

# Mangrove Conservation Application Based on Site Selection Using PlanetScope Imagery in Pedaleman Village, Tanara District, Serang

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## ABSTRACT

Mangrove conservation in Indonesia has progressed from planning, and implementation to monitoring, supported by the efforts of the government and non-governmental groups. Mangrove rehabilitation and conservation is an effort to restore the function of degraded mangrove forests and increase the potential for suitable land to be planted with mangroves. Mangrove rehabilitation efforts in Pedaleman Village, Tanara Sub-district, have created a significant mangrove ecosystem in the surrounding area, including the arrangement and restriction of conservation areas with fishpond business areas. Rehabilitation efforts can be realized by selecting suitable site of mangrove planting locations as part of conservation planning. Site selection by visual interpretation method using remote sensing imagery from PlanetScope satellite has provided a synaptic overview of land use in the coastal and estuary area of Pedaleman Village. This site selection results in potential mangrove planting areas and non-potential areas. More than 50% of the coastal area of Pedaleman Village is considered conducive for mangrove seedling planting planning. Of this percentage, there are some land uses of ponds and vacant land, most of which can be converted into part of the mangrove forest area.

**Keywords:** Land Suitability PlanetScope, Mangrove Conservation, Site-Selection.

## 1 Introduction

Mangroves are a collection of several types of plants that function as carbon stores in the tropics and have benefits such as disaster mitigation and climate change [1]. Mangrove conservation is an environmental preservation activity in estuaries and waters. Mangrove rehabilitation and conservation is an effort to restore the function of degraded mangrove forests and increase the potential of suitable land for planting mangroves. Mangrove rehabilitation activities are carried out to restore the declining mangrove ecosystem [2]. Rehabilitation efforts are significant to be carried out as an effort to preserve the environment. One of the rehabilitation process implementations is site selection for potential mangrove rehabilitation. Mangrove Rehabilitation Conservation is an effort to rejuvenate and relocate mangroves to a place following their rehabilitation designation.

The application of remote sensing imagery for various research has been widely applied in various studies. Remote sensing is used for conservation functions in applying baselines from the area, habitat conditions, related species diversity, and measuring loss/degradation or recovery related to specific events [3]. Remote sensing data aggregation using the visual interpretation method is a multi-disciplinary combination that can solve spatially related problems, one of which is the potential for mangrove rehabilitation. Remote sensing can acquire several data types, such as digital image data. An actual digital image is a picture of the similarity of an object on the earth's surface produced by digital equipment [4]. Digital images can be processed in such a way through several spatial and spatial analysis processes to produce an analysis of the potential for



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mangrove rehabilitation. Visual interpretation can be derived to derive the information contained in remote sensing images.

The Government of the Republic of Indonesia, through a Presidential Regulation, has established a mangrove restoration business in Indonesia. This is stated in Presidential Regulation Number 120 of 2020 concerning the Peat and Mangrove Restoration Agency. This Presidential Decree accelerates the rehabilitation and restoration of mangroves in Riau, Jambi Province, South Sumatra Province, West Kalimantan Province, Central Kalimantan Province, South Kalimantan Province, and Papua Province [5]. This can also be a reference for other provinces with significant mangrove forest reserves, such as Banten Province/Mangrove Location of Pedaleman Village. This can be proven from the work area of the National Mangrove Map. Various studies on mangrove restoration and selecting appropriate planting locations can uphold the acceleration of mangrove restoration.

## **2 Research Methodology**

The method used in this study is the visual interpretation of remote sensing digital images to determine potential mangrove conservation areas. Visual interpretation is a method for analyzing the appearance of the research study area orthographically (perpendicular) and then differentiating each element of the desired appearance through the interpretation key. The appearance element studied in this study is vegetation land cover so that through visual interpretation, we can distinguish vegetation land cover from other land covers. Several variables are interpretation parameters to facilitate the process of analyzing an interpretation. Some interpretation parameters are visual variables, such as color/hue, shape, shading, pattern, size, texture, site, and association [7]. The interpretation of mangrove vegetation emphasizes visual interpretation through hues/colors and textures. This is because mangroves have visual characteristics in the form of color differences that are easily distinguished from other land uses. Mangroves are darker green than terrestrial vegetation and are easily distinguished from residential objects. The texture of the mangrove vegetation is quite rough and repetitive. Mangrove vegetation is always associated with estuaries and river mouths, thus facilitating the interpretation process by focusing only on coastal areas.

## **3 Theory and Calculation**

### **3.1 PlanetScope Imagery**

PlanetScope imagery is an image initiated by PLANET with a high resolution of up to 3 meters. PlanetScope imagery was first launched in 2016. This imagery is a satellite constellation of more than 130 satellite rides. The Planetscope's orbit is 475 to 525 kilometers above the ground and has an inclination angle of 98 degrees to the sun. This multispectral image has several band combinations of 8 bands: red edge, red, green, green 1, yellow, blue, coastal blue, and near infra-red. The use of PlanetScope imagery is more utilized in the fields of monitoring land use, forestry, mapping, maritime, and many more. More details about the PlanetScope can be seen in the Table 1 below.

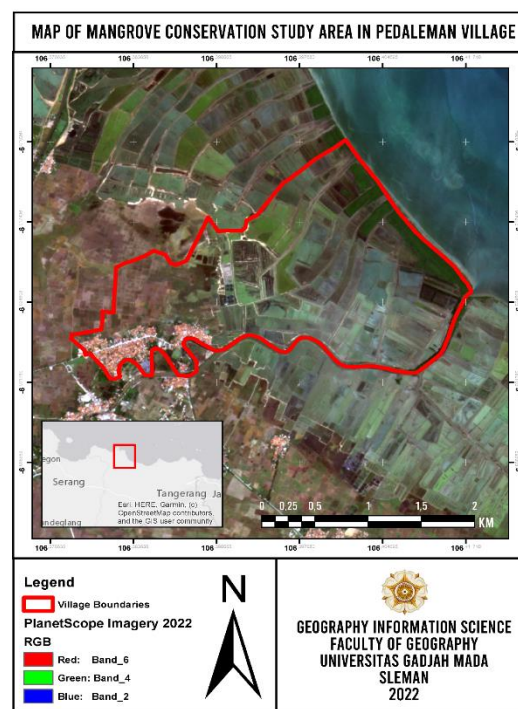
**Table 1:** *Specifications of PlanetScope Imagery Parameters*

Orbit Altitude	475 km - 525 km
Orbit Type	Sun-Synchronous
Orbit Inclination	98°
Repeat Cycle	Daily
Equator Crossing Time	9:30 - 11:30 am

Visually, the band combination shown on the potential mangrove planting area map is the true-color band combination. This true-color combination consists of bands with wavelengths that can be seen by the human eye, namely the red, green, and blue channels. This is done to facilitate reading and interpretation of the study area contained on the map.

### 3.2 Area of Studies

The mangrove conservation area in Pedaleman Village is an area with mangrove conditions in the form of a significant level of mangrove health. The mangrove area in this village is directly adjacent to the north coast of Java Island or the middle sea of Indonesia, as shown in Figure 1. Administratively, Pedaleman Village is one of the villages in Serang Regency, Banten Province. This village has a geographical characteristic that it is located on a flatland with a very low elevation without a mountainous structure. One main river intersects with this village, namely the Ci Durian River. The climate in this area tends to be hot and humid, according to the characteristics of the coastal area.



**Figure 1:** *Map of Mangrove Conservation Study Area in Pedaleman Village*

## 4 Results and Discussion

### 4.1 Potential Areas of Mangrove Planting

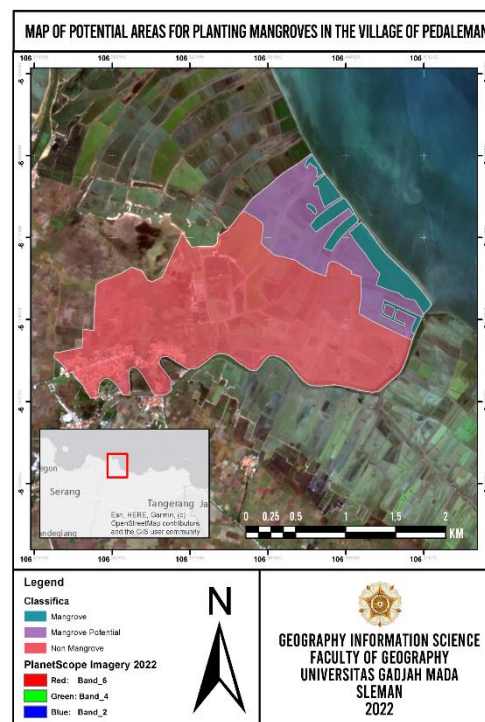
The mangrove area in Pedaleman Village is an area that is in direct contact with human activities and is filled with various fishing businesses in the vicinity. Even so, this mangrove area is very far from residential areas and is not touched by the community except for pond farmers and fishermen. This makes the only non-natural threats come from people who work as pond workers and fishermen. For this reason, education for the community is needed to preserve the remaining mangroves found on the coast of Pedaleman Village. Another threat that may occur in this mangrove area is the threat of abrasion and tidal intrusion. Although this rarely occurs on the north coast of Java Island, climate and weather fluctuations and shifts in sea breezes around this area can cause abrasion, which can damage mangrove seedlings and young mangroves that have just grown. The recent condition of Mangrove area in Pedaleman Village is shown in Figure 2. Visually, this

area is symbolized by a turquoise color on the study map. The detected mangrove area has the lowest area ratio compared to the other three classifications.



**Figure 2:** Recent Mangrove Condition in Pedaleman Village

Based on the map of the potential mangrove area, which covers all areas in Pedaleman Village that is shown in Figure 3, most of the area is dominated by non-mangrove areas. Visually, this area is depicted using transparent red polygon symbols. The boundaries of these polygons conform to the visual interpretation provisions described in the introductory section. The land use covered in this area is mainly dominated by fishponds, followed by residential areas in the southern part of the area. A small coverage of rainfed paddy fields and open fields correlate around residential areas. The pond area is also divided into two parts, namely, the area with the dominance of shrimp ponds and the area with the dominance of milkfish. These two types of ponds have differences, namely the difference in color hue, which indicates the level of depth and water substrate.



**Figure 3:** Map of Potential Areas for Planting Mangroves



The purple polygon visualization on the study map shows areas suitable for planting mangroves. This area is the core of the research, which can later be studied through field observations. This area was selected from a pond area that could be converted into a mangrove planting area. This method of planting mangroves can be done in stages, with the first step using the silvofishery method. This method can divide each pond plot by planting mangroves on the edge/center of the pond.



**Figure 4:** Mangrove Planting Event with the Government of Serang District in 2022

Mangrove planting needs special attention from the local government. For example, one of the mangrove restoration efforts in the Village was held in several villages in Serang District. by organizing the 8000 Mangrove Planting event with the government as shown in the Figure 4. This kind of event aims to provide seed assistance directly to suitable locations for planting mangrove seedlings. Even so, this activity has some weaknesses, such as seeds that are not correctly selected at the appropriate location. For this reason, mangrove conservation mapping plays a significant role.

#### 4.2 Statistical Data of Mangrove Planting Areas

Based on the statistical data described in the Table 2, there has been a significant change in areas from non-mangrove areas to areas that have the potential to be planted with mangroves. The non-mangrove area itself has an area of 338.9 Ha. This area comprises the majority of land uses in the form of settlements and fishponds. Non-mangrove areas cannot be planted with mangroves because they are unsuitable for mangrove habitats. Therefore, non-mangrove areas can be correlated to be more indented towards the mainland. This discrepancy is due to the limited and particular characteristics of mangrove habitat, starting from the level of salinity, sunlight intensity, and level of intrusion to soil type.

**Table 2:** The potential area for planting mangroves in Pedaleman Village

Classification	Area (Ha)	Location
Mangrove Area	36,833	Pedaleman Village
Potential Mangrove Area	89,005	Pedaleman Village
Non-Mangrove Area	338,955	Pedaleman Village
Total Area	464,793	

Meanwhile, the potential area for planting mangroves is up to 89 hectares. This area is mapped based on its association with the shoreline, which is quite close, thereby increasing the probability of seawater intrusion. The potential area for planting mangroves comes from the previous land use, namely fishpond. The classification of the mangrove area of 36.8 Ha is mangrove vegetation that has existed in Pedaleman Village for decades. If the three areas are added up, an area of 464.8 Hectares is obtained from the measurement.

## 5 Conclusions

Mangrove conservation is a conservation effort aiming to reduce degraded land and restore appropriate/better land functions. Remote sensing, especially visual interpretation of digital satellite imagery, can increase the effectiveness of mangrove conservation efforts so that they are right on target and efficient. Mangrove conservation mapping in Pedaleman Village was carried out by dividing the classification class into 3 parts: the non-mangrove class, the mangrove class, and the mangrove potential area class. Based on the results of area measurements obtained from mapping area measurements, some areas are quite different between the three classification classes. For example, the area in the mangrove area class is 36.8 Ha, while the area in the mangrove potential area class and non-mangrove areas, respectively, is 89 Ha and 338 Ha. The potential area for planting mangroves needs to be maximized so that the mangrove conservation process in Pedaleman Village can run efficiently.

## 6 Declarations

### 6.1 Study Limitations

Two significant limitations in this study could be addressed in future research. First, the study focused on potential land for mangrove planting throughout Pedaleman Village, and the second one is the mangrove planting and monitoring in Pedaleman Village.

### 6.2 Acknowledgments

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### 6.4 Publisher's Note

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