



# Utilization of ESA's Sentinel Satellite Missions to Support Integrated Management of Mahakam and Kayan-Sembakung Deltas in East and North Kalimantan in Indonesia

Yohanes Budi Sulistioadi<sup>1,2</sup>, Ali Suhardiman<sup>2</sup>, Rita Diana<sup>2</sup>, Yuniarto Setiawan<sup>3</sup>, Ismail Fahmy Almady<sup>4</sup>, Ariyanto<sup>1</sup>, Rachmad Mulyadi<sup>2</sup>  
<sup>1</sup> Center of Geospatial Information Infrastructure Development (CGIID/PPIIG) Mulawarman University, <sup>2</sup> Faculty of Forestry, Mulawarman University  
<sup>3</sup> Faculty of Engineering, Mulawarman University, <sup>4</sup> Faculty of Fisheries and Marine Science, Mulawarman University

## Abstract

European Space Agency is moving progressively toward the ultimate earth observation data for everyone on earth. Not only providing free access to multi level earth observation data related to land monitoring through optical satellite data, ESA also provides active remote sensing (i.e. RADAR and altimetry) with free access in multiple level of processing. This study explores the capability of optical and microwave remote sensing data provided by ESA to support a study on dynamic of the Indonesian Borneo's Deltas (i.e. Mahakam and Kayan-Sembakung Deltas). Supported by funding from the Indonesian Ministry of Research, Technology and Higher Education as well as the North Kalimantan Provincial Government, this study aims at characterizing the Mahakam and Kayan-Sembakung Deltas through ESA's multiple earth observation missions. The main output of the study is the current land cover and its dynamic in the last decade for both deltas.



Figure 1. An oblique view of the remaining nypa within active shrimp ponds near Muara Badak in Mahakam Delta, East Kalimantan. Photo was taken by Dji Panthom 4 Pro, 15 meters above sea level. Credit: YB Sulistioadi (2017)

## Introduction

Fishery sector contributes significantly to the annual revenue of North and East Kalimantan Provinces, but at the same time, shrimp ponds area are growing exponentially over time. Previous study (WWF, 2014 and CIRAD, 2002) shows that the shrimp ponds rapid expansion happened between 1991 to 1999, especially when the Asian's Economical Crisis occur around 1997-1998.



Figure 2. Perfectly cooked tiger shrimp on a plate. Tiger shrimp demand is so high in countries like Japan and United States. Credit: Wikimedia (2015)

The tiger shrimp business is now entering a new era where the buyer is getting more aware with the sustainability of shrimp ponds management. Various fishery product certification schemes are now requiring shrimp ponds to be managed in an area formally allocated for aquaculture.

## Objectives

This study has three main objectives, i.e.:

1. Define the ecological boundary of Kayan-Sembakung Deltas
2. Monitor the dynamics of mangrove forest and shrimp ponds development
3. Provide legality status of shrimp ponds related to designed mangrove forest area

## Study Area

The study areas are two major deltas, Mahakam and Kayan-Sembakung in East and North Kalimantan, respectively

## Methods

The following methods are planned to answer the research questions formulated as research objectives above.

- Identify the land system and initial vegetation composition of each part of the deltas. We use Landsat 1-3 MSS, Landsat 4-5 TM archives to identify the initial vegetation composition of each part of the deltas, supported by mangrove forest composition data collected from field campaign
- Develop spectral relationship between optical RS image with mangrove forest type
- Land cover changes over time (medium resolution optical imageries)

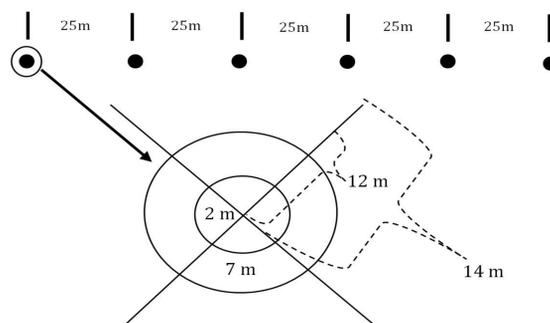


Figure 3. Vegetation Composition Sample Design. Credit: R Diana (2017)



Figure 4. Most Recent Sentinel-2 Coverage for Kayan Delta

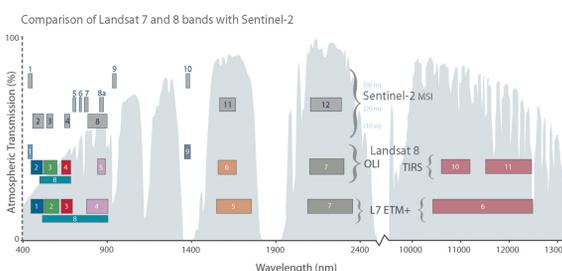


Figure 5. Spectral Resolution of Sentinel-2 Multispectral Sensor. Graphic: ESA (2016)

## Spatial analysis of shrimp ponds status

As the legality status of the shrimp ponds is required, we analyze each shrimp ponds to define whether they are located in the designed mangrove forest or aquaculture productivity zones

## Shrimp ponds suitability

One final product we are about to develop is a map with suitability information for shrimp farming. We analyze the soil and water quality samples to identify the presence of nitrogen, phosphor, organic matters as well as soil texture. This suitability map will be integrated with the mangrove conservation target area to come up with a comprehensive map of Delta Kayan-Sembakung development plan.

## Field Campaign Activities

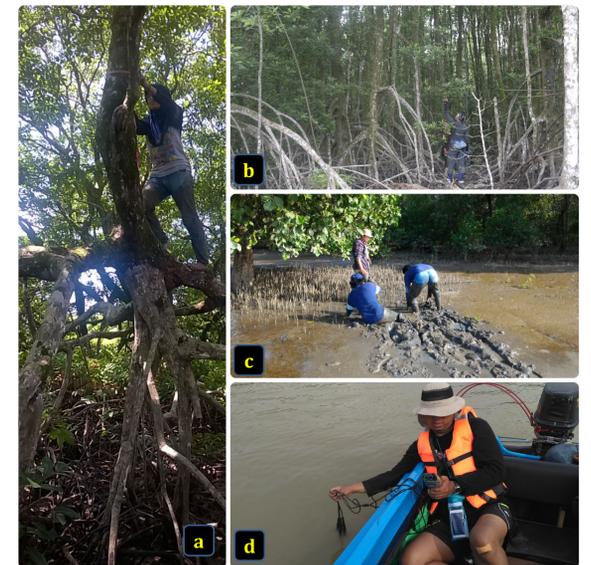


Figure 6. Field Campaign Activities (Credits: (a) Suhardiman (b) Diana (c) Sulistioadi (d) Gunaifi (2017))



Figure 7. Field Campaign Activities (Credits: (a) (b) (e) Sulistioadi (c) Diana (d) Almady (2017))

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Correspondence Email: ppiig@unmul.ac.id