Sustainable Food Security on Farmer Households in Flood Prone Areas

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Abstract

Indonesia both as archipelago and also agricultural country has special challenge to facing food security. There is lots of area in Indonesia which vulnerable with natural disaster have food insecurity when disaster happened. One of the flood prone areas is Bojonegoro Regency. Natural disasters can give significant impacts for economic and food security, especially for poor households. In the last three decades, there have been increasing number of natural disaster in Bojonegoro. It makes lots of area in Indonesia become disaster prone area. On of the annual natural disaster is flood. When flooding happened, food security is needed for the farmer households. This article has aims achieving sustainability of household food security of farmers in flood prone areas. Sustainable food security in flood prone areas for farmer households can be reach through empowering them with all kind activities. There are activity such as introducing of technology of deep water rice, optimizong of food consumption, increasing number of village which can produce their own food, making food barns on farmer households, living harmony with flood and early warning system. Government support has important role to reach sustainable food security.

Keywords: food barns, food security, flood prone, sustainable
INTRODUCTION
According to FAO (2006) "food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets reviews their dietary needs and food preferences for an active and healthy life". Food availability and food access have important role for acquiring good foods. Entitlements are defined as the set of all commodity bundles over the which a person can establish command given the legal, political, economic and social arrangements of the community in the which they live (including traditional rights such as access to common resources). Utilization related with how food can be produced with nutritional well-being. This brings out the importance of non-food inputs in food security. Stability is about how household or individual must have access to adequate food at all times. They should not risk losing access to food as a consequence of sudden shocks (e.g. an economic or climatic crisis) or cyclical events (e.g. seasonal food insecurity). The concept of stability can refer to both availability and access dimensions of food security. Food security, which is re-emerged in international discourse to frame responses to the 2007-2008 food price spikes and related anxieties about global climate change and key resource pressures (Ambler-Edwards et al., 2009; MacMillan and Dowler, 2011).

Food security is one of the highest problems that the governments have to face. Having regard to the fact that at least 70% of the poor population in the world lived in rural areas which is development of agricultural sector, in case the growth of its productivity, represents one of the key factors for providing food security. Food security depends on the agricultural directly and indirectly on other production factors which the agricultural production is based, such as the inputs represented by: seeds, fertilizers and equipment (Marza et al, 2015).

Natural disasters can give significant impacts for economic and food security, especially on the poor households. In the last three decades, there have been increasing number of natural disaster in the world. It affected to the populations and lots of impact in economic losses. One of the natural disaster is flood. Floods may cause deaths, injuries and severe food shortages. Flood have contributes to low crop productivity and food security. In the medium-term, flood has its toll on food reserves in the which stretches hunger Households period from two to six months of household food security and makes the situation worse (Musah and Oloruntoba, 2013). Floods are the most common natural disaster in both developed and developing countries, and the incidence of floods is growing steadily across the globe. Floods often show a devastating impact on human life and both physical and natural assets. Dilley (2000) studied about human activities and climate change can alter the intensity and frequency of floods and
droughts. In particular, droughts and floods have a devastating impact on livelihoods, mostly because they affect crop production.

Floods can create devastating impacts on food security of the people and their livelihoods. According to S. Foudia, et al (2014), the hazard type or nature of the flood (water velocity and/or depth) together with people’s exposure to flooding (people on the flood plain, population density) and vulnerability (age and health status of reviews those exposed to flooding as well as characteristics of there a in the which they live) determine the risk of death and physical injuries from flooding.

Floods result in loss of property, destruction the environment and many times leads to loss of life. The internally displaced people (IDP) are more vulnerable to such disasters as they live in hazardous areas in absolute poverty and with little or no knowledge of disaster management. According to Ramakrishna et. al (2014), climate change affects countries economies and food security through a variety of channels. Rising temperatures and changes in rainfall patterns affect agricultural yields of both rains fed and irrigated crops. The unchecked rise of sea levels leads to loss of land, landscape, and infrastructure. Ninno, et al (2003) cite Ramakrishna et al., (2014) studied the floods in Bangladesh and concluded that the floods have affected food security of millions of households. According Ramakrishna et al (2014), floods undermine farm yields and the national harvest, reducing household and national food availability, and agricultural income derived from crop sales. Poor harvests threaten food security and livelihoods from household to national level, to varying degrees according to the extent that the family or nation depends on agriculture for its food and income. Households and economies that are more diversified are less vulnerable to reviews these direct impacts of droughts and floods, provided that reviews their alternative income sources are neither correlated with rainfall nor directly or indirectly dependent on agriculture (ie, vulnerability falls to the extent that complementary sources of income and food are non-covariate.

Agricultural sector in Bojonegore East Java Indonesia is the main pillar of economic growth because it has contributed to GDP (Gross Domestic Product) about 46.38%. Agricultural commodities, especially food crops produced include rice, maize, cassava, yams, soybeans, peanuts and green beans. Bojonegore which is downstream area of Bengawan Solo River are threatened with flood. In Bojonegore almost happened the flood in last few years. Lots of food crops were washed away, damaged and died because of floods and crop failure because overflowing of Bengawan Solo river. Although farmer suffered losses over and over every time because of flood, farmers still cultivate rice plants that aren’t have bad response to deep water or flooding (Suprapti, et al, 2013). Farmer households that live in flood prone area losses lots of agricultural production that the area on Picture 1.
The results of the study in 2012 showed farmer households with food insecurity status is the largest about 71.11% of the total number of respondents, the status lack of food security about 27.78% and only about 1.11% of the total respondents is in food security status. Although floods occur almost every year, farming households in this area didn’t have plan how to improve their food security. Therefore, it is necessary to achieving sustainability of household food security of farmers in flood prone areas.

**METHODOLOGY**

According to Suprapti Supardi et. al (2014) the basic method used is exploratory research that is a study aims to get a picture or identification about the household food security of farmers in flood-prone areas at Bojonegoro. It is based on structured, semi-structured, or unstructured interviews. Where this interviews took place in 90 farmers household in three flood prone area. Researchers qualitative, it offers the opportunity to interview several respondents systematically and simultaneously (Babbie, 2011 cit
RESULTS AND DISCUSSIONS

Identification of Sustainable Food Security:

Sustainable food security has aimed to secure food reserve of farmers. Food security for farmer is one of important thing. Farmer who is producing food from their farm must be guaranteed their food security. Nowadays, global climate change affected to all sectors. Lots of natural disaster happened because climate change. This impact also affected to food security through natural disaster. One of them is Bojonegoro which has flood prone areas is have impact to food security. This study showed the factors which can be identify for sustainable food security of farmers household are:

1) Spirit of farmers to farming
   This spirit of farmers to have farming despite the danger of flooding every rainy season. That is in line with the study conducted by Ball, G. et. al (2013). The results showed that as many as 88.89% of respondent farmers have main job as farmer and 62.22% of them do not have a second job. This is makes farmers relied heavily on farming. Although high risk of crop failure but spirit of farmers on farming is still high. The spirit on farming synergized happened with rice cultivation technology in which rice floating or puddles will make the food supply be guaranteed sustainability.

2) Large number of farmyard
   Every farmer households in this area has a large number of farmyard which is used for the cultivation of fruits such as mangoes and bananas. Although it has not been used optimally, but the farmyard has function to add extra income for farmers. This farmyard should be developed to support sustainable food security in this area. Based on recent study from Dillon et.al (1993) optimization of the planning objective is defined as achieving the farm household's goals as efficiently as possible in the face of whatever constraints of a physical, environmental, legal or socio-cultural nature may be relevant. This implies obtaining maximum possible net benefit over time from the operation of
the farm system. Net benefit is measured, as appropriate, in terms of output or profit or, more broadly, as satisfaction or utility. Maximization of net benefit implies efficient use of available resources and opportunities. Many small-farm households place a high value on the long-term sustainability of their farm system.

3) There is a food reserve but only few farmers
Farmers are aware that food is very important thing, even though system slash rice grow rapidly in this area, but farmers still set aside a small number as food reserves. Farmers awareness about food reserves is still high. They know that food reserves can give lots of benefit. But they food reserves only in small number because if they take larger, they income can decreased. Based on Basu and Maisy (2015) study about food storage in East Indonesia. Food storage in farmer households is very important for they food reserve. The storage program offered households free food storage equipment—weather sealed drums and sacks—with high retention rates.

4) Food aid program for Government
Local government is responding to the emergency actions with providing food assistance and provide temporary housing. The government also set up kitchen during the floods in which to supply foods need of the community affected by flood. The program is carried out continuously whenever flood happened. Based on recent study of Sarkar et.al (2014) about Government support in India. India Government support and plant breeding programs have stressed the three major cereals (rice, wheat, maize) and also included in The Green Revolution. The Green Revolution made a significant contribution to the ongoing effort of transforming India into a food secure nation. However, in order to achieve inclusive growth, it is important for the new agricultural paradigm to be made truly more pro-people, including by addressing issues of poverty, gender, livelihood and environment.

Sustainable Food Security:
Availability, accessibility and distribution of food in farmer households when flood happened are difficult to reach. Because there is area that can’t be reach easily. Therefore, farmer households should be able to provide, access and distribute food in sustainable manner. Sustainable farmer households on food security in flood prone areas explaining that household food security can be improved by empowerment of farmer households. Empowerment of farmer households can be reached such as:

1. Introduction of technology of deep water rice
Modern farming techniques could be one solution in addressed the decreasing agricultural production, especially rice because of floods. One of the rice cultivation ways which can be applied in flood prone area is deep water technology. This technology needs to introduced to farmers who can’t doing rice cultivation in flood area. In the introduced rice floating technology is required training, demonstration plots and socialization to farmers. Few
researchers (Vergara et al., 1976; Catling, 1992) paid attention to deep water rice. Deepwater rice is a subsistence crop for about 100 million people in areas of Southeast Asia, where severe flooding occurs during the monsoon season. Whereas yields of modern rice cultivars average 6 tons/ha, the average yield of deepwater rice is only 2 tons/ha.

2) Introduction deep water rice seed

Rice varieties are often grown in Bojonegoro, especially in flood-prone areas that is IR 64 variety. However, this variety is not resistant to flood, so the plants being rotten. Therefore, study about deep water rice is needed. Based on study of Datta et al. (1976) seedlings of the deep-water varieties showed a greater resistance to submergence and continued their rapid growth rate in plant height until they emerged from the water (up to 11–12 days), but the flood resistant and the high yielding varieties did not come above the water surface. The growth of the deep-water varieties in the water was about seven times greater than that in the atmosphere. A daily growth of as much as 5 to 6 cm was frequently observed when seedlings were growing in the water. There is also some evidence that deep-water varieties possess anatomical adaptations that facilitate the internal aeration of plants.

3) Optimization of Food Consumption Diversification to Accelerate Food Program

Implemented in three main forms of activities, called 1) Optimizing the utilization of the farmyard through the concept of sustainable food house 2) the development of local food, and 3) Promoting and disseminating of food diversification program. Recent article about food system from Vitterso et al. (2015) that the discussion about transitions to sustainable food consumption, with a special emphasis on the role of the consumer in these processes. The article fills a knowledge gap related to how niches such as organic food can contribute to the transition to more sustainable food consumption. It questions the view of the consumer as a self-regulating, reflexive actor with power to change the relations in - and developments of - the present food system. The source of carbohydrates, fats and proteins required can be obtained from sustainable food home in farmyard. Farmyard can be optimized the functions to increase households income from fruits planted such as banana, guava, which have good market prospects. In addition, farmyard also can be used for poultry husbandry such as ducks. Local food derived from tubers need to be developed to increase value added. Various flour can be produced from the tubers including tapioca flour, cassava flour, mocaf, and sweet potato flour. Utilization of these tubers flour is very diverse as food, including baby food,
cosmetics, pharmaceuticals, until material supporting industries. Promotion and dissemination of diversification for households in flood prone area conducted to increase awareness about the importance of diversification food. It is important to raise the needed that food diversification program is needed household for themselves.

4) Increased number of village which can produce their own food

Self Food Village Program expected to motivated rural communities to achieve food security and nutrition, so that they can live a healthy and productive life every day. Efforts are made through empowering people to recognize the potential and ability, look for alternative opportunities and solving problems as well as being able to take the decision to use natural resources efficiently and sustainably, and finally achieved independence of the community. This program related with Warehouse Receipt which is a place to stored farmers production or easily called Food Barn. According Coulter et.al (2002) the prospective benefits of this system, include facilitating trade, enhancing market efficiency, easing access to rural finance, mitigating price risks, and enabling cost effective and management of public food reserves.

5) Making food barns on farmer household level

Revitalization barns household level should be encouraged more farmers to ensure food security for the household. There is no means to have money in flood prone areas if access to their food have difficult. Based on Linnekamp et.al (2011) study about farmers households in lower-income are more vulnerable with floods. The suggestion based in this study is to increase adaptive capacity by creating stronger collective action within communities and partnerships with local government. Socialization to introduced food barns are needed. With this socialization, can increased farmers awareness about the important food barn to stored their food reserve.

6) Living harmony with flood

People living in flood prone area should adapt to maximize resources and transform resources from disaster to opportunity. Living harmony with flood is the best option to minimize losses because of flood. Local community has a special way to face the disaster, such as:

a. Make a residence with system high rise houses or move to other area

b. People are working actively to earn income and make savings which can used earnings when flooding happened

c. Save harvested production both money or saving
d. Harmonize cropping pattern that is not only monotonous rice cultivation but also horticulture cultivation which can provide higher income

e. Have livestock to increase more income

7) Early warning system

Early warning system needs to be built in flood prone area which flood happened every year. Coordination between agencies and Governments important things in way to minimize the impacts of losses caused by flooding. This coordination not only involved the agency in Bojonegoro but also with other agencies from other area, especially area which flowed by Bengawan Solo River so when flood coming it can be detected early. Communities can get benefit from early warning system to get prepared. According to (Gautam and Phaiju, 2013) that the community based flood early warning system considered communities as an integral part and involved them in risk assessment, communication and dissemination and immediate response activities in a participatory way. Communities have been involved in the identification of the problems, activities and the design of the action plan. Participation of elderly people, women, children, young, people with disabilities and marginalized communities made the system truly inclusive

Government plays an active role on empowering households through optimizing role of local government. Optimizing that role is supported by strategic plan and effective early warning system. According to Jibiki et.al (2015) recent United Nations resolutions and related strategic papers have Provided a people-centric concept of Early Warning Systems (EWS). This concept consists of four key elements: knowledge of risks; monitoring, analysis, and forecasting of hazards; communication or dissemination of alerts and warnings; and local capabilities to respond to the warnings received. Sustainable food security through households empowerment can be seen on Picture 2.
Optimizing role the government to supporting sustainability food security will be implemented to the farmer households through:

a) Mapping village which have poor households more than 30% of the total number of households along Bengawan Solo River in Bojonegoro. Districts along Bengawan Solo River that affected by flood in Bojonegoro include District Margomulyo, Ngahro, Padangan, Purwosari, Kasiman, Malo, Trucuk, Kalitidu, Bojonegoro, Balen, Kanor, Baurenro, Dander, Kapas and Sumberrejo. From the results of identification next step is mapping village based on the number of poor households, area that gets floodwaters, household socio-economic conditions, location map and condition of agricultural resources. Anacio et al. (2016) noted identifying sense of place dimensions may be used for specifying needed interventions for environmental
management, especially for disaster risk reduction and management. Sense of place is important while there is an acknowledged risk for flooding events, residents have taken full advantage of a condition where in a housing structure is located the nexus of a disaster prone area and a positive sense of place. The results of this mapping is used as data base in the determination of the villages that will get programs to increase food security both for household and for region. Results of mapping these villages become selection data based on priority. Priorities are set by the criteria are:

a. The village of poor households have
b. The village has the resources of farmers who have the will to be empowered
c. The village is strategic as stimulant / motor for a pilot village that the results can be replicated to other villages

b) Formatting group become pilot group for each strategy to be implemented. Government programs both government Acceleration Diversification of Consumption Food program and selfness food security villages addressed to groups in community. Weak organizational management led to have not loyal members, the dissolution of group before or after the program ends, and ineffective programs from the plan. For that, is necessary to make formation of groups based on the needs assessment. The formation of groups based on needs assessment will be more stronger sense of belonging of the group. formation of groups based on the needs assessment can be done through self help mapping. "self-help mapping" is a participatory process that is done by the community to assess and formulate its own problems it faces and the potential of the so grows the real need (real) to tackle the various problems were mainly poverty, based on a wealth of qualitative information locally, such as perceptions and the traditional knowledge of local communities. According to Poniah et.al (2008) the popularity of participatory approaches is based on the assumption that they eliminate the weaknesses of the traditional ‘top down’ approach to research and development. Participatory approaches value the input of the beneficiary and are associated with increasing the respect for and incorporation of indigenous knowledge in all aspects of a program or project.

c) Optimizing the role of Agricultural Extension Staff doing the introduction and implementation technology to farmer groups. According to World Bank (2010) Agricultural Extension have aims to increase farm household income, which can both improve household food security and nutrition as well as increase access to health services and education for rural children. However, to achieve this goal, most agricultural extension systems will have to change their strategy, approach, and management structure, as well as upgrade the skills and competencies of their extension staff. Agricultural Extension Staff doing as a facilitator, motivator and as a supporter to farmers. the motion farmers' efforts is a central point to providing information to farmers about the importance of trying farm with attention preservation of natural resources. The process of implementation of agricultural extension can be run properly if it is supported by professional Agricultural Extension Staff. Agricultural Extension Staff through extension activities can help farmers (1) analyzing the situation for now and for forecast ,(2) increasing awareness of problems from the analysis, (3)
Improving knowledge and insights to a problem, and helping to make framework based on farmer’s knowledge, (4) Helping farmers acquire related knowledge to solve problem, (5) helping farmers to decide the right choice, (6) Increase the motivation of farmers become able to doing his choice, (7) Helping farmers to evaluate and improve their skills in forming opinions and making decisions.

Agricultural Extension Staff's role needs to be optimized when doing the introduction and implementation the result of introduction to farmers. Introductions rice floating and resistant puddle rice varieties to farmers because they were familiar with conventional farming. According to Russell et.al (2000) the belief that knowledge could be “transferable” has derived that associated belief that “communication” information was the process of transmitting. The media is convinced that we are now “Information Age” so its not surprising that the most widely used metaphor for the practice of extension is that of “information transfer”.

Farmers point of view need to open wider so farmers would have a strong motivation to do the introduction of technology. Agricultural Extension Staff in its extension approach used Visits Training System. Visit Training System is extension approach that combines training for facilitators as improving the ability of farmers in performing their duties, which followed with visits to farmers or farmer groups based on routine scheduled.

a) Demonstrating the results conducted by farmer groups.
According Tuty Herati (2010), demonstration is a form of agricultural extension methods and results showed how to used new technologies. As one of the agricultural extension media, demonstrations are very popular among farmers, especially because of demonstration can be directly viewed in farm. According to form, demonstration used by using Demonstration Plot. Demonstration Plot is a method of agricultural extension services to farmers, by making a pilot area, so farmers can see and prove to the object demonstrated. Demonstration plots should be carried out by pilot group. If pilot project done successfully, it will driving force to public who are interested to want to do the same thing.

b) Socialization demonstration plots to public
Demonstration plots need to be disseminated to public so the results provide more benefit to public. Demonstration plot can be applied / replicated to other areas that have the same condition. Socialization demonstration plot have aims in order to increase public knowledge about the results from farmers group. Socialization can be done through demonstration plots, promotion through various media both print and electronic media. If public response about the demonstration plot is negative, they won’t adopted the results they did not support the result of the introduction. So, we need to change their response through other agricultural extension activities.

c) Socialization barns at the household level and village farmers
The results this study showed that most of farmer households have no food reserve because of pay on land system. This system make farmer can sell all of agricultural product on land so they can’t have food reserve. Whereas food barns on farmer
household level is important it is related with stocks, distribution, and food access when flood occurred. This food barns in village level are getting lost in Bojonegoro. It because there is cheap rice for poor household. if flooding occurred so long, rice barns is very important as buffer stock. Socializing for existence of food barns both in household level or village level which affected by the floods. Food barns village can be done by warehouse receipt system. This system is system that store rice where farmer stored it in barns and they get receipt. With that receipt, farmers can borrow money in the bank to buy the necessary inputs for their farming. In addition this system can be alternative choice when prices decrease because harvest periods.

According Witoro, et al (2006) Food barns as rural communities organization to provide their food needs. Food barn in village level managed together and also have a social role to increase solidarity each other. Food barns such as media to increase bargaining position of farmers who are weak when dealing with other business and government. Most of farmers sell their product on low prices in order to avoid damaging product. The result agricultural product have low price especially in harvest period. Food barn can also play a role in building bargaining power of farmers and sustainable agriculture. Through food barn, farmers will have more power to provide their inputs for their farm. Food barn for communities not only support on food security, but also as evidence to reaching economic welfare. Food barn also used for storing plant seeds. Every harvest period farmers usually set aside part of their crops to be planted again. They sort rice, corn, or any other of the best quality to be used as seed. Rice or maize seed is usually left intact in panicles or stalk and stored in the barn. Seeds are stored in the barn will safe from damaged risk. It because food barns building designed cant affected with bad of weather or pests.

d) Food barn on region level
Food barns or warehouse on region level is related with the village barns. Availability in food barns village level can support food barns in regional level. Food barns can be done by choosing the appropriate area. According Witoro, et al (2006) indicator good food barn area includes:

- Area of rice production that have "surplus" production
- Area of rice production that have "minus" production
- Area with background population "homogeneous",
- Area with background population "heterogeneous", and
- Area that have low level relation with middlemen.

Coulter and G. Onumah (2002) found that warehouse receipt system will contribute to enabling farmers obtain better prices through deferring sale or selling further down the marketing chain. The benefits of the warehouse receipt system will contribute to improved agricultural commodity trade, reducing market instability and the political risks associated with it. Where strategic food reserves need to be maintained, the warehouse receipt system will make its management more cost-effective by reducing the organizational infrastructure and funding needed, as well as reducing rent-seeking by public officials.
Synergizing between related stakeholders

Synergizing between related stakeholders is important to increase food security in flood prone areas. With synergizing can optimization role of local governments through Regional Disaster Management Agency to have socialization, and sharing about weather forecasts. Weather forecast is important on disaster prone areas like Bojonegoro. So Department of Agricultural and Food Security Agency can socialize disseminate to farmers about the weather forecast future conditions and farmers can give socialization to farmers about weather forecasting. Regional Planning Agency is preparing to make Strategic Plan in Medium Term for 5 years. On those strategic plans, they can add about Food Barn on Region level and the Food Barn on Household level. This program will be handled by Department of Agriculture and Food Security Agency. Food barns program have aims to maintaining availability of food during drought or flood. Bengawan Solo River Office could used Early Warning System program to have forecast in Bojonegoro. An EWS is an integrated system for monitoring, collecting the data, analyzing, interpreting, and communicating monitored the data, the which can then be used to make-decisions early enough to protect public health and the environment and to minimize unnecessary concern and inconvenience to the public (USEPA 2005 cit Quansah et al, 2010). Bengawan Solo River Office can work together with Regional Disaster Management Agency so they can give a notice to public about forecast condition Bengawan Solo River. This can make people being prepared by floods. synergizing dan cooperation between related stakeholders make strategic planning runs properly.

CONCLUSION

Sustainable food security is important for community in flooding prone area. Along Bengawan Solo River which has prone area with flooding when rainy season came is include Bojonegoro as flood prone area. Most of community who face flooding in rainy season is farmer households. Sustainable food security in farmer households can be reach through empowering them with all kind of activities. There are activity such as introducing of technology of deep water rice, optimizing of food consumption, increasing number of village which can produce their own food, making food barns on farmer households, living harmony with flood and introducing early warning system. Government support has important role to reach sustainable food security. Government can increase farmer households awareness about how important food security in flood prone areas. This can be done through empower community about sustainable food security especially for farmer households in flood prone areas.

REFERENCES


