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DECREASE IN RICE PRODUCTION DUE TO CLIMATE CHANGE IN WEST JAVA INDONESIA

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ABSTRACT **The impact of climate change can decrease in rice production. This paper informs results of study on decreasing in rice production due to climate change in Karawang West Java Indonesia. The study aims to assess level of the decreasing in rice production and identify areas that have high or very high level. This study used data of rainfall, temperature, sea level rise, droughts, floods, harvested area, land area, productivity and production of rice. The data was collected by observation, and survey in area of study, and some data get from Bureau of Meteorology Climatology and Geophysics and Central Bureau of Statistics. The data analyzed use empirical formulation. The results was presented in spatial maps using GIS software. The results of this study indicated that in Karawang West Java has experienced climate change that was showed by changing of rainfall patterns, rainy day, and distribution of annual rainfall. Annual rainfall has decreased that showed by some areas become drier. Decrease in rice harvested area in Karawang West Java was average of 77.0 ha per year. While decrease in rice production in that region was average of 926.1 tons per year. Based on the results can be concluded that climate change has founded and reduced harvested area and production of rice in Karawang West Java Indonesia.**

KEYWORDS :climate change, harvested area, rice production

INTRODUCTION

The influence of global climate change, especially on the agricultural sector has been felt and become reality (Kurukulasuriya, et al., 2003; Semenov, 2009). The climate change was indicated by the floods, drought, and the shift of rainy season (Arnell et al., 2011). In recent years, the shift of rainy season causes the shift of planting and harvesting seasons of food crops (rice, pulses and vegetables). Extreme event such as floods and drought cause failures of planting and harvesting crop (Ruminta and Handoko, 2012 and 2016). In Indonesia, change of rainfall patterns is the greatest threat, because farmers depend directly on rainfall for their agricultural activities and livelihoods. Every changes of rainfall pose a great risk. Rain-fed agriculture is susceptible to climate change, if farming activities remain unchanged. Meanwhile, the quality of fresh water affect farming systems in coastal areas due to sea water intrusion and unsustainable irrigation activities. High salinity due to increasing sea level becomes a threat to food crop production in coastal areas because varieties are not resistant to high salinity. Furthermore, high temperature will affect the agricultural system. Plants are sensitive to high temperatures during critical stages, such as flowering and seed development. Combined with drought, high temperatures can also cause disaster for agricultural lands (Mendelsohn, 2008). Changes in temperature and humidity can lead to the development of sprawl of pests and plant diseases. Floods and droughts also affect agricultural productions (Kurukulasuriya and Rosenthal, 2003). Floods and prolonged droughts, caused by bad water management and low capacity, make significant decrease in productions (CCSP. 2008; IPCC, 2012).

The extent of climate change to affect agricultural systems depends on various factors, including the type of crops, operation scales, farming orientations toward commercial or subsistence purposes, the quality of the natural resource bases, and the influence of human and farm manager (for example, education, risk tolerance, age, etc.) (FAO, 2007; Ruminta and Handoko, 2016). Hazard on rice farming is a decrease in rice productivity (yield), harvested area, and rice land area caused by change of temperature, rainfall, and sea level rise, which affect production and cause a risk on food security disturbance. Hazard analysis is based on assumption that the decrease in plant productivity and harvested area has a strong relationship with changes in air temperature and rainfall, while sea level rise will cause a reduction in agricultural land area (Kumpulainen, 2011; Metternicht et al., 2014). Increase in atmosphere temperature is a climatic stimulus on the increase of crop respiration and shorter crop growing season. In addition, the increase in air temperature cause an increase in potential evapotranspiration that can reduce the area of irrigated field that is supplied with water. Increasing atmosphere temperature causes higher crop respiration rate which sequentially leads to a decrease in crops yield. The decline in crop yields due to shorter crop growing season caused by increasing temperatures is approached with the 'Thermal Unit' concept, i.e. the crop development rate is faster by the higher air temperature. Thus, the higher air temperature, the shorter plants age so the biomass accumulated by the crop becomes less which results in crop yield decline. The relationship between the decline in crop yield due to shorter crop growing season and increasing air temperature assumes that crop yield is linearly related with the growing season (Ruminta and Handoko, 2012). Rainfall determines the availability of water for the crop, especially on rain-fed fields (Aggrawal, 2008). Assuming a period of rainfall is spread equally during the crop growing season, then there is a strong relationship between rainfalls with crop yield. Changes in rainfall causing droughts or floods is cause to decrease in crop yield (Kang, et al., 2009). Increase in air temperature will lead to higher crop evapotranspiration, thereby crop water requirement also will increase. As a result, the irrigated field area that can be supplied with irrigation water will be smaller. Potential evapotranspiration is used as the basis for the calculation of crop water use to estimate water supply to the crop using irrigated water. Potential evapotranspiration (ETp) can be calculated from air temperature using Thornwaite and Matter formula which is the function of air temperature (T). In this analysis, it is assumed that irrigated field area is proportional to the ETp and the total supply of irrigated water does not change (Ruminta and Handoko, 2012). Besides its effect on crop yield, low rainfall causes drought which results in crops harvest failure. Conversely, excessive rainfall will cause flood that also lead to harvest failure. In this analysis, a decline in harvested area due to drought and flood derived from the relationship between harvested areas and rainfall changes. Sea-level rise directly drown the cultivation area. Therefore the reduction of field area is calculated using a scenario of sea level rise. The agricultural fields affected will then be delineated to calculate the area decrease.

Rice (*Oryza sativa*), one of staple food crops in West Java, is a plant that needs a lot of water during his life even though it is not a water plant. Because of catastrophic climate change have an impact on the amount and spatial distribution of water, rising sea levels, increasing extreme events and it is a risky on rice productivity (Bar et al., 2014) Analysis of food crops decrease was carried out by using rice which are the eminent crops in Karawang West Java Indonesia. By considering the impact of increasing air temperature, precipitation changes, and an increase in sea level on yield, harvested area, land area, and production of rice in that areas, the analysis was focused on potential decrease in rice harvested area and rice production. The purpose of this paper is to present the extent of impacts of climate change on rice production in Karawang West Java Indonesia.

2. **Materials and Methods**

This study was carried out in Karawang that's area of rice production center in West Java Indonesia from 2015 to 2017. The location of study was susceptible from the threat of climate change (Aldrian, 2007). This analysis used data of rainfall, temperature, sea level rise, droughts, floods, harvested area, land area, productivity, and production of rice. The data was collected by observation, and survey in study field, and some data get from Bureau of Meteorology Climatology and Geophysics and Central Bureau of Statistics. The data analyzed use empirics formulation that was used by Handoko (2007) and Wiratmo et al. (2016). Decrease in irrigated lowland rice production due to the increase in temperature and rainfall changes is calculated as follows:

$$\Delta G1 = \Delta Ya1.\ Ao1 + \Delta Ap1.Yo,\ 1$$

CONCLUSION

If the impact of climate change has reduced harvested area and production of rice in Karawang West Java Indonesia. Decrease in rice harvested area was average of 77.0 ha per year. Decrease in rice production was average of 926.1 tons per year. Some area of Karawang West Java had high level of decrease in rice harvested area above 100 ha/year and decreased rice production over 1000 tons/ha.

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ref_str

[1] Aggrawal, P.K. 2008. Global Climate Change and India Agriculture: Impacts adaptation and mitigation. Indian Journal of Agricultural Sciences 78 (10): 911-19.

[2] Aldrian E. 2007. Decreasing trends in annual rainfalls over Indonesia: A threat for the national water resources. Published by Journal of BMG. Jakarta.

[3] Arnell, N.W., Van Vuuren, D.P., and Isaac, M. 2011. The implications of climate policy for the impacts of climate change on global water resources. Global Environ. Change 21(2): 592-603.

[4] Badan Pusat Statistik (BPS). 2014. Jawa Barat Dalam Angka 2014. Badan Pusat Statistik Propinsi Jawa Barat.

[5] Bar, R., E. Rouholahnedjad, K. Rahman, K.C. Abbaspour, and Lehmann, A. 2014. Climate change and agricultural water resources: A vulnerability assessment of the Black Sea catchment. Environmental Science & Policy, ENVSCI -1351; 13p.

[6] CCSP. 2008. The effects of climate change on agriculture, land resources, water resources, and biodiversity in the United States. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. U.S. Department of Agriculture, USA.

[7] COST. 2012. Impacts and Adaptation to Climate Change of Crops in Europe in Climate Change Impacts on Agriculture in Europe. Published by Firenze University Press, Italy.

[8] FAO. 2007. Adaptation to climate change in agriculture, forestry and fisheries: Perspective, framework and priorities. Food and agriculture Organization of the United Nations, Rome.

[9] Handoko. 2007. Relationship between crop developmental phases and air temperature and its effect on yield of the wheat crop (Triticum aestivum L.) grown In Java Island, Indonesia. Journal of Biotropia 14(1): 51- 61.

[10] Howden, S.M., Soussana, J.F., Tubiello, F.N., Chetri, N., Dunlop, M., and Meinke, M. 2007. Adapting agriculture to climate change. Proc. Natl. Acad. Sci. USA 104(50): 19691-19696.

[11] IPCC. 2012. Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New york, Ny, USA, 582 pp.

[12] Kang, Y., Khan, S., and Ma, X. 2009. Climate change impacts on crop yield, crop water productivity and food security- A review. Progress in Natural Science 19: 1665-1674.

[13] Kumpulainen, S. (2011). Vulnerability concepts in hazard and risk assessment. Natural and Technological Hazards and Risks Affecting the Spatial Development of European Regions. Geological Survey of Finland, Special Paper 42: 65-74.

[14] Kurukulasuriya, P. and Rosenthal, S. 2003. Climate Change and Agriculture: A Review of Impacts and Adaptations. Climate Change Series Paper No. 91 of the WorldBank, Washington D.C.

[15] Li YP, Ye W, Wang M., and Yan XD. 2009. Climate change and drought: A risk assessment of crop-yield impacts. Clim. Res. 39:31- 46.

[16]Mendelsohn, R. 2008. The impact of climate change on agriculture in developing countries. Journal of Natural Resources Policy Research 1: 5–19.

[17]Metternicht, G., Sabelli, A., and Spensley, J. 2014. Climate change vulnerability, impact and adaptation assessment. International Journal of Climate Change Strategies and Management 6(4): 442-476.

[18]Ruminta and Handoko. 2012. Climate Risk and Adaptation Assessment of Agriculture Sector in the South Sumatra Province. Ministry of Environment, Indonesia.

[19]Ruminta and Handoko. 2016. Vurnerability Assessment of Climate Change on Agriculture Sector in the South Sumatra Province, Indonesia. Asian Journal of Crop Science 8(2): 31-42.

[20]Semenov, M. 2009. Impacts of climate change on wheat in England and Wales. Journal of the Royal Society Interface 6(33): 343-350.

[21]UNDP. 2007. The other Half of Climate Change: Why Indonesia must adapt to Protects its Poorest People. UNDP Indonesia, Jakarta.

[22]Wiratmo, J., Y. Yuwariah, Ruminta, and Y. Rochayat Suradinata. 2016. The Impact of Climate Change on Rice Production Center at Area of the City near the Beach in Indonesia. International Journal of Science and Research 4(4): 2319-7064.

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