GEOMORPHOLOGICAL ANALYSIS FOR ASSESSMENT OF COASTAL RECREATION SITES IN THE COASTAL AREA OF TRISIK, KULON PROGO REGENCY, YOGYAKARTA PROVINCE

by

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ABSTRACT

The sand dunes and beach ridges area along the south coast of Yogyakarta Special Region are prime potential for a recreation area. The development of the Trisik Coast in Kulon Progo as a recreational area, is feasible for its natural landscape condition and its location, close to the outlet of Progo River. For this purpose, a basic survey should be carried out, in which case, a geomorphological survey may be a part of the survey that contributes to the study of land forms and their processes. Relevant geomorphological aspects, such as morphodynamics of the local area, wind erosion and flood hazard in the assessment of physical potential of the Trisik coast for recreation have been analyzed. Aerial and orthophoto interpretation proved to be a useful tool in delineating landforms.

INTRODUCTION

Geomorphological reconnaissance are essential prequisites for almost any kind of applied geomorphological work. The field of geomorphology encompasses landforms, processes, genesis in their environmental context (Vastappen, 1980). By analyzing these geomorphological data, the geomorphologist may contribute the solution of current development problems.

To develop the coastal area of Trisik as a recreational area, a physical survey should be carried out to evaluate its potential. Geomorphological surveying can applied to delineate landforms, because landforms are more recognisable features in the field and on aerospace imagery. By interpreting ortho-photos (1982) and aerial

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photographs of 1971, landscapes and related geomorphological aspects for recreation can be identified. The landforms are classified according to their general.

Aerial-photo and or ortho-photo interpretation is a conventional technique that can be adopted in determining inherent characteristics and mapping land units. As considered from its physical characteristics and historical context, the Terasik coastal area is potential for such recreational areas as camping, fishing, and cultural performances.

In the assessment of coastal recreation in the Terasik coastal area, other geomorphological aspects are considered, such as wind waves, eustrophodynamics of the tidal zone and the Progo River flood hazards. These geomorphological aspects are analyzed in order to determine location for coastal recreation.

OBJECTIVES AND METHODOLOGY

The objective of this paper is to analyze the relevant geomorphological aspects by the assessment of the coastal recreation in the Terasik coastal area, Kulon Progo Regency, Yogyakarta. Aerial-photo and Ortho-photo interpretation has been carried out during the geomorphological surveying and mapping. A geomorphologi- cal field survey has been done on the beach for morphodynamic studies.

LOCATION AND PHYSICAL ASPECTS

The Terasik coastal area is situated in the Kulon Progo Regency, Yogyakarta. It is close to the mouth of the Progo River (Figure 1).

Climatically, it has a humid tropical monsoonal climate. The characteristic of the climate is reflected by a pronounced dry season which normally lasts from January to October, and wet season which prevails from November to April. The average rainfall is about 1,004 mm. Littorally, the Terasik coast is covered by alluvium consisting of gravel, silt and clay. Sand deposits of reworked volcanic material from Merapi volcano are transported by Progo River. Geomorphologically, the Terasik coast is located within the marine, colline and fluvial units. Progo River transports sediments into the sea, sea water along the shore yellowish blue. During the wet season flooding may occur in the fluvial plains due to the high peak discharg- es of the Progo River. In the dry season, wind erosion seriously occur in the sand dune area and salt water approaches up to the fluvial plains near the outlet of Progo River.

Soils are sandy, loamy, and clayey. The sandy soils are distributed along the sand dunes areas and the loamy, clayey soils are found in the fluvial plain unit (Barnes, 1955). Dry field is the dominant land use in the sand dune areas. Whilst, wet rice fields cover the fluvial plains.

Figure 1. The Outlet of Progo River.
GEOMORPHOLOGICAL ANALYSIS FOR COASTAL RECREATION

Landforms Analysis

To produce a geomorphological map of the Tairisk coast, interpretation of 1981 orthophotos scaled 1:5,000 can be employed. The main geomorphological features to be presented on the maps are landforms and processes (Figure 2). Detailed geomorphological information such as slopes, wind erosion, floods and tides, have been collected during the field campaigns.

By analyzing the geomorphological map, the following landforms of the Tairisk coastal area can be identified:

a. Progo River, Galar Canal and Lagoon

The outlet of Progo River is a nice object that shows the contact between fresh and sea water. In the wet season, Progo River brings yellowish sediment into the sea and it causes the sea water along the shore to be yellowish blue. In the dry season, the outlet of Progo River is occasionally dammed up by sand deposits (see Figure 1). The Progo River outlet is dangerous for swimming because of the effects of swell and waves, especially during the high tide periods. It is less potential for water recreation due to the effect of sea water and the activities of the Progo River due to floods and river bank erosion. The Galar canal might be used for water recreation, such as swimming and other sports, because of the width and shallowness of its calm water, and the reduced effect of waves.

b. Active Sand Dunes

The sand dunes in the Tairisk coastal area are irregular and of the longitudinal type. They are formed by eolian processes. Field observations show that the agricultural activities are largely absent due to wind erosion and unfavourable factors, such as soil and water conditions. Therefore, sparse vegetation and bare land occur in sand dunes areas; these areas are available for walking or passive recreation to enjoy the nice view of the sea.

c. Less Active Sand Dunes

This is partly used for agricultural activities such as growing secondary crops especially in the wet season. The larger part of the area is still in a natural condition with grass and bush cover. The wind action is less active. The land surface is mostly covered by natural vegetation. Therefore, the materials of the dunes are not easily transported by eolian processes. From field observations, it was found that the local people make wind barriers from local vegetation. These conservation practices should be considered in the development of this area as a communal recreation site. Forest recreation and camping may be considered as suitable alternatives of recreational activities.

d. Inactive Sand Dunes

The wind action in this area is further reduced and depositional processes are less active. The materials are mostly fine to medium-grained sands. The vegetation cover and landscape is different from the previous sand dunes. In this area, secondary
crops such as groundnut or cassava are found. The sand dunes are less suitable for recreation, since it is rather far from the beach.

e. Fluvial Plain and Backswamp areas

It is characterized by a flat topography, poorly to moderately drained, and frequently flooded during the wet season. These conditions allow the farmers to grow crops as dry field rice. This area is potentially used for agricultural activities in the dry season, since water may reach the alluvial plain through the Canal Canal. In the backswamps, the water conditions permit fishing, and therefore, this area is potential for fishing.

Morphodynamics of the Beach

Morphodynamics is an aspect of studies on morphogenesis. The study of the dynamical effects of waves in the tidal zone is important for water recreation evaluation. The condition of the sea for swimming can be inferred from morphodynamical measurements. Three cross-sections are measured in the field, the data are calculated in Table 1, and presented in Figure 8.

By analyzing the map, the area is not suitable for swimming because of the strong waves. The effect of strong waves is reflected on the presence of the cliff in the tidal zone.

Wind erosion

In the study area, wind erosion processes can be observed at the zones along the coast. A strip of low, undulating dunes occurs where the young Mekong products nearly reach the coast. The dunes consist of loose sands containing pebbles, pebbles, magnetite, iron, horizons, hypersthene, volcanic glass, and small and white rock fragments.

The dominant factors of wind erosion in the study area can be estimated from soil conductivity, climate, vegetation, and land use. Soils in the youngest water dunes are characterized by dark grey colour (7.5 YR 3/0, dry) with wholly unweathered sands, whereas soils on the minor dunes are light brownish grey (5.5 Y R 6/2, dry) slightly more slick and clay containing sands to sandy loams.

The greater part of the area consists of particles of 0.1-0.5 millimetres in diameter, and have a weak clay size distribution. These soil characteristics are considered to indicate high variability.
**Table 1: Data of Cross-Section Measurements**

<table>
<thead>
<tr>
<th>Date of observation</th>
<th>Y2 R3 elevation 8 cm point</th>
<th>Y2 R4 elevation 7 cm point</th>
<th>Y1 R1 elevation 20 cm point</th>
<th>Y1 R1 elevation 10 cm point</th>
<th>Y3 R2 elevation 17.5 cm point</th>
<th>Y2 R3 elevation 10.5 cm point</th>
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<td>1. 2.10 + 1</td>
<td>1. 2.10 + 1</td>
<td>1. 6.00 + 1</td>
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<td>1. 6.00 + 1</td>
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<tr>
<td></td>
<td>2. 4.00 - 6</td>
<td>2. 4.20 - 3</td>
<td>2. 5.70 - 1</td>
<td>2. 5.70 + 1</td>
<td>2. 5.90 - 1</td>
<td>2. 5.30 - 2</td>
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<tr>
<td></td>
<td>3. 15.90 - 1</td>
<td>3. 10.00 - 0</td>
<td>3. 14.60 + 2</td>
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<td>3. 14.60 + 2</td>
<td>3. 8.80 - 2</td>
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<tr>
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<td>6. 10.60 + 2</td>
<td>6. 32.10 + 8</td>
<td>6. 10.60 + 2</td>
</tr>
</tbody>
</table>

**Note:** TR = tracing line

The climatic factor of temperature is the dry period, which lasts about four months (May up to August), ranging from 22.36°C in the daytime, plays an important role in the local wind velocity, and desiccation of the land surface.

The low height and low density of vegetation along the coast have a strong influence on wind action. The sandy vegetation consists mainly of Pandanus Calotropis Gigantea, Casuarina rhus on the dunes and of Ipomoea Pes-caprae and A. Hypogaea on the beach.

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**Flood Hazard and Salt Water Intrusion**

A coastal alluvial plain is an area which may be subjected to damage by flooding and salt water intrusion. Altitudes of the coastal alluvial plain range from 3 to 8 metres above sea level. The flooding occurs yearly, and vary from a half up to three months, i.e. December to March or January/February. The area is poorly drained with shallow water tables.

The parent materials have fine texture alluvial river deposits are originating either from near by limestone of Sanakoa Hill or young Merapi Volcano. The soils are generally light grey, dark grey, olive grey or black heavy clays over bluish-grey or olive subsoil.

**Coastal-Resevoir Zoning**

Based on the geomorphological analysis, the coastal recreational area of the Trikik coast can be divided into seven zones. The zoning is based on landforms, morphodynamic aspects, wind erosion, flooding and saltwater intrusion. The coastal recreation zones of the Trikik coast are then described as follows (Figure 4 and 5).

1. **Water-recreation zone.** The zone extends along the tidal zone, the outlet of the Progo River, Gubur canals and lagoon. The most important object for water recreation is the Gubur canal because the conditions of water of canal itself are stable. While the tidal zone and outlet of the Progo River are more dangerous because the effect of waves and swell.

2. **Passive coastal-recreation zone.** This zone lies within the active dunes area. Within this zone, a view of the sea can be enjoyed at the day time. The problem of this zone is the relatively high, land surface therefore, this area is suitable for sun-bathing and quiet areas under shelter.

3. **Active coastal-recreation zone.** This zone covers the seaward side of the active dune area, because the wind action is less active here. The zone is more stable dunes, so that playground is available for active recreation in this zone.

4. **Coastal forest-recreation and camping zone.** The zone occupies the less active to inactive sand dunes areas. The sand dunes are partly natural and therefore, they should be protected by growing a forest. The coastal forest is intended for conservation and recreation. The sand dunes area has a undulating topography, which is considered suitable as a camping area.

5. **Cultural-recreation zone.** This zone is proposed for local cultural festivals. The suitable area for cultural recreation is in the inactive sand dunes area. The main reason is that the wind action is very low, therefore the building facilities can be constructed in this area.

6. **Recreation facilities centre zone.** This zone covers the less active sand dunes close to the main road and villages. The recreation facilities to be
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