paddy field by the citizens. Residents who managed to catch the mice were given rewards or gifts of money 5.000.00 rupiah per rat tail that successfully captured. In the region of Nanggulan and Sentolo are still many farmers are planting less distance. So this will have an effect on plant growth and yield of the crop farm production.

In Galur form of adaptation is done by farmers to increase farm production results is to change the type of seeds are planted, more use of organic fertilizers instead of chemical fertilizers, applying the trunks, and pay more attention to return on soil fertility by not forcing constantly making planting on his farm all year round. At the time of observation research plant soybeans in district Sentolo who do

not heed the trunks of many caterpillars as the pests are attacked, while paying attention to in the Galur trunks of soybeans free of caterpillars.

Planting pattern in the area of research is the study of rice-rice-vegetable. Farmers in Kulon Progo now a days is no longer using the calculation of the growing season to determine the time of planting. Timing of cropping is done according to the instructions from the Department of agriculture and irrigation. Usually beginning in August started wetting the rice paddies, planting acreage in MT I (planting season I) carried out in late August. Nevertheless there are some in Galur district farmer who still pay attention to the calculation of the season for planting, the calculation of the season are also still involves signs of nature that exists.

Conclusion

1. The rainfall annual average in the four districts are also experiencing fluctuations, in annual precipitation that occurs due to the rainy season and the dry season which is not necessarily the result of Global Warming
2. Community food security classification in Temon district which is included in the categories of food are resistant 46,67% and 53.33% fall into the classification of food insecurity.
3. Adaptations made to the community in order to maintain food security is by following a group of farmer, extension services, seeds selection, use of organic fertilizers, cropping and cropping pattern distance.

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