

Research Proposal

(For MSc thesis Hydrology and Quantitative Water Management)

“Hydrological classification of Mangrove forests in Mahakam delta, Indonesia”



Mahakam delta from the air (<http://fosi.iagi.or.id>)

Tijn Oostewaal
reg. no.: 830331 020 626
Wageningen University

Supervisor:
R. Dijkma (*Hydrology and Quantitative Water Management Group*)

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1 INTRODUCTION

1.1 BACKGROUND

Due to human activity in the past and the present, mangrove forests are reduced in size and biodiversity. However, mangrove forests in coastal areas are unique ecosystems. Therefore plans are developed to start up reforestation projects. All species in mangrove systems have demands regarding the physical properties of the soil and the hydrological conditions. A simple classification for the hydrological conditions can be of help to determine which species will develop on the locations of interest.

1.2 MOTIVE

In Vietnam in the year 2004 a research started on reforestation which focused on the multifarious composition of the vegetation. Within this research the Watson classification (Watson, 1928) is examined and tested. The classification was adapted by R. Dijkma and A.F. van Loon to the so called 'extended Watson classification' (van Loon, 2005). This seems to be a more applicable version for foresters and forest managers. In the year 2008 the classification is further improved by R. Dijkma, B. te Brake and M.H.J. van Huijgevoort to the so called 'new hydrological classification' (van Huijgevoort & te Brake, 2008). See paragraph 6.1 Appendix 1: 'new hydrological classification'.

1.3 PROBLEM DEFINITION

The 'new hydrological classification' was tested in two different locations in Vietnam; Can Gio and Ca Mau, with positive results. However, to make the classification a useful and widely accepted instrument it must be applicable in delta areas in (sub-) tropical regions in South-East Asia. For that reason the 'new hydrological classification' needs to be assessed in the field in other locations. If necessary it has to be adapted again to become a functional tool for forest managers in all delta areas in South-East Asia. This is the purpose of this research. Also a special tool for using the classification might be developed.

2 RESEARCH OBJECTIVE

2.1 MAIN QUESTION

- Is the 'new hydrological classification' for mangrove forests generally applicable on mangrove forests in delta areas in South-East Asia.

2.2 SUB-QUESTIONS

In order to fulfill the main question properly a couple of sub-questions are formulated:

- A. Is the information exclusively coming from water level measurements adequate to classify a subarea properly?
- B. How is the tidal regime in the Mahakam delta characterized?
- C. How important is the thin water layer which remains after the retreat of the tidewater?
- D. How is off-flowing tidewater distributed between overland flow and creek flow?
- E. Which vegetation is located in the research area and how is it distributed over the different classified areas?
- F. How can the hydrological information best be processed and presented by local services?

3 RESEARCH APPROACH

3.1 OUTLINE

This research is divided in three main parts: the proposal, the fieldwork and the data analyses.

- This document is the proposal; it describes the rough outline of the whole research project and will act as both an agreement between the MSc student and the supervisor; and as a guideline during the fieldwork and the data-analyzing phase.
- The fieldwork will take about 2,5 month, an intensive period of data gathering; measurement, observation and sharing information with local organizations. This exchange of information is necessary to give answers on the research question.
- The data-analyzing phase is the moment to answer the research question and to draw conclusions. In this phase there can also be worked on possible adaptation or reformulation of the tested classification. If adaption of the consisting classification is not too time consuming, a simple computer model can be developed as well.

3.2 FIELDWORK

3.2.1 FIELDWORK ACTION PLAN

To exploit the fieldwork-time most efficiently an action plan is formulated below. It is intended to find answers to the different sub-questions from A to E. For the planning of the fieldwork period see paragraph 6.3, Appendix 3: Planning fieldwork.

- A. In order to answer sub-question A. 'piezometers' will be installed. They will be equally distributed on different groundwater contour lines, preferably according to a straight line perpendicular to a creek where tidewater enters or leaves the area. However in case of strongly bended creeks the line can differ from a straight one. From now on this set of measurement-points is called 'measurement transect'. From experience in Can Gio and Ca Mau concerning a 'measurement transect' like this, it is known that multiple 'piezometers' are required; beside the 'piezometers' in the transect, also one is needed to measure the atmospheric pressure (van Huijgevoort & te Brake, 2008). In the analyzing-phase the data from those measurements will be studied and the answer to the sub-question will be formulated.
- B. In order to answer sub-question B. a 'piezometers' will also be installed in an open sea situation which will act as reference point and determine the tidal regime during the fieldwork period. Besides tidal predictions from offshore activities will be collected to make a comparison with the collected data.
- C. In order to answer sub question C. the areas which stay covered under a thin layer of water, after the retreatment of the tidewater, will be studied in more detail. Elevation of those areas will be determined by level measurements or visual observations. In addition the growing species in the areas mentioned above, will be studied in detail.

- D. In order to answer sub question D. the gathered information described in A. will be used again. In addition visual observations will be made in the field, with help of a camera which takes series of photos over particular series of time.
- E. In order to answer sub question E. species in the research area will be documented, and there area will be categorized according to the 'new hydrological classification'. Different types of vegetation can be identified with the help of the booklet 'Identifying Plants in Mangroves by Pictures' (Nam & Thuy., 1999).
- F. In order to answer sub question F. a technique or procedure will be developed with which the local services can easily classify and therefore determine the best species on specific locations.

3.2.2 FIELDWORK EQUIPMENT

For the fieldwork some equipment is required. The student and the supervisor will arrange those materials, some will be brought from the Netherlands, others will be bought at the research location. The costs of those materials will be covered by the supervisor. For the complete list of required materials see paragraph 6.2 Appendix 2: List of required materials.

3.2.3 FIELDWORK RISK ANALYSIS

For this research and the related fieldwork, some risks are involved. The student and the supervisor will do their best to exclude those risks as much as possible. Nevertheless this paragraph is to cover an agreement on forehand in case of a risk will turnout negatively.

- The purpose of the fieldwork is to collect data. If any problems appear concerning the data (failure of material, loss of data, theft of material, health problems of the student), the supervisor will try to arrange other opportunities for the student to finish his MSc thesis in the time left.
- If damage of fieldwork equipment appears, the costs of replacement will be covered by Wageningen University.

3.3 DATA-ANALYZING-PHASE

3.3.1 DATA-ANALYZING PHASE ACTION PLAN

The data-analyzing-phase will start after the fieldwork period. It will be executed in the Netherlands. Nevertheless some data will be roughly analyzed during the fieldwork period to exclude possible problems with the measurements. For the planning of the data-analyzing-phase see paragraph 6.4, Appendix 4: Planning Data-analyze-phase. If problems occur, there will be a conversation between the student and the supervisor about the problems and in cooperation there will be searched for the most suitable solution.

The detailed activities for the data-analyzing-phase depend on the outcome of sub-question A. If the answer is negative, the emphasis will be subsequently on adapting or reformulating the 'new hydrological classification' again. If the answer of sub-question A is positive the emphasis will be subsequently on proving the answer with the collected data. Furthermore if the answer of sub-question A is positive, the time left will be spend on the development of a model or algorithm which

makes it possible for forest managers to analyze their personal collected data, and categorize the area where the data is collected, according to the 'new hydrological classification'.

In the first weeks of the data-analyzing-phase there will be a discussion between the student and the supervisor about the outcome of sub-question A, and there will be made a detailed action-plan.

After the fieldwork period, there will be 3 academic periods left for the data-analyzing phase but in this time also 4 courses are scheduled. It is important for the research that in these periods the thesis work will continue on a regular basis. So, while courses are followed the thesis work will carry on.

4 SITE DESCRIPTION

The preferred location of the research area is the Mahakam delta on Kalimantan, in Indonesia. It is chosen because of the fact that it is a typical area on which the 'new hydrological classification' seems to be applicable; mangrove forest in (sub-) tropical area in South-East Asia. The location is visible in Figure 4-1: Research Area

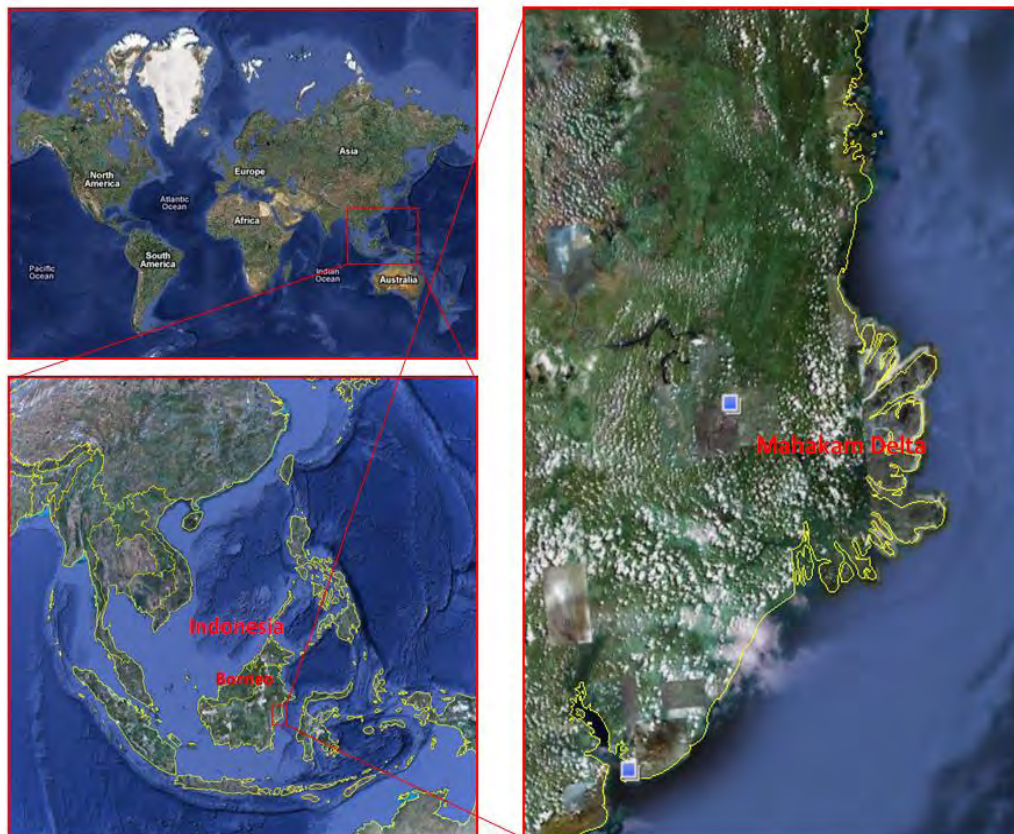


Figure 4-1: Research Area

Information required for this research is the distribution of different vegetation types and the authenticity of the present vegetation. To test the 'new hydrological classification' a more or less natural piece of mangrove forest in which higher biodiversity is required. Because detailed information of the area is not available in advance, two potentially suitable areas in the Mahakam delta are selected by studying the satellite images from Google-earth. This is done by looking for dense forest areas close to the coast combined with the typical meandering shaped of rivers.

The selected areas are marked in Figure 4-2: Research Area. The coordinates of the two selected areas are:

Area A)	upper-left corner:	0° 46' 00" South, 117° 28' 00" East
	lower-right corner:	0° 46' 10" South, 117° 30' 00" East
Area B)	upper-left corner:	0° 48' 00" South, 117° 22' 00" East
	lower-right corner:	0° 49' 00" South, 117° 23' 00" East



Figure 4-2: Research Area

Of course inspecting at the site for suitability is crucial before starting the observations, if the locations A and B are not suitable for this research another, more suitable location has to be found within the Mahakam delta. Factors which play a role in the judgment of the suitability of the area are; variation in the present vegetation, variation in the height of the surface level, the accessibility of the area and the safety with regard to the installed measurement equipments. The final judgment about the location will be happen in the first week of the fieldwork period; there will be a discussion between the student and the supervisor about the properties of the location and a final choice will be made in cooperation.(van Loon, 2005) (van Huijgevoort & te Brake, 2008) (Baartman, 2004) (Watson, 1928) (Nam & Thuy., 1999)

5 LITERATURE

- Baartman, J. (2004). *The relationship between various soil characteristics and mangrove distribution in the Dong Nai River delta, Vietnam*. Wageningen: Wageningen University.
- Bakker, e. (ex. 1988). *ex. Climate change*. ex. Wageningen: ex. Wur Press.
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- van Loon, A. F. (2005). *Water flow and tidal influence in a mangrove-delta*. Wageningen: Wageningen University.
- Watson, J. (1928). *Mangrove forests of the Malay Peninsula*.

6 APPENDICES

6.1 APPENDIX 1: 'NEW HYDROLOGICAL CLASSIFICATION'

Inundation class	Tidal regime	Elevation cm + MSL	Duration of inundation min per day	Duration of inundation min per inundation	Vegetation species
1	all high tides	< 0	> 800	> 600	none
2	lower medium high tides	0 - 50	400 - 800	450 - 600	<i>Avicennia alba</i> , <i>Sonneratia</i>
2*	higher medium high tides	50 - 100	250 - 400	200 - 450	<i>Avicennia spp.</i> , <i>Rhizophora spp.</i> , <i>Bruguiera parviflora</i>
3	normal high tides	100 - 150	150 - 250	100 - 200	<i>Rhizophora spp.</i> , <i>Ceriops</i> , <i>Bruguiera</i>
4	spring high tides	150 - 210	10 - 150	50 - 100	<i>Lumnitzera</i> , <i>Bruguiera</i> , <i>Acrostichum aureum</i>
5	equinoctial tides	> 210	< 10	< 50	<i>Ceriops spp.</i> , <i>Phoenix paludosa</i>

(van Huijgevoort & te Brake, 2008)

6.2 APPENDIX 2: LIST OF REQUIRED MATERIALS

- Transportation into the field
- 7 X Piezometers
- Software to establish and read the Piezometers
- Cable to connect Piezometers to a computer
- 6 X PVC tubes (length 2 meter, diameter 40 mm), penetrated with holes from 2 mm
- 6 X Plug to close the tube at the top side
- 6 X Plug with drill point to close the tube at the bottom side
- 6 X Filter to cover the holes from 3 mm in the PVC tubes
- wire to install the Piezometers in the tube
- Plasticized map of the research area
- Gps
- Camera
- Notebook computer
- Writing materials for in the field
- Colored tracer fluid
- Automatic rotating laser level and leveling staff

6.3 APPENDIX 3: PLANNING FIELDWORK

	1	2	3	4	5	6	7	8	9	10	11	12	13
fieldwork week	41	42	43	44	45	46	47	48	49	50	51	52	53
year week	5-oct	12-oct	19-oct	26-oct	2-nov	9-nov	16-nov	23-nov	30-nov	7-dec	14-dec	21-dec	28-dec
start date													
FIELDWORK													
Divers													
orientation in area (present vegetation)													
collecting materials													
placement of divers													
measurement period													
collecting of data from divers													
in between processing of data from divers													
adapting location divers if necessary													
Visual observations													
series of photos over particular series of time in area													
growing species in the research area will be charted													
Levelling of area													
levelling of area A													
levelling of area B													

6.4 APPENDIX 4: PLANNING DATA-ANALYZE-PHASE

