# SOIL QUALITY ANALYSIS ON LAND SUITABILITY OF SHRIMP PONDS IN ACEH BESAR DISTRICT

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***ABSTRACT***

*This research was conducted in the coastal area of Neuheun and Lamnga Villages, Mesjid Raya Sub District of Aceh Besar District. The aim of this study was to analysis the soil quality on land suitability of shrimp ponds in Aceh Besar. This study using survey method (descriptive), by collecting and analyzing field observation data based on the chemical and physical soil properties for land suitability of pond and secondary data from the supporting maps and some literature review. Land characteristics data is indispensable to determination of land suitability classes of the study site, that includes the analysis of soil samples, climate and hydrological information, then compared (matched) with recommended aquaculture requirements. The results showed that the actual land suitability of Lamnga and Neuheun ponds classified into suitable criteria (S2) with the limiting factor is the rainfall. After repairs with high input of building a fresh water reservoir, it can be improved into potential land suitability, so it turned into very suitable criteria (S1).*

*Keywords: Soil Quality,Land Suitability, Shrimps Ponds*

## I. INTRODUCTION

The development of aquaculture is one way to resolve the decline of capture and the increased of oil prices. The development of these businesses will be able to guarantee the fish supply every year and it will be a positive impact on the lives of fishermen in the future.Most of the population livelihood in Aceh Besar district as fishermen and fish farmers. Based on the Department of Marine and Fisheries Data in Aceh Besar district, Lamnga and Neuheun villages overall have total area about 46.45 hectares of ponds.

The impact of the tsunami that occurred at the end of 2004 and has destroyed most of Nanggroe Aceh Darussalam (NAD) province, and casualties hundreds of thousands of lives. It also cause damage to agriculture and fisheries. Because of the disaster has been estimated ± 61,816 hectares of crops and horticulture which consists of 37,471 hectares of wetlands and 24.,345 hectares of dry land were destroyed by the tsunami (FAO, 2005).

Besides agricultural land, there are severe damage occurred also to aquaculture scattered along the coastal areas of Aceh. Most of the land covered by tsunami silt even inundation of seawater damage the dikes and ponds so that its existence is no longer clear as before. As a result of the damage, have change the quality of the physical and chemical soil properties and water that is unfavorable to the productivity of pond. The soil quality related to consideration of the land more holistic in its capacity for diverse functions.The relevance and

quality of the soil depends on its use where the ground was laid. In a wider ecological, soil quality to be considered in line with the water and air quality to determine the health of the ecosystem (Lal, 2003).The changes in soil properties after the tsunami that negatively impact aquaculture include a high soil sodicity and salinity, cation exchange capacity and texture, while the crucial water properties is pH, brightness, temperature and others.

Land Evaluation is essentially a process to estimate the potential of land for various utilization (Sitorus, 1985). The land of aquaculture especially in Lamnga and Neuheun villages, Mesjid Raya sub district of Aceh Besar district were affected by the tsunami require the reclamation efforts so that the land can re-cultivated by fish farmers. By knowing the soil characteristics for aquaculture suitability, it is expected the land management for aquaculture in Lamnga and Neuheun villages to do as much as possible and be able to increase the productivity of land aquaculture.

By knowing the soil characteristics on land suitability of shrimp ponds, it is expected that land management for aquaculture in Lamnga and Neuheun villages to do as much as possible and be able to increase the productivity of aquaculture land.

### 1.1. Research Purposes

The aim of this study was to analysis the soil quality on land suitability of shrimp ponds in Aceh Besar District.

### 1.2. Hypothesis

The land suitability of shrimp ponds after the tsunami disaster in Lamnga and Neuheun villages, Mesjid Raya sub-districtof Aceh Besar District was suitable for shrimp ponds.

## II. MATERIALS AND METHODS

The location of the study was conducted in Lamnga and Neuheun villages, Mesjid Raya sub-district of Aceh Besar District (Figure 1).This study uses survey method (descriptive), which is based on primary and secondary data analysis, that is field observations on the chemical and physical soil properties for land suitability of pond and some literature review.

To determine the land suitability classes of study site,the soil characteristics data required that includes the analysis of soil samples, climate and hydrological information, then compared (matched) with the requirements of shrimp aquaculture.

Determination of the limiting factor in the classification of land suitability for shrimp aquaculture as follow: (1) select the quality and land characteristics that directly affect the aquaculture through various sources and literature and land surveys also; (2) measures the land characteristics from the chosen location by soil survey and laboratory analysis, and (3) determine the land characteristics that have a relationship to the shrimp aquaculture.

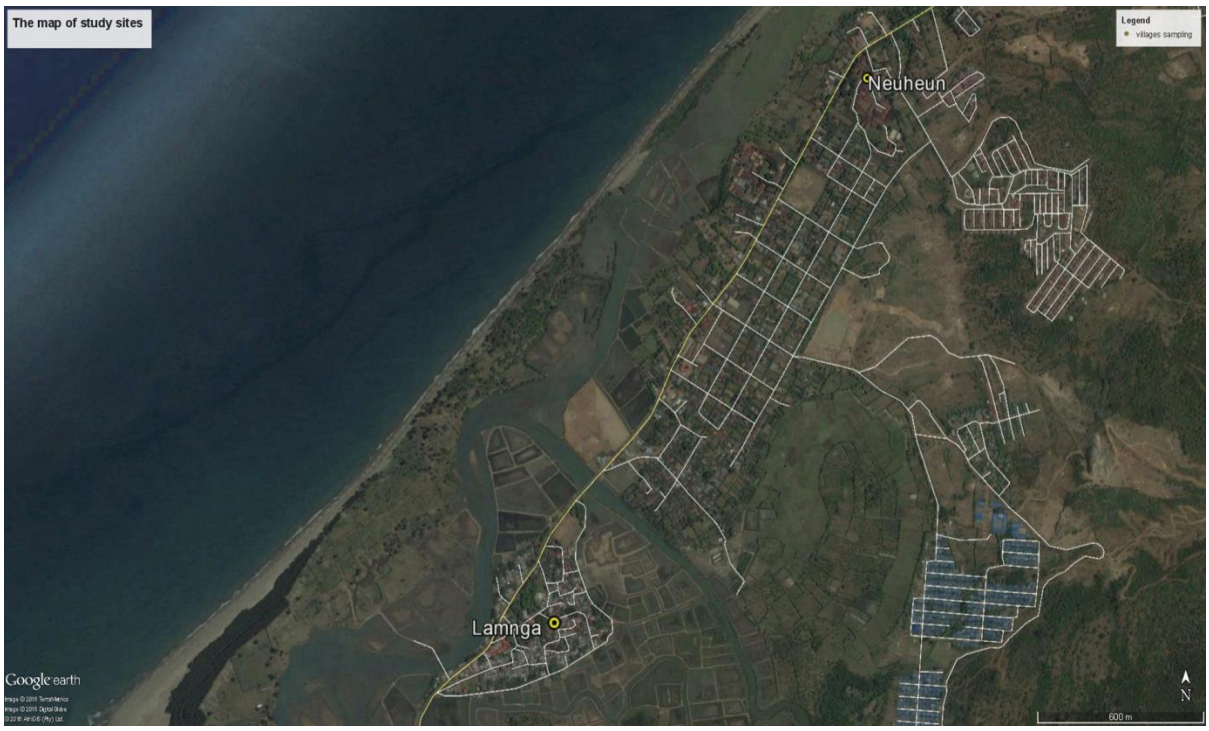


Figure 1. The Map of Study Sites

## 2.1. Implementation Research

This research was conducted through the following steps: (1) preparation, (2) field data collection, (3) soil analysis in the laboratory, and (4) the interpretation of the data processing.The soil sampling method were taken systematically at 100 meters distance between samples either vertically or horizontallyas many as 10 samples at each location by using an auger (hand bor) at 100-150 cm depth from the bottom of the pond.Soil properties analyzing in the laboratoryare presented in Tables 1.

Table 1. Soil properties analyzing in the laboratory

| No. | Variables | Methods |
|---|---|---|
| 1. | Texture | Pipetting |
| 2. | pH $H_2O$ | Glass electrode |
| 3. | Total Nitrogen | Kjeldahl |
| 4. | P-available | Olsen |
| 5. | Organic Carbon | Walkley& Black |

## III. RESULTS AND DISCUSSIONS

### 3.1. Soil Quality

#### a. Soil Texture

The results of soil texture analysis in each study site showed that in Lamnga and Neuheun ponds areas having sand and silt content greater than clay of soil texture. This indicates that in the pond area has a lower soil fertility. The study site has 145 cm of effective depth.

#### b. pH $H_20$

The measurement results at each study site showed that soil pH values ranged from 7.6 to 7.9 (alkaline). The productive ponds having soil pH between neutral to alkaline. The Soil with a pH of 7, contains a lot of sodium and phosphorus, so it can support the growth of algae on the bottom of ponds.

#### c. Organic Carbon

The results of soil organic carbon analysis, showed that the ponds of Lamnga village having organic carbon content ranged from 0.98 to 1.11%. In Neuheun pond area having organic carbon content ranged from 0.89 to 1.18%. The content of soil organic carbon at both sites showed low fertility levels. Indonesia shrimp ponds having soil organic carbon content between 1.32 to 8.95% (Murtidjo, 1996; Hanafi and Badayos, 1989).

#### d. Nitrogen and Phosphor

The measurement results at any location nutrients studied ponds showed that nitrogen (N) measured ranged from 0.08 to 0.09 percent. While elements of P ranged from 2.19 to 2.34 percent. The value of N and P nutrients, indicating that the soil fertility of pond at very low category.

#### e. Actual Land Suitability

The actual land suitability is an assessment of land suitability level, it was apply to the current or temporary, that is before the restrictions contained in the repaired area. The actual land suitability assessment in this study was based on analysis results of climate, hydrology, soil characteristics, soil quality through the results of measurements in the field and in the laboratory to see matches in land suitability guidelines for shrimp aquaculture that have been recommended. The summary results of the soil quality interpretation field data of study sitescan be seen in Table 2.

There are two land factors that assessed, namely; permanent (relatively can't changed by human) and temporal factors (which can be changed by humans). Changed or can't changed called the temporary and permanent limiting factor. The permanent limiting factor is

relatively difficult include climate, soil texture and effective soil depth and the remaining is temporal limiting factor (Pujiyanto, 1991).

Table 2. The summary results of soil quality in the field of study sites

| Land Characterictics | Pond Sites | | | |
|---|---|---|---|---|
| | Lamnga | | Neuheun | |
| Slopes % | <2 | ($S_1$) | <2 | ($S_1$) |
| **Soil (t)** | | | | |
| Depth of rocks (cm) | 152 | ($S_1$) | 152 | ($S_1$) |
| Texture | Sandy loam | ($S_1$) | Sandy loam | ($S_1$) |
| Drainage | Worst | ($S_1$) | Worst | ($S_1$) |
| the thickness of peat soil (cm) | - | ($S_1$) | - | ($S_1$) |
| **Water (a)** | | | | |
| DO (mg/l) | 6.8 | ($S_1$) | 6.8 | ($S_1$) |
| Salinity (ppt) | 30 | ($S_1$) | 30 | ($S_1$) |
| Temperature ($^oC$) | 29 | ($S_1$) | 29 | ($S_1$) |
| Brightness (cm) | 36 | ($S_1$) | 36 | ($S_1$) |
| pH | 7.7 | ($S_1$) | 7.7 | ($S_1$) |
| Amoniac ($NH_3$) | 0.03 | ($S_1$) | 0.03 | ($S_1$) |
| $H_2S$ (mg/l) | - | ($S_1$) | - | ($S_1$) |
| **Hidrology (h)** | | | | |
| The amplitude of tides (m) | 1,5 | ($S_1$) | 1,5 | ($S_1$) |
| The source of fresh water | exist | ($S_1$) | exist | ($S_1$) |
| **Climate (i)** | | | | |
| Dry month (<60 mm) | 3 | ($S_2$) | 3 | ($S_2$) |
| Rainfall (mm $thn^{-1}$) | 2.342 | ($S_2$) | 2.342 | ($S_2$) |

Based on interpretation data of land quality and comparison with the land suitability table, obtained the actual land suitability classes are presented in Table 3 below.

Table 3. Actual Land Suitability Classes

| Sites | Land Suitability Classes | Limiting Factor |
|---|---|---|
| Lamnga | Suitable ($S_2$) | i (rainfall) |
| Neuheun | Suitable ($S_2$) | i (rainfall) |

## f. Potential Land Suitability

Potential land suitability is the suitability of the land after the land improved as deemed necessary or in other words, the land potentially for improved the quality.Potential land suitability classes of study sites are presented in Table 4.

Table 4. Potential Land Suitability Classes

| Sites | Actual | Input/Input Level | Potential |
|---|---|---|---|
| Lamnga | $S_{2-i}$ | T/High input | $S_1$ |
| Neuheun | $S_{2-i}$ | T/High input | $S_1$ |

Notes:
Suitability Classes: limiting factor: Input:T =building of fresh-water reservoir
$S_1$ = Very Suitable i = rainfall
$S_2$ = Suitable

The results of the land suitability evaluation in Lamnga and Neuheun villages ponds classified as very suitable criteria (S1), thus this area does not have a serious limiting factor or no influence on their uses. But keep in mind is the condition of DO, salinity and temperature are still not optimal for it is necessary to manage the water quality by providing an aeration system in the ponds, replacement and addition of fresh water on shrimp pond units.

## IV. CONCLUSION

The actual land suitability of Lamnga and Neuheun ponds classified in the suitable criteria (S2) with the limiting factor is the rainfall. After repairs with high input of building a fresh water reservoir, it can be improved into potential land suitability, so it turned into very suitable criteria (S1).

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