

..... an event for 50th Anniversary of Sriwijaya University
World Water Day 2010 – March 22



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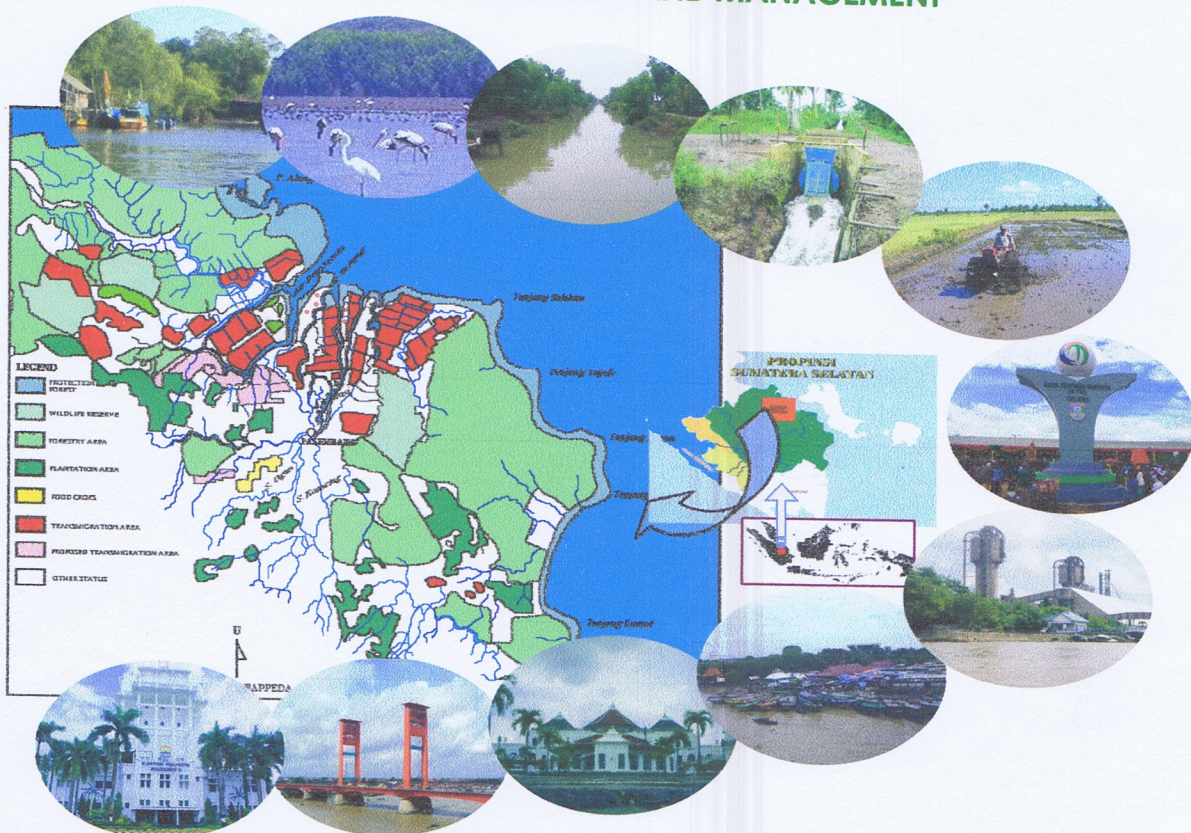
Double Master Degree Program on Integrated
Lowland Development and Management Planning

Proceedings

INTERNATIONAL SEMINAR-WORKSHOP ON “INTEGRATED LOWLAND DEVELOPMENT AND MANAGEMENT”

THEME:

THE ROLE OF AGRO-ECO-EDU PROGRAM THROUGH
MULTISTAKEHOLDERS PARTICIPATION ON THE SUSTAINABILITY OF
LOWLAND DEVELOPMENT AND MANAGEMENT



PALEMBANG CITY – BANYUASIN DISTRICT
SOUTH SUMATRA - INDONESIA
MARCH 18 – 20, 2010



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FOREWORD

Lowland areas consist of swampy areas, wetlands, coastal areas, saturated and high water table areas in the sides of rivers or estuaries.

Hydrologically these lowland areas are defined as upland swamps (lebak) when the high water table condition is affected only by the rainfall and the surface run off in the watershed. On the other end, it is named tidal lowlands when affected by the tidal movement, either directly or indirectly interact with the river flow. Mineral soil, deposited sediment, or peat are material which formed the land with these high water table condition. Mega biodiversity within the wetlands and coastal areas are of concern in the management and development of lowlands.

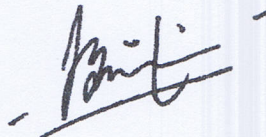
Some suitable lowlands areas are developed for living of the people since hundreds of years ago, ie. Bugineese, Banjarees people development for paddy field and aquaculture system. This community based development triggered the government of Indonesia since 1969 to develop a transmigration program for food crops production. Estate crops development mostly by the private sector - agro industry based development - has started to work on the lowlands.

If we look on different perspectives, both conservation and development of the lowlands should be considered. Integrated lowland development and management is one of the key issues need to be addressed.

International Seminar-Workshop is theme The Role of Agro-Eco-Edu Program through Multistakeholders Participation on the Sustainability of Lowland Development and Management. International Participants are from Netherlands, Thailand, Malaysia.

International Seminar and Workshop committees wish to gratefully acknowledge the support extended by the Sponsors. Committees are also indebted to all those who have kindly helped in the preparation of these proceedings and deeply grateful to the Authors, for their valuable contributions in the form of papers.

Palembang, South Sumatra, Indonesia, March, 2010
Chairman of the Organizing Committee



Dr. Robiyanto Hendro Susanto, M.Agr.Sc

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THE ROLE OF SUSPENDED PARTICLE SIZE ON THE FORMULATION OF SEDIMENTATION AREA IN MODADA PT FREEPORT INDONESIA

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ABSTRACT

Existence of natural succession area at Modified Ajkwa Deposition Area (ModADA) closely related to sedimentation process happened. Data of suspended particle in ModADA on April 2009 indicating that particle is precipitated follows particle size. The biggest suspended particle tends to precipitate in advance. Particle value suspended in water is calculated to apply method APHA (2005) and done in laboratory TRMP PT Freeport Indonesia. Picture as of particle swampy forest suspended at area ModADA projected in data Landsat Acquisition 2007, 2008, and 2009. Suspended particle data analysis in 2007 indicating that distribution of large suspended particle sized (> 600mg/l) in upstream ModADA followed by precipitation of smaller fairish particle (300-600mg/l and 50-300mg/l) in centered and 0-50mg/l in estuary area. Distribution of suspended particle shows the same pattern in the 2008 and 2009 that is the large of particle suspension tends to precipitate in centered of ModADA. Kinetics of rainwater and surface current of influential to sedimentation in river body. Sedimentation process causes changing of river stream pattern. Change of river stream pattern in ModADA depicted in Landsat Accusation 1991, 1999, and 2008. Result of image analysis to suspended particle swampy forest to indicate that smooth and small fairish particle tends to precipitate in part of downstream ModADA especially in gabion area. Deceleration of current in gabion detains suspended particle stream so that particle to tends to sedimentation. Suspended sediment characteristic and material contained by it to stand to form sedimentation area which can be grown vegetation. Sediment characteristic like this found at Double Levee which is part of area ModADA and grows as natural succession area. Based on analysis result this has been done able to be predicted that sedimentation process formed in ModADA can be exploited and managed as area growing of natural vegetation. Condensed of particle is dissolved entering ModADA, high water debit and climate influence causes sediment area formed cannot be exploited carefully as place of growing of vegetation, causing natural succession process doesn't take place in area ModADA.

Keywords : suspended particle, ModADA, sedimentation, natural succession

INTRODUCTION

Mining activity affecting at the happening of area change. Reality impact resulted by mining activity be changing the landscape. PT Freeport Indonesia (PTFI) as one of the biggest mine company in a world of location of the concession resides in Mimika District, Provenca of Papua, Indonesia in the activity is also causes

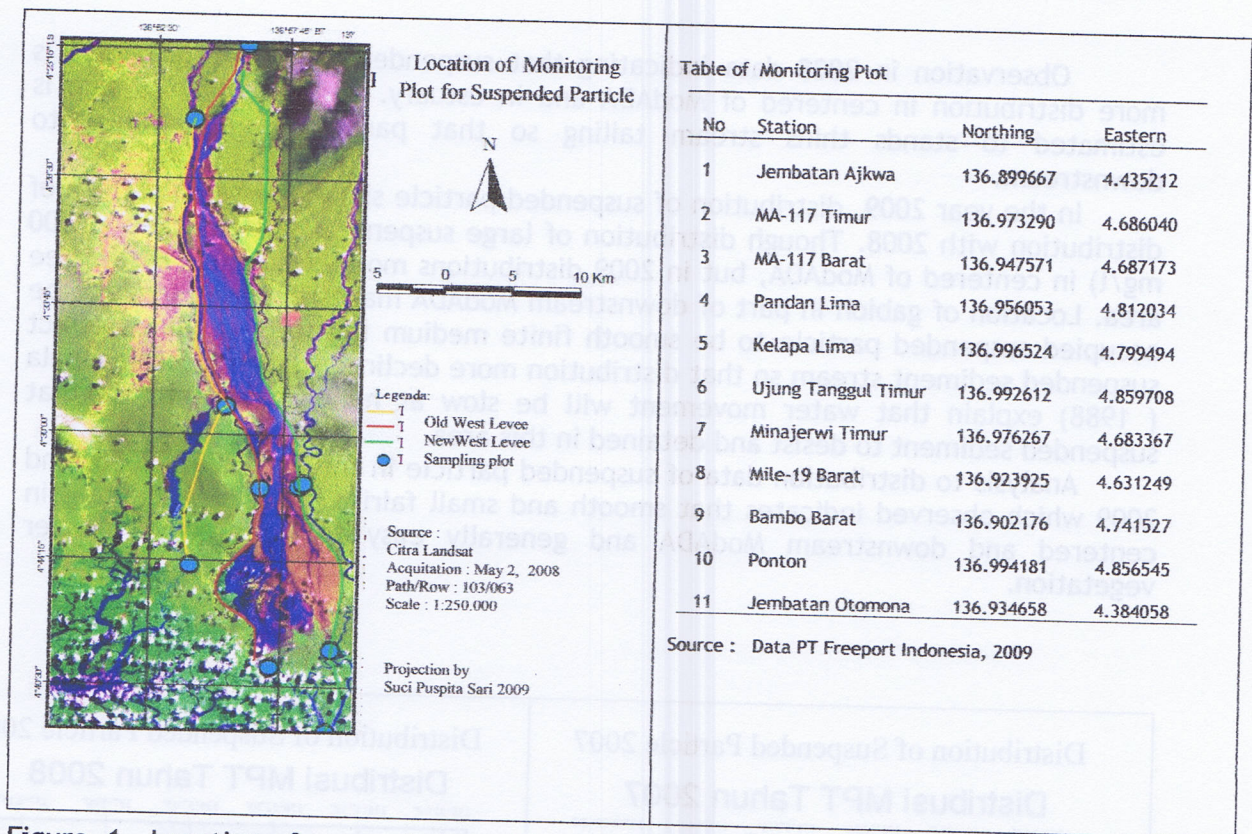


Figure 1. Location of suspended particle sampling (Data from Team Research Unsri, 2009 that projection by Suck Puspita Sari, 2009) and Table of Monitoring Plot

RESULT AND DISCUSSION

Analysis to suspended particle value in ModADA to indicate that sediment suspended particle in the precipitation area pertained height as result of its concentration. According Walling & Moorehead (1989), level of sediment measure transported by current determined by sediment measure entering river body, water debit, channel characteristic, and characteristic physical of sediment particle. Speed of sediment transport hardly influenced by sediment supply and river stream energy. Sediment particle size and speed of river stream played important role in process of sedimentation hence if higher sediment supply than river stream energies, hence sedimentation process takes place quickly. Therefore, distribution of suspended particle closely related to sedimentation process (Walling *et al.*, 2000).

Result of formulation based on method APHA (2005) regression and adapted for digital value at image classifies 4 groups of suspended particle size in ModADA that is 0-50mg/l, 50-300mg/l, 300-600mg/l, and > 600mg/l (Data Team Research Unsri, 2009)

Picture II indicates that there is difference of particle distribution pattern is dissolved in ModADA in all the years observation. In the year 2007, large suspended particle sized (> 600 mg/l) more distribution in part of upstream which nearby outlet tailing when alighting from mountain and come to ModADA. Comes near downstream ModADA, smooth and medium size particle (300-600mg/l and 50-300 mg/l) distribution in gradual in centered of ModADA, while suspended particle to be very smooth fairish (0-50 mg/l) tends to precipitated in estuary. Difference of this distribution can be because of change of topography from precipitous mountain at the time of flowing tailing and sloping lowland topography at the time of tailing enters ModADA.

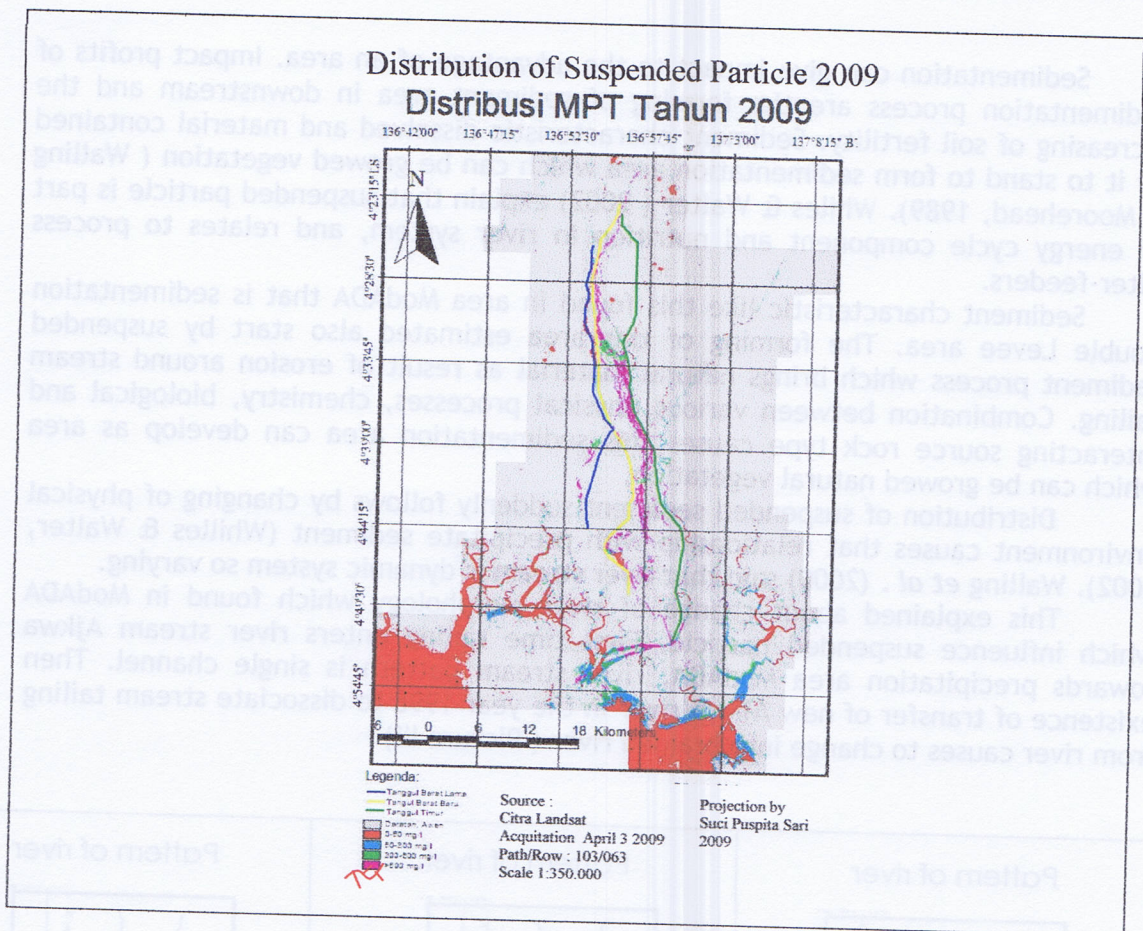


Figure 2. Distribution of suspended particle pattern in ModADA that digitations in the years 2007, 2008, and 2009 (Data Team Research Unsri, 2009) who projection by Suci Puspita Sari, 2009), Suspended particle size data is the result laboratory TRMP analysis PT Freeport Indonesia

Process of making transect channel in ModADA for girder of stream tailing by company estimated influence distribution of suspended particle to be more peripatetically eastwards levee. Rainfall in precipitation area also stands in propagating suspended particle. Follow by Reading (1996), condition of climate hardly influences precipitation of sediment, especially mixed effect of rainwater with sediment. Sediment precipitated also comes from aeolian dirt and sand.

Difference of distribution can be because of change of topography that is from precipitous mountain and sloping lowland topography. Factory residing in height around 3,000m above sea level (asl) which is beginning of current of tailing and lowland around 650m asl when tailing enters ModADA (PT Freeport Indonesia, 2006) estimated quickens sedimentation process.

Prothero & Schwab (1996) explain that transportation of sediment is influenced by current strength, particle size, sediment volume transported, density and sediment particle surface shape. Stronger river current causes particle brought farther, though some of biggest sized particles will be left behind and precipitate. Walling *et al.* (2000) adds that level of sediment entering river and level of debit influenced by topography, vegetation, river morphology, level of crudity of river base, and inclination of river. Follow by Walling & Moorehead (1989), sedimentation also hardly is influenced kinetics rainwater and surface current. Walling *et al.* (2000) adds also that factors interaction of number determines and sediment types and rate of sediment transport influences forming of sediment area or sedimentation.

that is formed widespread channel. Hickin & Sickingabula (1988) adds channels formed have the character of mobile, so that its the situation is changing especially floods. Channel will make a move to other side with rate differs in. Water movement will be slow at hollowing interior causing suspended sediment will stop and detained in the area.

Follow to Schumm & Kahn (1972), braided channels happened at river with elevation which is precipitous and or big sediment charge. Braided channels also are distinguishing from area that is dramatically experiences superficiality as consequence from acceleration of stream. As a result is formed river delta and alluvial fan. Braided river happened when sediment charge threshold boundary has been reached. Improvement of sediment charge from time to time will increase elevation of river.

Condition of precipitation area of ModADA which still be influenced stream tailing and fluctuation of a real strong river water causes this area have the character of unstable and creates condition of extreme area for vegetation growth. Emerging vegetation first time is plant type pioneer capable to increase microclimate in the area. Forming of sedimentation area in ModADA is not expected by PTFI because the requirement to create open area and wide to tailing deposition.

The result of analysis in this research indicates that actually precipitation area of tailing can be exploited as growth area of vegetation naturally and or can be developed as reclamation area.

CONCLUSION

Based on result of analysis to distribution of suspended particle and forming of succession area observed through Landsat data inferential periodic year that:

1. Condition of tailing deposition area ModADA which still be influenced stream tailing and fluctuation of a real strong river water causes this area have the character of unstable and creates condition of extreme area for vegetation growth.
2. Distribution of suspended particle determine river stream pattern in ModADA. Pattern of river stream Ajkwa grows quickly becomes braided rivers supported by existence of difference of topography when tailing enters ModADA and level of sediment charge
3. Distribution of suspended particle as component in energy cycle and nutrition plays important role to create sedimentation area which can be growed vegetation. This thing relates to it's the role in filter- feeder.

ACKNOWLEDGEMENT

We wish acknowledge Dr. Wisnu Susetyo of Senior Advisors PT Freeport Indonesia, Ir. Didiak Subagyo of Senior Superintendent TRMP Department, Ir. Pratita Puradyatmika, M.B.A. of Superintendent Environmental and staff for their support in field observation. This research was funded by PT Freeport Indonesia.

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changing it ecosystem order and landscape. Conscious of mine impact, hence PTFI has made many policies is concerning its the responsibility to area ecosystem continuing managed (PT Freeport Indonesia, 2000; 2005). To reach capacities produce of 220-240K ton ore per day, PTFI obtains 3-4% concentrate of copper, gold and silver, and yields counted 96-97% tailing which must thrown. This tailing still containing small number of concentrate (PT Freeport Indonesia, 2005).

Exploiting of river Aghawagon-Otomona applied to throw away and flows tailing has been considered technically and gets permission from government of Indonesia. Tailing is placed in lowland Ajkwa area modified as precipitation area and named by Modified Ajkwa Deposition Area/ModADA with a width of this 23,000ha limited by levee in both sides (PT Freeport Indonesia, 2006).

Trends of tailing applies riverine system affects at changing it concentration of suspended sediment particle in ModADA. Change of area as result of change of concentration of suspended sediment particle to affects at continuity of vegetation succession process at sediment area.

Walling & Moorehead (1989) explain that particle characteristic from suspended sediment to holds main role in forming process various environmental types in water territory. Forming of area as result of sedimentation is combination between physical processes, chemical and joining biology forms separate sedimentation type, and hardly influenced by source rock type forming it. Therefore, a sedimentation area can be growed by vegetation as result of the happening of interaction between biotic factors and abiotic (Reading, 1996).

Based on statement which has been told, hence the aim of research to study pattern or sedimentation process of material tailing in sediment area ModADA based on size distribution suspended particle. Mukherjee *et al.* (2007) explain that observation to distribution of particle is suspended needed for watching spreading pattern of particles is suspension in water territory. Particle category or suspended sediment according to Parwati *et al.* (2007) be solid matter like sand, mud, soil and also heavy metal suspension in water territory area. Walling & Moorehead (1989) explain that suspended sediment characteristic and material contained by it using for forming of sedimentation area which can be growed vegetation. Therefore, this research is important because sedimentation of suspended particle to plays important role in forming substrate for growing of root. Finally can be analyzed how sedimentation process occurs in tailing deposition area ModADA and the forming of sedimentation which can be growed vegetation, like at Double Levee area. This information needed for describe about exploiting and manages area of sediment tailing in the future.

RESEARCH METHODOLOGY

This research done in contract area of PTFI at Timika, Mimika District, Provence of Papua, Indonesia at ordinate $136^{\circ}45'00''\text{BT}$ - $137^{\circ}07'00''\text{BT}$ and $04^{\circ}20'00''\text{LS}$ - $4^{\circ}55'00''\text{LS}$ during April until July 2009. Water sample for observation to suspended particle taken away from some point of observations in Old West Levee, New West Levee, East Levee and monitoring area that is not hit by stream of tailing.

Analysis to suspended sediment or suspended particle charge follows method APHA (2005). Suspended particle value data for the year 2007 and 2008 obtained from TRMP Department. Data processing as of suspended particle swampy forest to applies annual multi image projection by Suci Puspita Sari (2009 in Team Research Unsri, 2009).

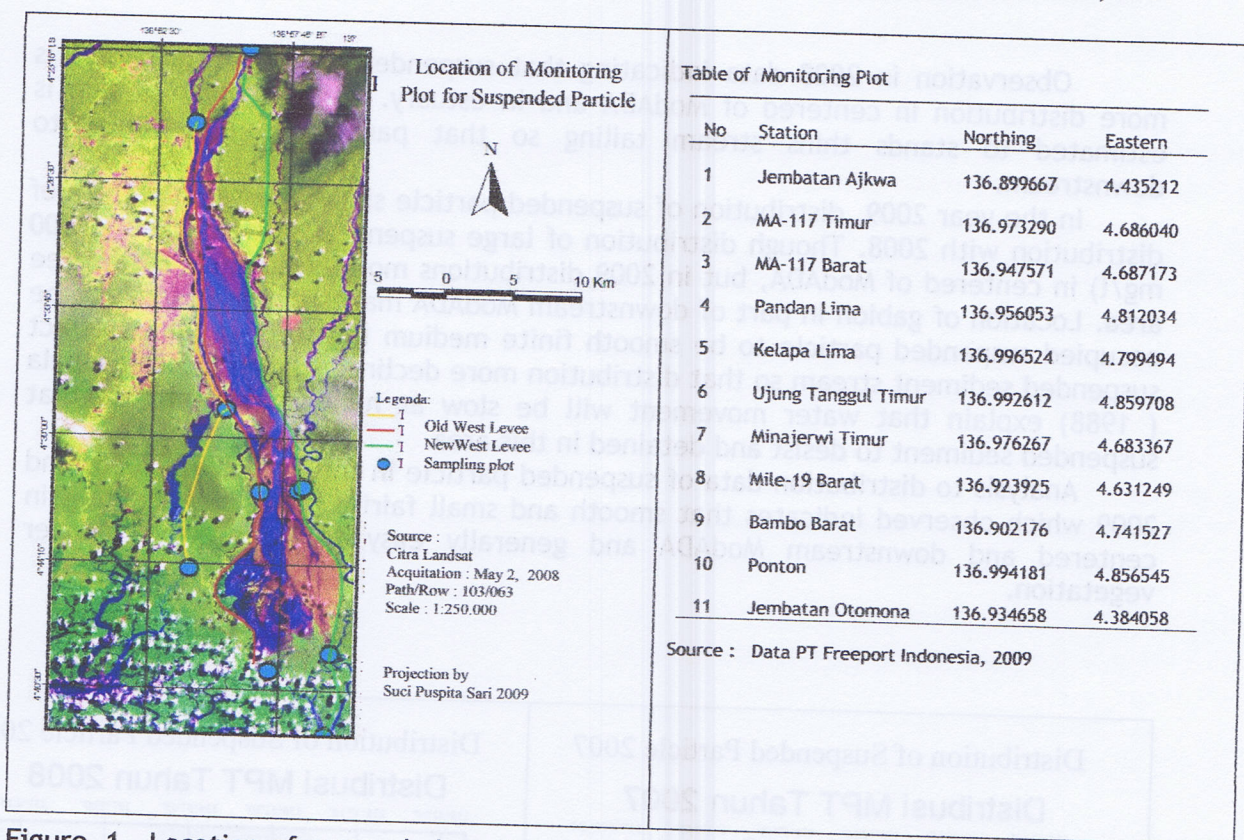


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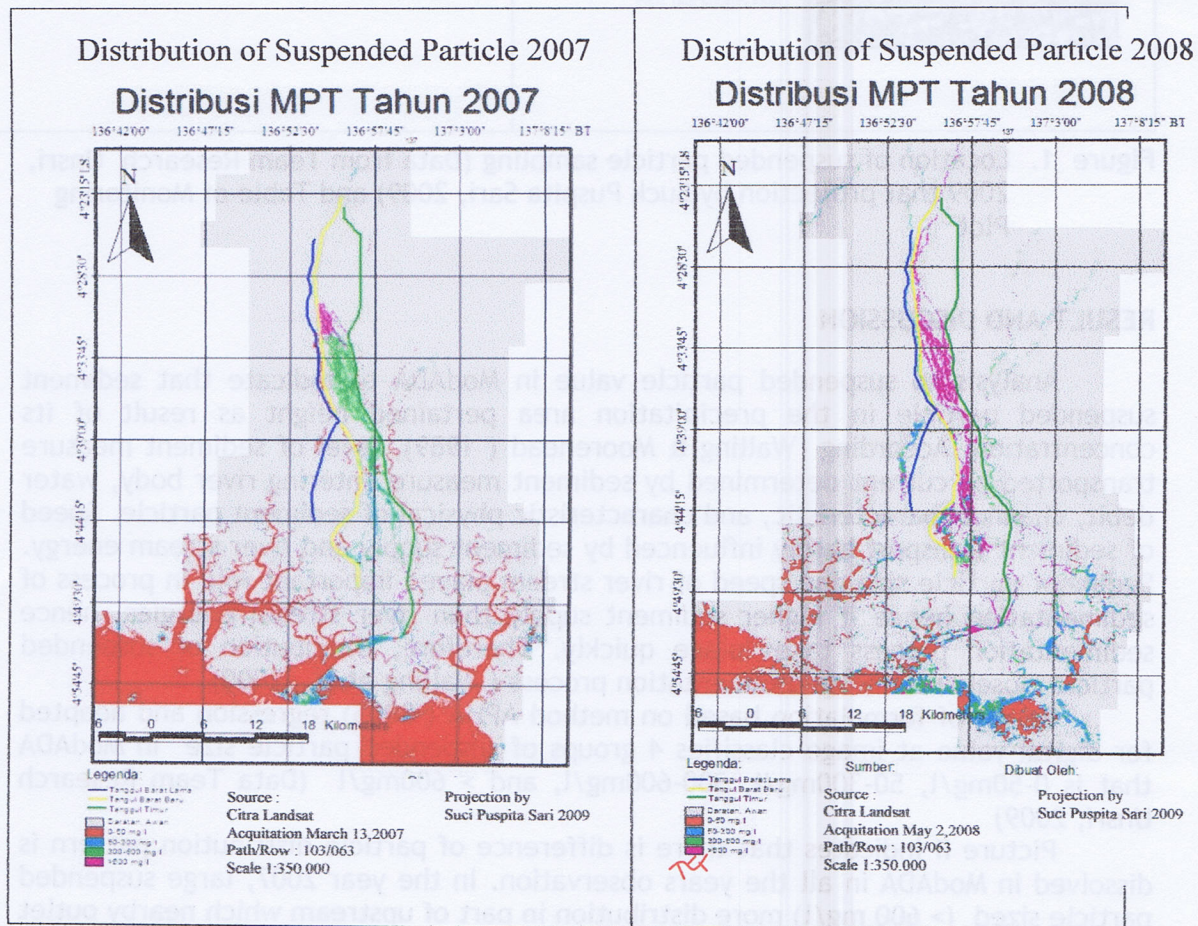
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Observation in 2008 data indicating that suspended particle > 600 mg/l is more distribution in centered of ModADA and in estuary. Rainfall which is high is estimated to stands this stream tailing so that particle is distribution to downstream.

In the year 2009, distribution of suspended particle shows the same pattern of distribution with 2008. Though distribution of large suspended particle sized (> 600 mg/l) in centered of ModADA, but in 2009 distributions more closingly is East Levee area. Location of gabion in part of downstream ModADA makes this area tends to be occupied suspended particle to be smooth finite medium fairish of detained effect suspended sediment stream so that distribution more declines. Hickin & Sichingabula (1988) explain that water movement will be slow at hollowing interior so that suspended sediment to desist and detained in this area.

Analysis to distribution data of suspended particle in the year 2007, 2008, and 2009 which observed indicates that smooth and small fairish particle precipitate in centered and downstream ModADA and generally easy to be growed pioneer vegetation.



ModADA, smooth and fairish particle (300-600mg/l) and fine suspended particle to be very distribution in centered of ModADA, while suspended particle to be very smooth (airish (0-50 mg/l) tends to precipitated in estuary. Difference of this distribution can be because of change of topography from precipitation mountain at the time of flowing and sloping lowland topography at the time of flowing.

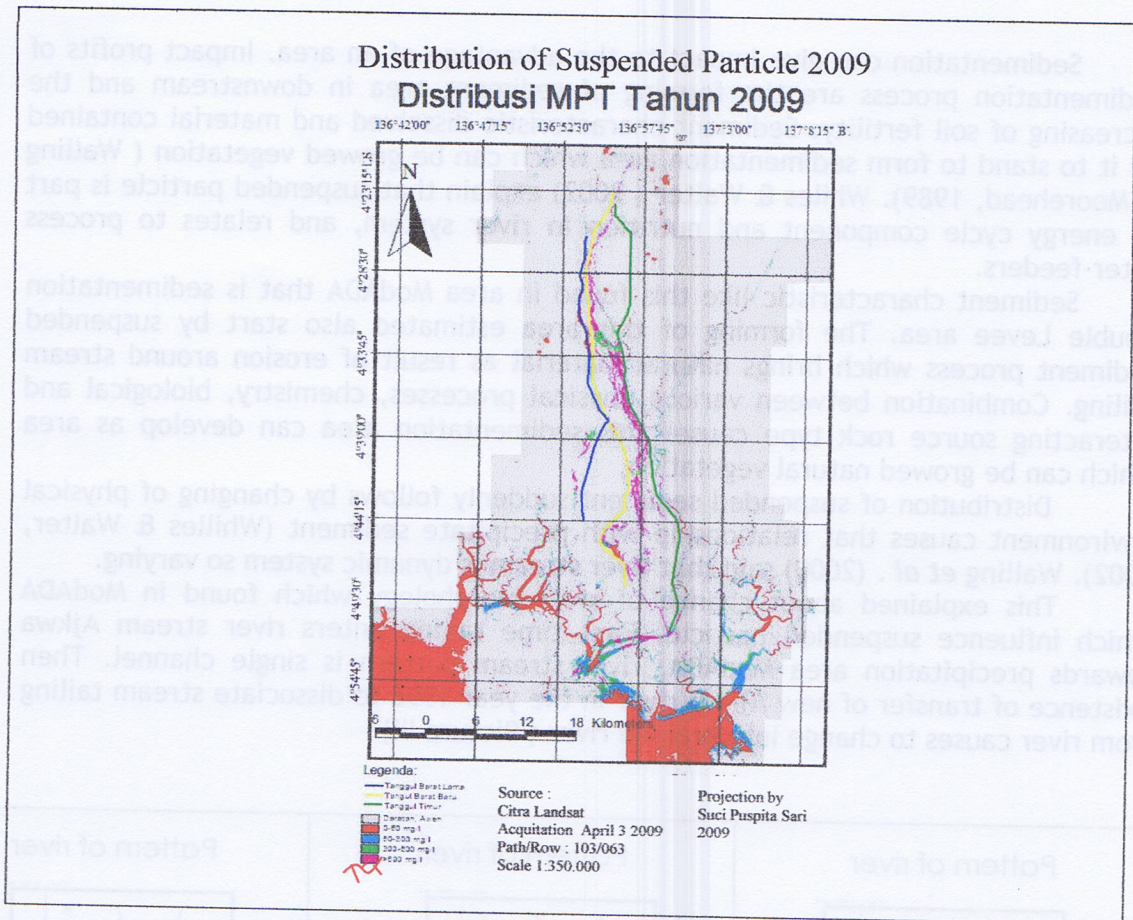


Figure 2. Distribution of suspended particle pattern in ModADA that digitations in the years 2007, 2008, and 2009 (Data Team Research Unsri, 2009 who projection by Suci Puspita Sari, 2009), Suspended particle size data is the result laboratory TRMP analysis PT Freeport Indonesia

Process of making transect channel in ModADA for girder of stream tailing by company estimated influence distribution of suspended particle to be more peripatetically eastwards levee. Rainfall in precipitation area also stands in propagating suspended particle. Follow by Reading (1996), condition of climate hardly influences precipitation of sediment, especially mixed effect of rainwater with sediment. Sediment precipitated also comes from aeolian dirt and sand.

Difference of distribution can be because of change of topography that is from precipitous mountain and sloping lowland topography. Factory residing in height around 3,000m above sea level (asl) which is beginning of current of tailing and lowland around 650m asl when tailing enters ModADA (PT Freeport Indonesia, 2006) estimated quickens sedimentation process.

Prothero & Schwab (1996) explain that transportation of sediment is influenced by current strength, particle size, sediment volume transported, density and sediment particle surface shape. Stronger river current causes particle brought farther, though some of biggest sized particles will be left behind and precipitate. Walling *et al.* (2000) adds that level of sediment entering river and level of debit influenced by topography, vegetation, river morphology, level of crudity of river base, and inclination of river. Follow by Walling & Moorehead (1989), sedimentation also hardly is influenced kinetics rainwater and surface current. Walling *et al.* (2000) adds also that factors interaction of number determines and sediment types and rate of sediment transport influences forming of sediment area or sedimentation.

Sedimentation can give impact to the advantage of an area. Impact profits of sedimentation process are the forming of sediment area in downstream and the increasing of soil fertility. Sediment characteristic dissolved and material contained by it to stand to form sedimentation area which can be grown vegetation (Walling & Moorehead, 1989). Whiles & Walter (2002) explain that suspended particle is part of energy cycle component and nutrition in river system, and relates to process filter-feeders.

Sediment characteristic like this found in area ModADA that is sedimentation Double Levee area. The forming of this area estimated also start by suspended sediment process which brings natural material as result of erosion around stream tailing. Combination between various physical processes, chemistry, biological and interacting source rock type causes this sedimentation area can develop as area which can be grown natural vegetation.

Distribution of suspended sediment suddenly follows by changing of physical environment causes that relationship with precipitate sediment (Whilles & Walter, 2002). Walling *et al* . (2000) said that river stream is dynamic system so varying.

This explained about change of river morphology which found in ModADA which influence suspended particle. First time tailing enters river stream Ajkwa towards precipitation area ModADA, river stream pattern is single channel. Then existence of transfer of new Ajkwa river in the year 1998 to dissociate stream tailing from river causes to change into braided river (Picture III).

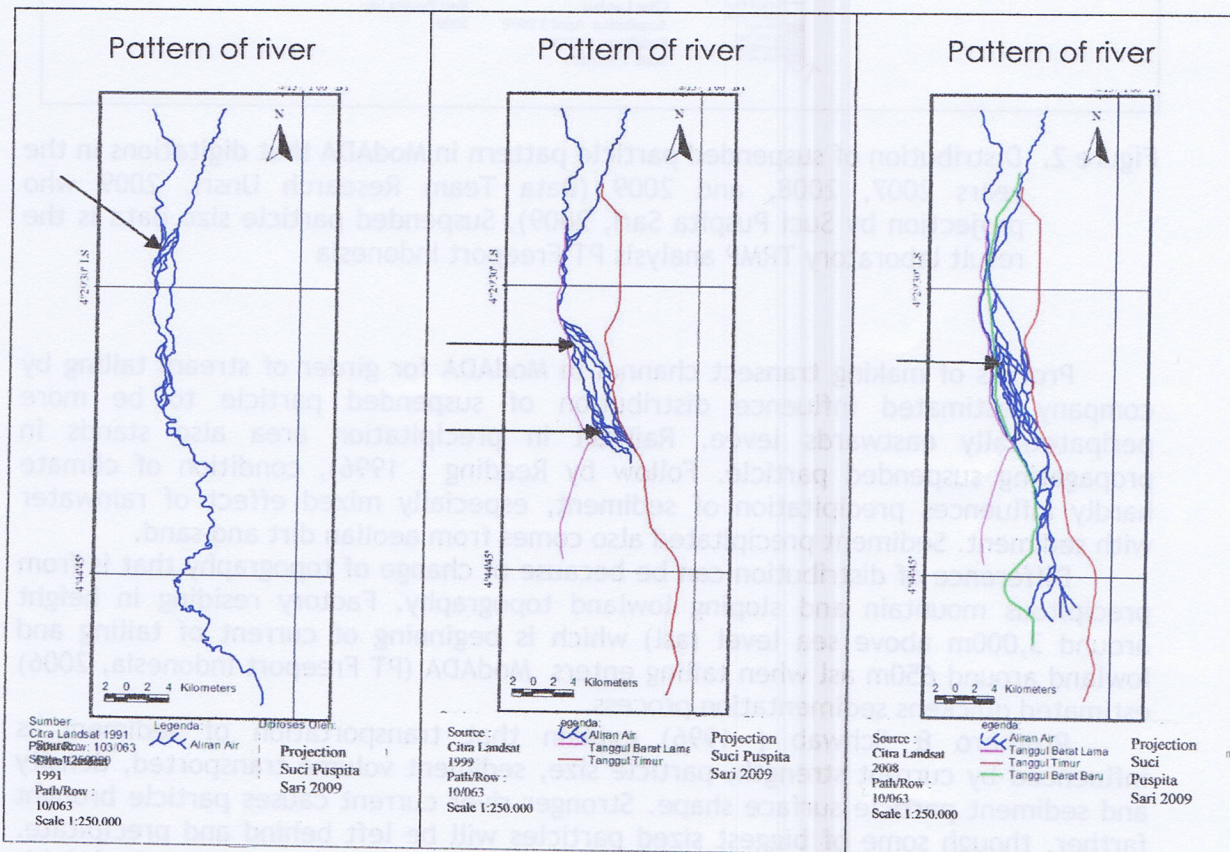


Figure 3. River stream pattern in ModADA that influence by sedimentation of suspended particle

Braided pattern happened as result of has not been formed new mid channel but some old channels has interacted (Xu, 1996). As a result is formed unstable mid channel distribution pattern and hinders transportation of sediment well-balanced so

that is formed widespread channel. Hickin & Sickingabula (1988) adds channels formed have the character of mobile, so that its the situation is changing especially floods. Channel will make a move to other side with rate differs in. Water movement will be slow at hollowing interior causing suspended sediment will stop and detained in the area.

Follow to Schumm & Kahn (1972), braided channels happened at river with elevation which is precipitous and or big sediment charge. Braided channels also are distinguishing from area that is dramatically experiences superficiality as consequence from acceleration of stream. As a result is formed river delta and alluvial fan. Braided river happened when sediment charge threshold boundary has been reached. Improvement of sediment charge from time to time will increase elevation of river.

Condition of precipitation area of ModADA which still be influenced stream tailing and fluctuation of a real strong river water causes this area have the character of unstable and creates condition of extreme area for vegetation growth. Emerging vegetation first time is plant type pioneer capable to increase microclimate in the area. Forming of sedimentation area in ModADA is not expected by PTFI because the requirement to create open area and wide to tailing deposition.

The result of analysis in this research indicates that actually precipitation area of tailing can be exploited as growth area of vegetation naturally and or can be developed as reclamation area.

CONCLUSION

Based on result of analysis to distribution of suspended particle and forming of succession area observed through Landsat data inferential periodic year that:

1. Condition of tailing deposition area ModADA which still be influenced stream tailing and fluctuation of a real strong river water causes this area have the character of unstable and creates condition of extreme area for vegetation growth.
2. Distribution of suspended particle determine river stream pattern in ModADA. Pattern of river stream Ajkwa grows quickly becomes braided rivers supported by existence of difference of topography when tailing enters ModADA and level of sediment charge
3. Distribution of suspended particle as component in energy cycle and nutrition plays important role to create sedimentation area which can be growed vegetation. This thing relates to it's the role in *filter-feeder*.

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