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KEYNOTE SPEECH

THE MINISTRY OF AGRICULTURE - REPUBLIC OF INDONESIA

SUSWONO

Future agriculture development, particularly increasing production to attain and maintain food security facing four main constraints *i.e.* (a) decreasing and degradation of land and water resources, (b) more frequent climate anomaly and climate change, (c) shrinking and conversion of fertile agricultural lands, and (d) fragmentation of present agricultural lands and limited availability of potential lands for expansion.

Increasing intensity of climate anomaly and climate change are threatening national food security and farmers welfare. Climate change with increasing atmospheric temperature will (a) change the rainfall pattern, (b) increasing the frequency of extreme climate such as El Nino and La Nina, and (c) rising the sea level.
Attaining soybean, sugar, meat and maintaining rice and maize self sufficiency is one of four goals in national food security. Climate variability and climate change are the main challenge in the achievement particularly for rice, maize and soybean that are vulnerable to climate change.

In coping with climate change the strategy are mitigation to harness the adverse effect of climate change by reducing GHG emission particularly in developed countries. The effects have been observed and the negative impacts already felt by the poor in the developing countries with limited ability and resources the need adaptation to increase resilience. Without proper anticipation, adaptation and mitigation efforts national food security certainly will be threatened.

Agriculture Complex Linkages to Climate Change Issues

Agriculture development is one of national agenda because of its multiple objectives both for economic and social purposes. It provides devisa and substatially contributes to gross domestic product. Socially, through agriculture rural development and poverty alleviation can be attained. Agriculture is also important politically by enhanciing national integrity by promoting inter-regional trade and environmently through development of sustainable agriculture
Agriculture has strong interlinkage with climate change. Agriculture has strategic role as the biggest employer and staple food provider but also as one of the most vulnerable to climate change. Despite small contribution presently, agriculture development can be directed to become sink by sequestering CO_2 in mitigation efforts.

Climate change is believed by increasing GHG emitted by human activities. Agriculture is one of the GHG sources through development af agricultural lland on peat soils as well as emission from paddy cultivation and livestoccks. GHG emission from agriculture excluding peat and forest fire is only 6%. Forest fire is the biggest contributor (65%), while paddy cultivation and livestock, respetively 24% and 9.3%.

Plants have the ability to absorb carbon in the form of CO2 is very large, some of which are utilized in process plants metabilisme, and most other stored in various form of organic material. At the annual crop of organic material are stacked in various organs of plants (stems, roots, etc.) in the longer term as carbon sequestration.

Impact of Climate Change on Food Security

The impact of climate change on food security which is divided over the continuous impact, dis-constinuous impact, and permanent impact. Impact of continuous, generally caused by changes in precipitation patterns increase in air temperature, whereas discontinuous impact caused by temporary climate change variables, such as extreme climate events (droght, floods, high winds, etc.). Permanent impacts are generally caused by the degradation and/or shrinking resources, especially land and genetic resources,

In general, climate change impacts on the agricultural sector: (a) directly, affecting food production and agriculture through changes in the biophysical conditions of climate and resources, (b) indirectly affect the growth and income distribution that affect the demand for agricultural products, and (c) in a broader context, climate change will also affect the policies and levels even up to the constellation of world politics.

Climate change will affect among others (a) degradation and reduction of agricultural resources particularly land due to flood, drought, inundation and sea water intrusion, (b) decreasing capacity of agriculture infra-structure such as irrigation, (c) decreasing yield and production because of rising temperature, flood and drought, increasing pest and disease, and (d) eventually social and economically increasing poverty.

The impact of climate change on food security which is divided over the impact of continuous, discontinuous and permanent (Boer, 2011). Continuous impact is generally caused by changes in precipitation patterns increase in air temperature, whereas discontinuous impact caused by climate change discontnuous elements too, such as extreme climate events (drought, flooding, high winds, etc.). Permanent impacts are generally caused by the degradation and/or shrinking resources, especially land and genetic resources, eg land downsizing due to increased sea levels or extinction of some species or genetic resources due to whipping the air temperature, etc.

Recent studies (2010) indicate that in 2050 sea level will rise by 50 to 100 cm, causing about 5,251 ha and 14,950 ha or about 0.30% and 0.86% of 1,732,124 ha rice fields along the nothern coast of Java will be inundated. Although proportianally small agregated 50 to 150 thousand tons of rice production will permanently loss annually.

Rate of land degradation including abandoned lands averagely 2 million ha annually. Beside due to deforestation and improper management the degradadtion is due to flood, landslide, drought because of extreme rainfall.

Increasing intensity of extreme climate strongly affects cropping season resulting in delay planting, decreasing yield and even crop failure. Studies of AARD indicate that climate change will increase significantly flood prone agricultural lands including crop failure. During El Nino cropped area decrease by 14% will La Nina will increase the area by 10%. National rice production can decrease due to flood, drought, pest and disease from presently 2.5-5% to 10%. Rising temperature alone can decrease rice production by 10 to 19% in the coming 4 decades.

TABLE OF CONTENTS

Sub Theme : Bioproduct and Post Harvest
Poster Presentation

Sub Theme : <u>Agroforestry and Environmental Management</u>
Oral Presentation

Sub Theme : *Social and Economic Issues*
Poster Presentation

Sub Theme : Strategy and Food Security Policy
Oral Presentation

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MONTHLY WATER BALANCE ANALYSIS FOR THE DETERMINATION OF AVAILABLE GROWING SEASON AT NORTH SAMARINDA DISTRICT, EAST KALIMANTAN

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ABSTRACT

North Samarinda District this geographical area position 0°17'30"-0°30'00" LS dan 117°06'00"-117°22'00" BT, with the 31 475 Ha. Characteristics of rain this area included in he Area Class III (1500 – 2000 mm/ year). With the Bimodel or Double Wave rainfall models with C patern. The hight rainfall depth periode at December and April, therefore the low rainfall depth at September and November. Have level Q = ± 9.9 %, or rainfall tipe A (very wet area with tropical wet vegetation) and E1 agroclimte zone. Water Balance monthly indicated that this area have potential growing season about 12 months or all year round, have to water surplus 8 month as much as 478, 8 mm year^{-1} and water deficits about 3 months as much as 44.5 mm/year.

Keywords : Water Balanced, Growing Season

INTRODUCTION

Water is a natural resource that can be renewable and can be found everywhere, although still limited in quantity and quality of presence and availability both geographically and reviewed according to the season. Therefore, increased use will result in human intervention against the greater water resources. It will allow the change order and the hydrological cycle as more and more territory and the presence of uneven distribution of water, both in spatial and temporal as well as decreasing water quality. At the same time the utilization efficiency and lower water use and often ignore areas where water flow is derived, or river basin area (RBA).

Along with the development of the city, most of the upstream region of sub-watersheds have experienced pressure river Karangmumus degradation mainly due to logging, housing needs, and changes in regional function. Conditions are very obvious on a swamp area that stretches along the banks of the river downstream and the downstream Karangmumus sub-river of other rivers, a large part has been transformed into economic zones and settlements.

Management of sub-watershed with good manners and right is an attempt at controlling the reciprocal relationship between natural resources such as vegetation, soil and water by humans and all its activities. So that the basin management objectives to ensure sustainability and harmony of the ecosystem and increase the benefits of natural resources contained therein for human life can be achieved. It is intended as an effort to maintain the Mahakam river water discharge in the dry season which can prevent the intrusion of sea water. It also avoids increasing the flow rate of surface water in the rainy season which can lead to the high frequency of flooding in the area of the city of Samarinda (Trisusanto, 2002).

The direct impact that is felt is the change in the basin water balance Karangmumus tangible with the occurrence of droughts and floods are more widespread and more frequently lashed various aspects of life (Suyitno, 1989; Anonymous, 2001).

MATERIALS AND METHOD

a. Time and Place Research

The study was conducted at North Samarinda District for approximately 6 (six) months (July-December 2008) in an area of approximately ± 31 475 hectares.

b. Data Collection

Data collected from both primary and secondary data related to the research, include:

a. Climate, particularly rainfall and evaporation

b. Physiographic characteristics, particularly land slope

c. Soil conditions, especially those related to water status in soil

d. The vegetation, especially the dominance of vegetation, land cover

c. Water Balance Analysis

Analysis of water balance of land stated in the form of integral equations by simplifying some similarities, so that the water balance of a land area can be expressed in the form of the equation:

$$CH = ETA \pm \Delta WCS \pm Li$$

Where: CH = rainfall (mm $months^{-1}$)

ETA = actual evapotranspiration (≤ETP)

Δ WCS = soil water content changes (mm $months^{-1}$)

Li = runoff (surplus or deficit depending on its value) (mm $months^{-1}$)

c.1. Analysis of Potential Evapotranspiration (ETP)

Calculation of potential evapotranspiration (ETP) using equations from Buckman and Braddy (1969), quoted by Sujalu (1997), as follows:

$$EPTi = 616 \times \left(10 \times \frac{Ti}{I}\right)^{al}$$

$$I. = \sum_{jan}^{des}\left(\frac{Ti}{5}\right)^{1.514}$$

$$a = 6.75 \times 10^{-7}\, I^3 - 7.71 \times 10^{-5}\, 1^2 + 1.792 \times 10^{-2}\, 1 + 0.492$$

where; ETP = Evapotranspiration
Ti = temperature of the month to the first monthly
I = Index monthly heat
a = Constant

C.2. Analysis of Soil Water Content (WCS)

Changes in Water Content of Soil (WCS) is the difference in soil moisture content on a period to prior periods between sequential. For each change in soil water content, can be calculated with the formula R - ETP that if a negative value, there will be a deficit (lack of) water for (ETP = Eta). Conversely, if (R - ETP) is positive, then there will be a surplus/excess of water (R-ETP-ΔWCS), so that soil water availability decreases water exponentially and expressed by the equation:

$SWA = WHC \times k^a$,

$WHC = FC - PWP$,

$WCS = PWP + ASW$

Where:

WCS = Actual Soil Water Content (mm)

ASW = Availability of Soil Water Actual (mm)

WHC = water holding capacity or availability of Maximum Soil Water (mm)

FC = Field Capacity (mm)

PWP = Permanent Wilt Point (mm)

K = Constant (obtained $k = ((Po + P_1) / WHC)$,

with

Po = 1.000412351 and P_l = -1.073807306

a = accumulation of potentially lost water (Accumulate Potential Water

Loss, APWL), which represents the accumulated value (R-ETP) when the value of R <ETP

RESULTS AND DISCUSSION

A. Preview Area North-Samarinda District

North-Samarinda District geographically located in the region North Samarinda districtis part of the Mahakam river basin is located at coordinates between 0°17'30"-0°30'00" SL and 117°06'00"-117°22'00" EW with a total area reaches 31 475 hectares. This area is traversed by two creeks ie. sub-watershed areas, namely sub-ssub watershed Karangmumus and sub-sub-watershed Siring as well as several other small rivers.

North Samarinda district has the largest area, 20,520 hectares, or 28.58% of total large city. Similarly, the total population, 138,726 people. Generally inhabiting North Samarinda is transmigran district of Java, is a district with the most extensive region in Samarinda and herein lies Siring River Airport is under construction. North Samarinda district includes 6 (five) sub-districts, namely sub-district Lempake, Pelita, Sempaja Utara, Sempaja Selatan, Sungai Siring and Tanah Merah.

This area has varied topography, with elevation ranging from topographic region 10-120 m above sea level with a diverse variety of heights.

Table 1. The total area of the basin based on gradient class North Samarinda district

The range of slope (%)	Slope Class Size	Area	
		Hectares	(%)
0 ~ 8	I (Flat)	4.907,85	15,59
8 ~ 15	II ((flat)(Landai)	2.780,66	8,83
15 ~ 25	III (Rather Steep)	18.134,51	57,62
25 ~ 40	IV (Steep)	6.398,13	20,33
>40	V (Very Steep)	472,93	1,50
□ amount		31.475	100.00

Source : Anonim (2001)

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Appendix Table 1. Monthly Water equilibrium in the North Samarinda District area ($0^0$17'30"- $0^0$30'00" SL and $117^0$06'00"-$117^0$22'00" EL)

Parameter	Month											
	Jan	Feb	Mar	Apr	May	June	July	Agst	Sept	Okt	Nov	Des
Rainfall (mm)	194.0	143.0	233.0	333.0	183.0	113.0	178.0	121.0	104.0	134.0	198.0	214.0
Potential Evapotr/ETP (mm)	139.0	138.7	139.6	140.2	139.6	138.4	137.2	138.1	138.4	139.3	139.3	138.7
R – ETP (mm)	55.0	4.3	94.4	192.8	42.4	-25.4	40.8	- 17.1	- 34.4	- 5.3	58.7	75.3
APWL (mm)	0	0	0	0	0	0	0	-17.1	-51.5	-61.8	0	0
Water Content of Soil /WCS (mm)[1]	268	268	268	268	268	242,6	268	250.9	198.5	136.7	185.4	260.7
ΔWCS	0	0	0	0	0	-25.8	0	- 17.1	- 58.0	- 62.0	- 3.3	0
Actually Evapotran/ETA (mm)[2]	139.0	138.7	139.6	140.2	139.6	138.4	136.9	142.0	152.0	196.0	139.3	138.7
Deficit (mm)	0	0	0	0	0	0	0.3	3.9	13.6	26.7	0	0
Surplus (mm)	55.0	4.3	94.4	192.8	42.4	0	0	0	0	0	58.7	75.3

Description: 1. Water Content of Soil (WCS) at Field Capacity (FC)

2. Actual evapotranspiration (ETA) in the period of time deficit (R<ETP) was obtained from R (mm) + □ WCS. While at the time of surplus (R> ETP) the amount equal to ETP

Table 2. The Area Land Use Type at North Samarinda district

No.	The Area Land Use Type	Area	
		(ha)	(%)
01.	Farm (dry land farming)	203,13	0,65
02.	Forest	146,15	0,46
03.	Shrub	6.996,25	22,23
04.	Mixed Garden	4.473,44	14,21
05.	Bush	14.501,36	46,07
06.	Wetland	648,99	2,06
07.	Garden	1.106,64	3,52
08.	Settlements	2.267,78	7,21
09.	Settlement expansion (Pp)	215,61	0,69
10.	Slough/swamp area	915,63	2,91
Amount		31.475,00	100

Source : Anonim (2001)

Table 3. Climate Data Average Monthly North Samarinda district area ($0^0$17'30"- $0^0$30'00" SL and $117^0$06'00"-$117^0$22'00" EL)

Climate Elements	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Rainfall (mm month^{-1})	194	123	233	333	183	113	178	121	104	134	198	214
Rainy Days (days)	12	11	12	14	12	11	9	10	9	11	11	12
Temperature (^{0}C)	26.8	26.7	27.0	27.2	27.0	26.6	26.2	26.5	26.6	26.9	26.9	26.9
Humidity (%)	87.2	86.3	89.2	90.2	88.6	86.5	85.6	86.2	83.4	85.9	87.1	86.3
Sun Radiation (Kkal cm-^{2})	0.55	0.48	0.51	0.53	0.53	0.51	0.51	0.49	0.41	0.44	0.44	0.52

B. Condition Elements The climate in the North Samarinda district

Based on rainfall data from 3 (three) climate observation station in the basin area Karangmumus year period from 2001 to 2009 showed that rainfall monthly average ranged from 104-214 mm $month^{-1}$ or an average of 168 mm $month^{-1}$, whereas The average rainfall ranging from 1510-2850 mm $year^{-1}$ or average of 2018 $mmyear^{-1}$. Rainfall occurred on rainy days (rd) monthly rates ranging from 9-14 rd with an average rainfall occurred 11 rd $month^{-1}$.

Analysis of rainfall characterization includes four main components, namely:

1. Annual Rainfall spread of this area falls within Class Region III (rainfall between 1500-2000 mm $year^{-1}$).
2. Spread Type Rainfall North Samarinda district area has a period of dry months (months with rainfall of <100 mm $month^{-1}$). Thus obtained value of Q = ±9.9%, or rain type A (which may imply that North Samarinda district is very wet areas with dense vegetation of tropical rain
3. Rainfall patterns or Bimodel Dual (Double Wave) with the notation Pattern C, periods of high rainfall occurred in December and April, while periods of low rainfall occurred in September and November.
4. Agro-climate zones, the North Samarinda district the same as the basin area Karangmumus has a 1 (one) dry months (DM), 8 months humid (HM) and three wet months (WM), including agro-climate zones E1.

C. Calculation of Potential Evapotranspiration (ETP)

Calculation of potential evapotranspiration (ETP) conducted monthly by using equations from Buckman and Braddy (1969), quoted by Sujalu (1997) in the North Samarinda district ranged from 137.2-140.2 mm or an average of 138.8 mm $month^{-1}$, the highest point in months April amounted to 140.2 mm and the lowest points in July amounted to 137.2 mm.

D. Water Balance

The calculation result in soil water status were obtained from analysis of soil physical properties in the laboratory soil Assessment Institute for Agricultural Technology (BPTP) East Kalimantan Prov. from Heriansyah (2004) showed that soil available water content (WCS) in the range between 244-299mm or average 268 mm

Water equilibrium implies about the details of the input and outputs of water in one place at a certain time period, compiled in the form of quantitative equations, which provide information in the form of quantitative values of each component of input and output water, can be seen in Appendix Table 1.

Monthly Water Equilibrium analysis of the results mentioned above can be seen that these areas have a surplus during the eight months that occurred in a period of months from January to June and in November-December. The monthly water surplus in detail is in January amounted to 27.0 mm, 57.3 mm in February amounted, in March amounted 119.7 mm (the highest monthly surplus), in April amounted to 72.8 mm, 48.4 mm in May, months of June amounted to 19.6 mm (the lowest monthly surplus), the month of November amounted to 58.7 months in December and amounted to 75.3 mm in overall water surplus reached 478.8 mm year^{-1}. In addition to having monthly water surpluses, the region normally monthly cumulative water deficit in a period of months from June to October as a whole as much as 44.5 mm year^{-1}, with details of the deficit in June amounted to 0.4 mm month^{-1}, July amount 0.3 mm month^{-1}, the month of August amounted to 3.9 mm month^{-1}, the month of September amounted to 13.6 mm month^{-1} and in October of 26.7 mm month^{-1}.

As has been previously communicated its position Karangmumus river divides the city of Samarinda especially North Samarinda District, and considering the amount of potential run-off that occurred in the region and also by considering the conditions Karangmumus area topography, the basin area Karangmumus at the North Samarinda Regions very possible to build dams or reservoirs, which have various functions. Although the main function is to accommodate the construction of the dam monthly surplus water run off resulting in the potential is big enough in this area, as well as water reserves in the period in the months of water deficit that can be utilized by a variety of purposes including drinking water.

E. Analysis of Cropping Periods (Growing Season)

To determine the length of cropping period (the length of growing season) can be done based on the ratio P/PE (ratio between precipitation and potential evapotranspiration), defined as the time interval in a year that have a ratio P/PE>0.5 plus the time needed for evapotranspiration 100 mm of ground water is considered available in the soil (FAO, 1978). Results of analysis ratio P/PE can be seen in Table 4 below.

Table 4.Ratio rainfall (R) and potential evapotranspiration (EP) monthly

Climate Elements	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
Rainfall (mm / month)	194	123	233	333	183	113	178	121	104	134	198	214
Evapotr.Pot. / ETP (mm)	139.0	138.7	139.6	140.2	139.6	138.4	137.2	138.1	138.4	139.3	139.3	138.7
Ratio P/PE	1.4	0.9	1.7	2.4	1.3	0.8	1.3	0.9	0.8	0.9	1.4	1.5

Based on this analysis the ratio P / PE ratio of the above in mind that the P / PE in the rain fall average monthly cumulative throughout the year (12 months) is always> 0.5. Therefore, according to the restrictions provided FAO (1978), the North Samarinda District areas have planting period (the length of growing season) for 12 months or all year round.

CONCLUSION

Based on the description as a whole can be concluded that North Samarinda districtarea has a all year round (12 month) potential planting period (growing season) which is supported by the surplus water during 7 (seven) months or cumulatively amounted to 478.8 mm year-1 and a deficit of water for four months or cumulative 44, 5 mm years^{-1}.

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