COASTAL ZONE RESOURCE ANALYSIS SURROUNDING THE TANIMBAR ISLAND, INDONESIA USING THE DIGITALLY PROCESSED LANDSAT TM IMAGERY

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ABSTRACT:

Resource potential analysis surrounding the Tanimbar island, Indonesia is being conducted using supervised classification, unsupervised classification and ranged density sliced Landsat TM imagery for acquaculture potential area delineations.

Coastal bathymetry surrounding the island is being divided into three depth range classes and their correlations to the specified aquaculture development within each class may be assessed.

The areas delineated suitable for acquaculture resource development are in the western coast of the island.

KEY WORDS: Density Slicing, Unsupervised Classification, Acquaculture, Indonesia.

I. INTRODUCTION

Republic of Indonesia is the world's largest archipelagic country, consisting of more than 17000 islands scattered along the equator extending approximately 5100 kilometers from East to West. The number of islands within the archipelago reflects indirectly to the resource potential of its coastal zone areas, particularly for possibilities of developing it to become the potential acquaculture zone areas. As Indonesia is currently entering its Second 25-Year Development Program, the development of the Eastern part of Indonesia is becoming increasingly high in the priority lists, where the coastal areas resource development program is one of the primary objectives to be developed. The implementations of remote sensing technology, particularly to assist the inventory of the coastal resources, will enable the country to develop the prospect areas fast, accurate and with an appropriate and readily available data.

Test area on implementing coastal zone analysis is being conducted in the Tanimbar island, the Province of Maluku, Indonesia, a group of islands located in the eastern part of Indonesia, north of the Australian continent (Figure 1).

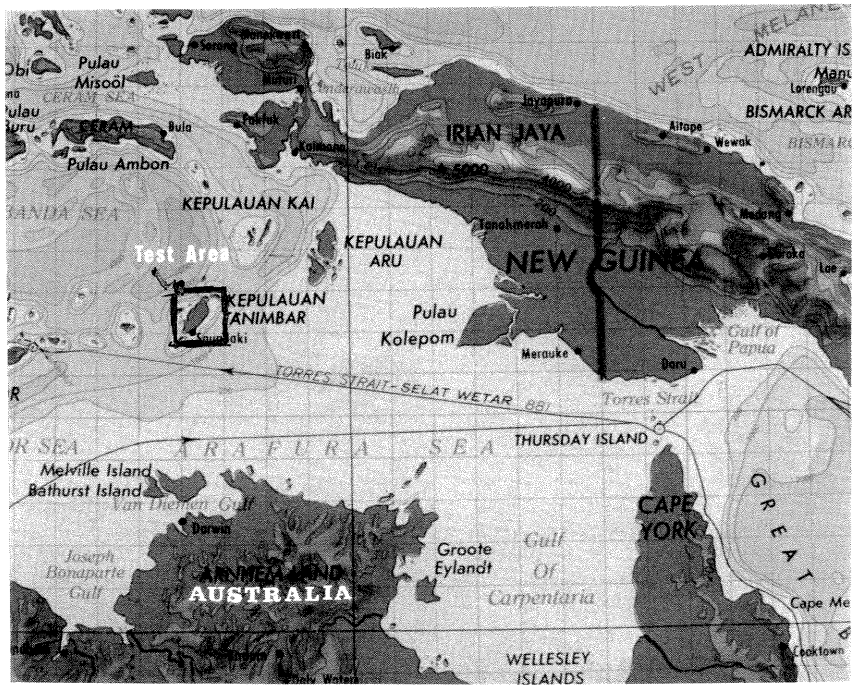

Figure 1: Test area, Tanimbar island, between Australia and Irian island.

Landsat TM imagery of the Tanimbar island taken on November 8, 1988 is being used for analysis (Figure 2). The data were acquired from the Australian Ground Receiving Station facility and were digitally processed by the South Australian Center for Remote Sensing (SACRS) in cooperation with the Government of Indonesia's Agency for the Assessment and Application of Technology (BPP Teknologi).

The primary objective of the study is to make inventory on areas with high potency to be developed as acquaculutre area, based on the sedimentenation, bathymetric conditions and the land suitability of the areas.

II. TANIMBAR ISLAND AND ITS PHYSICAL CONDITIONS

The Tanimbar island is a part of the Maluku Province, Indonesia and one of the nine island groups in Maluku with low population density. The island is situated off the continental shelf of Australia and Irian. As seen on the Landsat TM imagery (Figure 3), this island is still heavily forested and lightly cultivated. These lightly forested areas occured due to shift cultivations and also due to the poor quality of soils because of its karstic terrain conditions. As seen also in the imagery (Figure 3), that karst topography are distributed all over the island and commonly occupied by limestones, marls and calcareous sandstones. The island's ground water distribution is very much related to the karstic topographic conditions, where underground water springs may be found in many locations within this karstic topographic terrain.

The hydrologic conditions of the island is characterized by the drainage pattern flowing westward with Way Ranamoie river is the major river in the island. Other drainage pattern is identified flowing westward into the Salwasa bay. Alluvial deposits, and recent marine sediments are commonly found in the coastal areas, particularly within this drainage caption area.

A sustainable development approach concept may be implemented around the Tanimbar island by enhancing its coastal zone area's capabilities into an acquaculture productive areas. The inventory of potential acquaculture zone areas around the island is being conducted utilizing Landsat TM digitally processed imagery. Coastal zone areas around the island are being delineated based on their prospect potentials on density sliced Landsat TM imagery, supervised and unsupervised imagery.

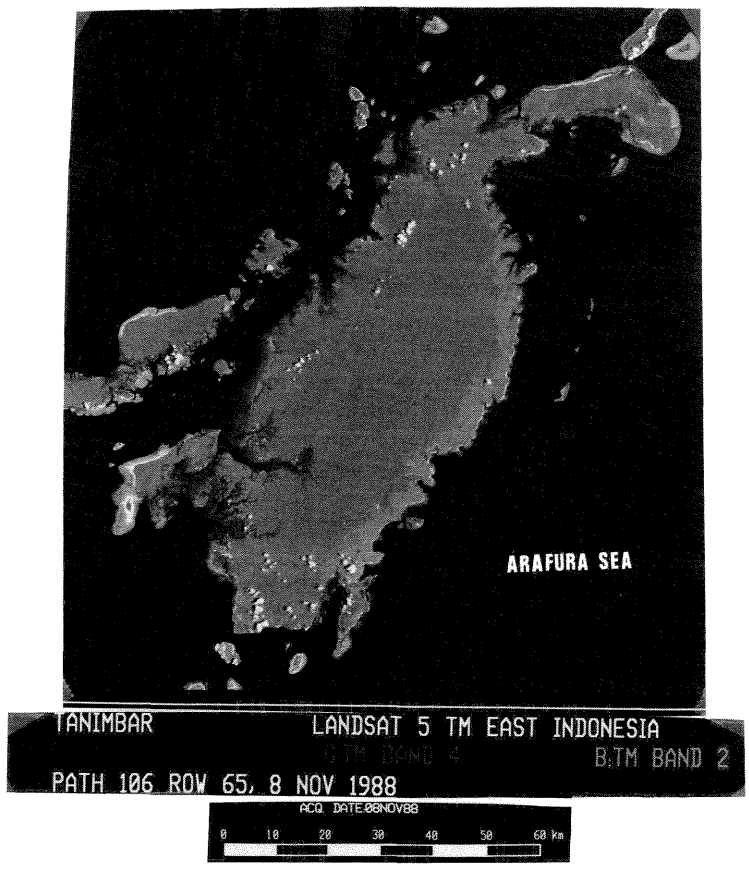

Figure 2: Landsat TM False Color Composite, Tanimbar island, Indonesia. Data take: November 8, 1988

(Courtesy of SACRS)

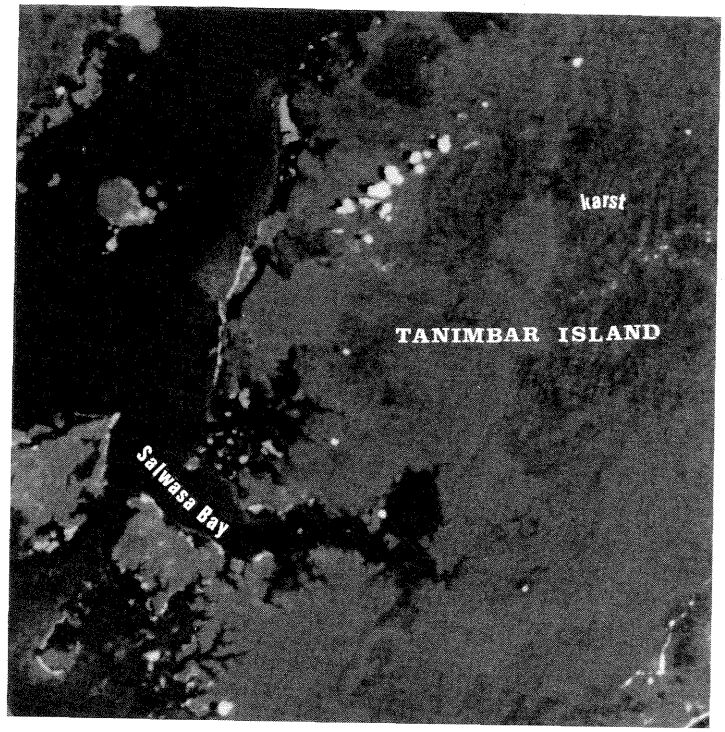

Figure 3: Landsat TM FCC Imagery western coast of Tanimbar island. River flowing westward into Salwasa bay. Inland, karstic terrain occupied by limestones. Marshes are distributed along the coast.

III. LANDSAT TM DIGITALLY PROCESSED IMAGERY FOR ACQUACULTURE DELINEATIONS

As mentioned by IFREMER (1985), salt marshes and mangroves in the tropical belt play a double role: 1) as buffer towards erosion factors and 2) as a host to many forms of life. The conditions of the Tanimbar island resemble and relate to these two factors. For that matter, the development of acquaculture industry is one of the possible insentive in order to meet the sustainable development approach concept.

Considering that the potential sites for acquaculture are located either in tropical marshes adjacent to mangroves or inside the mangrove itself, an inventory of marshes areas may be conducted utilizing digitally processed Landsat TM imagery as a base. A density-sliced digitally processing was performed in order to produced density sliced imagery over the island (Figure 4). It is shown on this processed imagery that sedimentary processes and also the marshes distributions are found along the western coast of Tanimbar island indicated by the density variations reflected as tone variations. The accumulations of sediments and marshes are parallel to the drainage outflow found all over the island. A detailed analysis of the imagery around the Salwasa bay and Way Ranamoie river (Figure 5) showed a clear pattern of marshes distribution in the area. This area is the ideal location for acquaculture resource development in the Tanimbar island.

Unsupervised classification Landsat TM imagery off the western coast of Tanimbar island, particularly in the Way Ranamoie downstream river areas, shows pattern of sedimentation distributions and marshes where acquaculture resources may be developed (Figure 6). It is indicated in this imagery that various acquaculture resource areas may be delineated based on its depthness and its distances from the coast. There is some indications that shrimp farming may be developed in areas near the coast where intermix between ocean and river waters are occuring. Other types of acquaculture resources may be developed farther from the coast where the influence of river water is decreasing. Types of these potential areas may directly be identified on this unsupervised imagery.

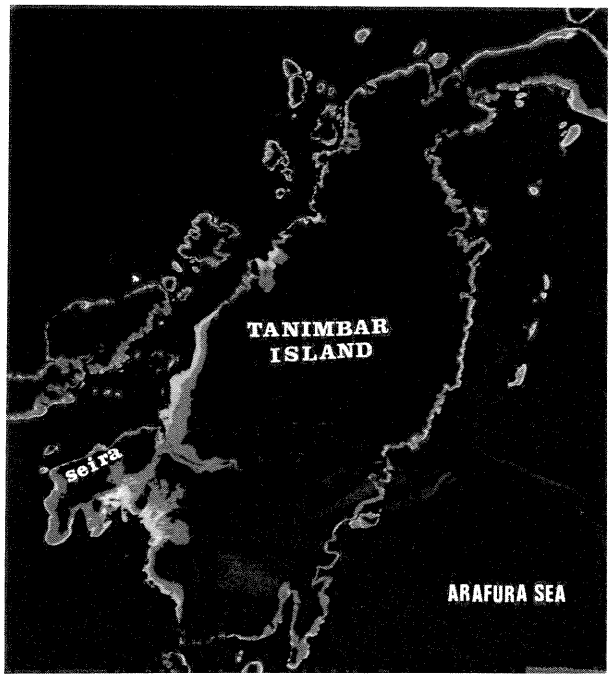

Figure 4

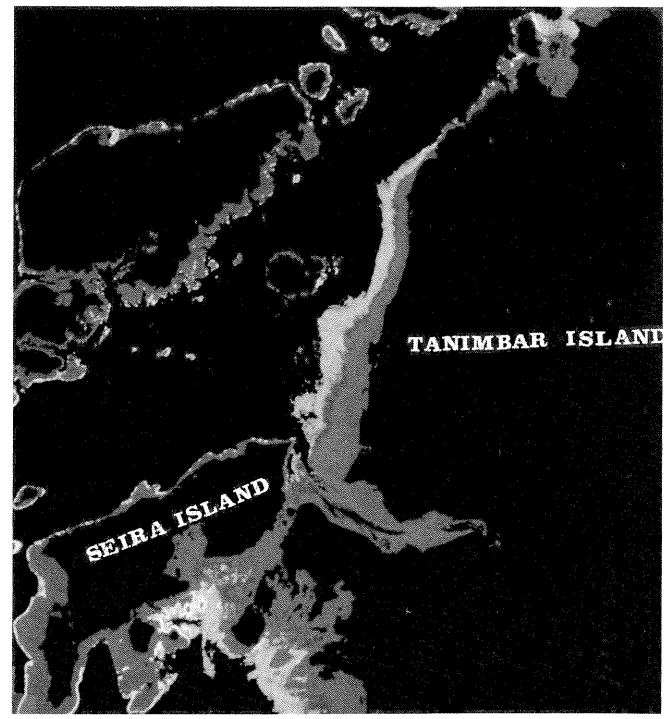

Figure 5

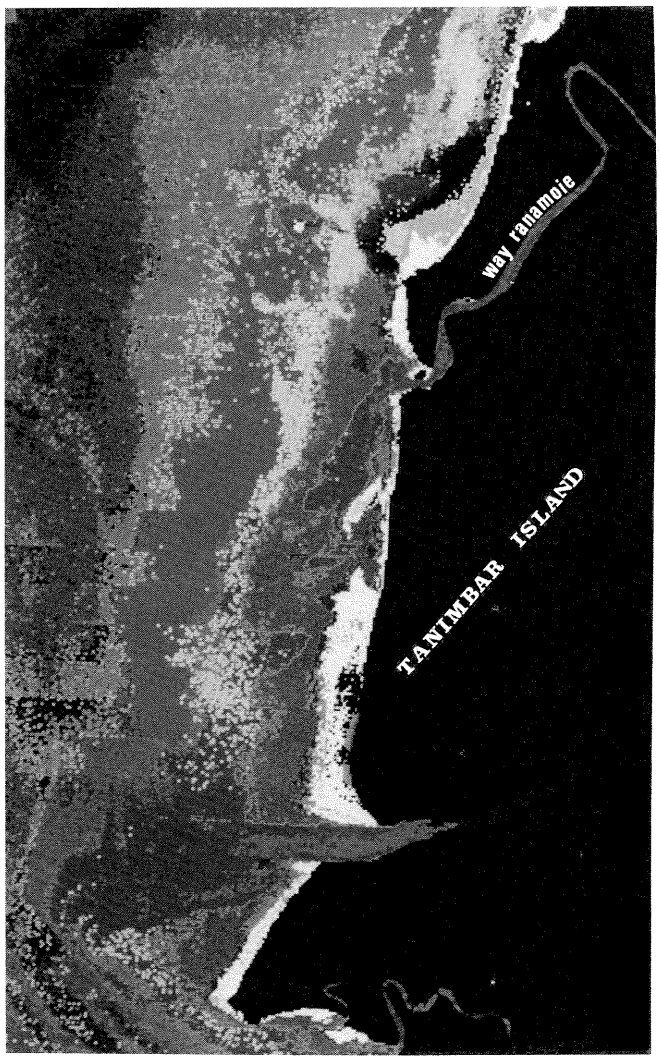

Figure 6

Figure 4: Density-sliced imagery, Tanimbar island. Marshes and sedimentation are identified and distributed particularly in the western coast of the island.

Figure 5: Density-sliced imagery, Way Ranamoie river and Salwasa bay area. Areas suitable for Acquaculture development.

Figure 6: Unsupervised imagery off the coast of Way Ranamoie river area. Marshes distributions based on sedimentary processes. The acquaculture type developments relate to the depthness and ocean-river water intermixs.

IV. CONCLUSION AND RECOMMENDATION

An archipelagic country like Indonesia may prioritize its development task by developing its coastal zone areas into potential acquaculture resource areas. The inventory tasks to delineate these potential areas may be conducted utilizing high resolusion processed remote sensing imagery, such as Landsat TM and SPOT.

The acquaculture resource analysis of the Tanimbar island conducted on density-sliced unsupervised Landsat TM imagery showed coastal areas in the western part of the island as the potential location where acquaculture resource areas may be developed.

It is recommended that similar undertaking may be conducted in various parts of Indonesia's coastal areas in order to acquire potential acquaculture areas fast and with a high degree of reliability.

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