ISSN 2301 -4490

PROCEEDING

GREEN TECHNOLOGY
International Conference

The 7th international Conference on
GREEN TECHNOLOGY

The Collaboration and Contribution of Islam, Science, and Technology for ASEAN Economic Community

Faculty of Science and Technology
Maulana Malik Ibrahim State Islamic University

Malang, October 5-6th, 2016

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Maulana Malik Ibrahim State Islamic University, Malang

Published Online *** 2016

FOREWORD

The ASEAN Economic Community has been started from 2016 among South East Asia Countries. The policy includes human resources, free trade and service industry. Indonesia as a part of participants should take an essential role to contribute to the community. Accordingly, the collaboration of Islam, science, and technology will provide a significant effect to the national and regional development in the future. Therefore, the Faculty of Science and Technology, Maulana Malik Ibrahim State Islamic University of Malang, collaborates with Faculty of Life and Environmental Sciences, Prefectural University of Hiroshima to dedicates. The 7th International Conference on Green Technology with theme The Collaboration and contribution of Islam, science, and technology for ASEAN Economic Community. We are delighted to invite academicians, researchers, and practitioners to participate in advancing nation through the exchange of information, knowledge, experience, expertise and research in the following fields:

1. Islamic Studies on Science and Technology
2. Natural Sciences (Biology, Chemistry and Physics)
3. Architecture
4. Computer Science and Engineering
5. Mathematics and Modeling
6. Applied Sciences and Technology
7. Pharmacy and Medical Sciences

Best Regards

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Climate Change Impacts on Carbon Stock and Water Availability in Coban Rondo Watershed

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ABSTRACT

Global climate change effect on temperature, relative humidity, solar radiation, wind speed, precipitation and river discharge. The high intensity of rainfall in the aftermath of the climate change impact on discharge fluctuation Coban Rondo watershed. This study examines climate change in Coban Rondo watershed with prediction variable carbon dioxide (CO_2). The results showed that the potential value of CO_2 in Coban Rondo watershed is 648.83 tons/Ha decreasing compared in years 1993 amounted to 603,236.07 tons and in 2008 amounted to 489,263.89 tons .The air temperature affect the outcome a drought index Coban Rondo Watershed with the relationship $Y = -3.7889 X + 149.33$.

Key words: climate , temperature , velocity , precipitation , carbon dioxide

Published Online *** 2016

1. Introduction

Climate change as the implications of global warming, which is caused by the increase in gas-greenhouse gases, especially carbon dioxide (CO2) and methane (CH4), resulting the two main points that happen in the atmosphere layer at the bottom, whichthe fluctuationhigh rainfall and sea level rise. As an archipelago, Indonesia is most vulnerable to sea level rise.Rising global temperatures are expected to increase the intensity of extreme weather phenomena, as well as changes in the amount and pattern of precipitation where rainfall intensity will increase, the period becomes shorter rainy season and the dry season becomes longer. Increasing the intensity of rainfall and the rainy season could lead to increased intensity and frequency of floods, landslides as a result of increased potential for high water saturation.

Changes in land use in the watershed and population growth causes high pressure on forest land. Pressure changes have resulted farm land more intensively, more widespread forest clearing, soil biodiversity loss and the higher the impact on global warming. Rahayu (2007), forest fires and land and other land disturbance has put Indonesia in the third largest CO2 emitters in the world.Cobanrondo watershed region has an area of about 23,700 ha, including the two local districts, namely Pujon and Ngantang. DAS extents Pujon Cobanrondo in the area is approximately 12 505 ha. As for the western region of the watershed Cobanrondo covers an area of 11 195 ha in Ngantang. Increasing population density in the watershed Cobanrondo is 587 people / km2 in 1990 to 1 057 inhabitants / km2 in 2012 allegedly encourage increased human activity in the use of land. The result is a conversion of forests into agricultural land. In the period 1990-2012, a decline in forest area is accompanied by increased area of shrubs and plantations. So that would affect the change in CO2 levels. Formulation of the problem

1. What is the value of carbon reserves in accordance with the type of land cover in the Cobanrondo watershed
2. How to value of Cobanrondo watershed drought due to climate change

Object of research is Watershed Cobanrondo and time studies were conducted in two situation that the rainy season and the dry season.

Tools used are

1. Automatic water level recorder (AWLR) located in the village of Jabon managed by the Office of Water Resources Stork-Gedangan Malang.
2. Two daily rainfall recorder
3. The GPS is used to determine the change in land use

Methods of data collection in this study using a survey method approach, the data obtained by directly collected from the first source or direct measurements in the field and from relevant agencies or indirect (secondary data). The data used are:

1. The daily rainfall data
2. Topographic map scale of 1: 25,000.
3. Data Climatology
4. Photos Land sat satellite imagery and Aster
5. Land use planning map

Measurement of soil conditions is done by taking soil samples on each land use. Soil sampling is done at the depth of the surface soil layer further ground in the analysis in the laboratory. Laboratory analysis includes analysis of texture, bulk density, porosity and pF.

Cobanrondo watershed topographic map (Figure 1) used is a scale of 1: 25,000 of Perum Jasatirta I. While land use maps, maps of the watersheds and river network (scale 1: 25,000) was obtained from the Central Management of Brantas watershed.Cobanrondo watershed forest land use has an area of 754.071 ha and a value coefisien runoff (C) = 0.2; on land use garden area of 356,735 Ha has a value of C = 0.1;

land use residential area of 114.702 ha has a value of C = 0.3 and the land-use area of 346.957 ha of rice fields memunyai value C = 0.2, bringing the total value of the runoff coefficient (C) DAS Coban rondo of 0.8.

Meteorological data used onthis study was taken from the Meteorological and Geophysics Agency Karangploso on the post station located at coordinates Selorejo 7o 53 'South Latitude and 122o 21 BT at an elevation of 637 m in the village of Banu Ngantang. The data obtained are temperature, humidity, solar radiation, wind speed and air pressure in 1993,1997,2002,2003,2005, and 2006. The calculation of evapotranspiration in this new study used a computer program CropWat 4 Window Version 4.2. developed by FAO (1992).

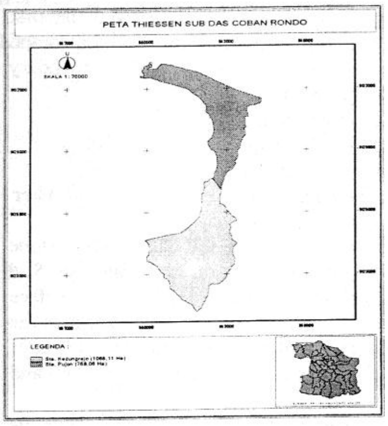

Figure 1. Cobanrondo Watershed Map

Index Analysis drought

Drought cangenerally be defined as the extreme persistence of precipitationdeficit (González and Valdés 2006) over a specific regionfor a specific period of time (Beran and Rodier 1985;Correia et al. 1994). In addition to the elements of 'persistence'of 'substantial precipitation deficit', 'bounded by timeand space', definitions have expanded to include impacts onenvironment and society (Tsakiris and Vangelis 2004).

Analysis of drought index one of which was developed by Palmer. In principle palmer index value calculation is based on the amount of rainfall and the ability of soil to hold water according to soil type. Palmer uses a two-tier model of the land, namely the top layer and bottom layer which is based on the method of Thornthwaite (Huang et. Al., 20011; Vasiliades and Loukas, 2009). Palmer index is based on the concept of income and expenditure of the water balance equation, which is also influenced by the data of rainfall and temperature and soil water availability (Kao and Govindaraju, 2010; Mishra and Singh, 2010). In calculating the index values palmer seeking, first calculating the water balance using the Thornthwaite. Data used include: monthly rainfall (CH), potential evapotranspiration (ETP), field capacity (KL).

2. Results

Test data consistency rain is done by using double mass curve is an analysis conducted by illustrating the correlation between the accumulation of high yearly precipitation of the station is checked by the station index, and draw a line through these points is called a line correlation masses of rain. Change in slope of the line correlation gives an indication of a change. This method can be done with the correction to the data an inconsistent rainfall. The next is to compare the price of the accumulation of annual rainfall at stations tested by the accumulation of annual rainfall averages from a network base station which corresponds rain, then plotted on a curve. The following are the test results in a data consistency Kedungrejo stations and stations in the watershed Conanrondo Pujon.

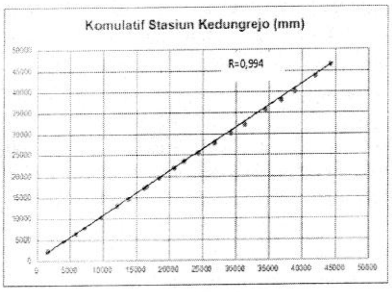

Figure 2. Double mass curve at Kedungrejo Station

Figure 2 shows the test data consistency annual rainfall between 1993 - 2014 by using double mass curve the results obtained R = 0.994 means there is consistency rainfall data obtained from both the station so it can represent the value of rainfall in Cobanrondo watershed.

The amount of water availability in the study area is relatively abundant, in December-May have a surplus water, and in June -Nopember deficit. assess previous studies on water balance of an area using the Thornthwaite Mather, the distribution of the amount of such water is often found or presence of similarity pattern.The pattern follows the wet tropical climate in Indonesia, where in April-September will take place in the dry season and will take place from October to March rainy season. The season change will affect rainfall and evapotranspiration levels that occur. Input water occurs maximally in the form of rain in the rainy season progresses, so that in these months will be an excess of water (surplus).

Rainfall is always proportional to the availability of water or water deposit, while evapotranspiration is inversely. Quantitatively study area has a large output water availability because the area of forest land use is quite extensive. The more widespread a forest tatagunalaha (Widiyono, 2016), the run-off that occurs will also be greater. It also occurs in the following months and monthly affect water availability, though not significant

Factors that affect the water balance according to Thornthwaite method Mather is rain the air temperature and also the location of astronomy region will affect the amount of evapotranspiration that occurs (acting as water output). Factors topography and land use factors will affect the catchment area that affect the amount of infiltration and surface runoff. Thornwaite matter in accordance with the note that the availability ait (debit) Cobanrondo DAS in 1993 discharge Q = 1.345 m3 / s, 1997 discharge (Q) = 0.68 m3 / s, 2002 discharge Q = 1.135 m3 / s, 2005 discharge (Q) = 0.297 m3 / s and 2006 discharge Q = 1,497 m3 / sec. This shows that with an area of land use is reduced, followed by discharge runoff will be reduced.

Drought Index Values

Palmer Drought Severity Index (PDSI) is a popular meteorological drought index, especiallyin the US(Palmer 1965). The PDSI bases its concept of drought on watersupply-and-demand instead of precipitation anomaly. Emphasisis on abnormalities in moisture deficiency rather thanweather anomalies (Guttman 1999). PDSI uses precipitation,temperature, and the local available water content (AWC)data for soil. Using these inputs, PDSI computes four termsin the water balance equation: evapotranspiration, runoff,soil recharge, and moisture.Drought index in the Cobanrondo watershed calculated based on the water balance of the watershed and the following method Thornwaite water balance . Drought index value in 1993 was 16.61; in 1997 DI = 47.38; 2002 DI = 30.95; 2003 DI = 33.82; in 2005 the value of DI = 24.83 and in 2006 DI = 33.86.

Tabel 1. Thornwaite Droght Index

Index	Drought Level
< 6.77	Mild or no
6.77 – 33.33	moderate
>33.33	severe

According to table 1, the situation shows that in 1993 the level of dryness at the watershed Cobanrondo was mild whereas from 1997 to 2008 of moderate to severe drought.Based on the data the average temperature on land use Cobanrondo watershed known that a sufficiently high temperature is not always followed by the rising value of drought in the watershed Cobanrondo and by using linear regression is known air temperature affect the results of a drought index Cobanrondo Watershed with the relationship Y = -3.7889 X + 149.33 (figure 3)

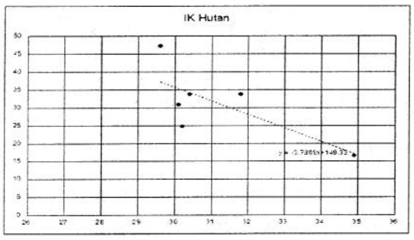

Figure 3. Graph of average temperature and droght index

Carbon Reserves

Calculation of carbon stocks on average each cropping cycle (time-avareged C stock) is performed to obtain a picture of the dynamics of reserves in the landscapes on the current conditions. The amount of time-avareged C stock is influenced by the rate of accumulation of each year, the amount of the minimum and maximum carbon stocks for each land use system, the time required to reach maximum carbon stocks and harvest time. the plantation system (pine, mahogany and damar aged 25-40 years) of about 139 tons / ha, agroforestry approximately 111 tonnes / ha, while annuals only about 79 tonnes / ha of natural forest and 161 tons / ha. (Hairiyah, 2010). research has been done on forest land is known that the average value of carbon potential in the watershed Cobanrondo is 648.82 ton / ha so that the total value of carbon in 1993 amounted to 603,236.07, 1997 C = 602,898.03; 2002 C = 685,826.94; 2003 C = 509,105.11; 2005 C = 602,705.97; 2006 C = 602,818.22 by 2008 on forest land.

in Cobanrondo watershed has changed considerably, especially in the year 2008 where the forest land greatly affect the availability of carbon reserves. The amount of the potential value of carbon dioxide (CO2) in the Cobanrondo watershed on forest land use amounted to 648.83 tons / ha and the potential value of the total carbon in the Cobanrondo watershed more year decreased in 1993 amounted to 603,236.07 tons and in 2008 at 489,263.89 tons.

3. Conclusion

The results showed that

1. The amount of the potential value of carbon dioxide (CO2) in the Cobanrondowatershed on forest land use at 648.83 tons / ha and the potential value of the total carbon in the Cobanrondo watershed more year decreased in 1993 at 603,236.07 tons and in 2008 at 489 263, 89 tons.
2. The air temperature affect the outcome of a drought index Watershed Cobanrondo with the relationship Y = -3.7889 X + 149.33

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