Spatial analysis on school environment characteristics in mangrove management based on local wisdom (Case study at Lhokseumawe, Aceh)

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Abstract. After 2004 tsunami, lots of efforts have been made, such as building school and distributing mangrove forests. This study examines the perception of teachers and students about mangrove management which spread in the administrative area of Lhokseumawe to become a reference then applied as local education regarding mangrove after tsunami disaster. This paper was based on primary data taken using questionnaire with a predetermined analysis unit to interview teachers and students in the study area. The result presented with quantitative and descriptive analysis. The result is of the total number of junior high schools in the city of Lhokseumawe as many as 41 Public Schools, Private and Religious School, there are 31 schools with priority for local wisdom education implemented mangrove. The result is classified with 3 class. The school’s first priority is schools with a melee, with mangroves mangrove poor condition. Educational priority 2 is schools with close proximity to the mangrove and mangrove condition with moderate levels of damage. Schools with third priority are school with a close range, and mangrove good condition. Priority I as many as 18 schools, 10 schools priority II and 3 school for priority with learning competency standards that differ from each other.

1. Introductions
The earthquake and tsunami that hit Aceh on the 26 of December 2004 had created a terrible disaster of a scale that has never been faced by Indonesia. Mangrove forests were among the worst damaged wetland ecosystems in Aceh, but sources vary widely as the extant of mangrove forest damaged by the tsunami. Unfortunately, area of mangrove forest damaged by tsunami in Lhokseumawe, Aceh is 308.6 ha [1]. A number of organizations, both governmental and non-governmental, initiated a variety of environmental restoration activities, in particular the planting of mangrove. It takes a conservation program that is continuous and educative through the education, in this case the application of local wisdom based education mangrove. But in this case, teachers and students who are on the coastal environments abrasion and damage to mangrove forests on the environmental conditions should know about local wisdom based education mangrove. So, perception from them was needed to assessment how far they understand about local wisdom based education mangrove.

Disaster prone areas in the city of Lhokseumawe, covers regions prone to earthquakes, tsunami disaster prone areas, flood prone areas, areas prone to erosion and tidal wave. These disaster prone areas are in protected areas and some cultivated areas, necessitating intensive management primarily located in cultivated area. With the risk of vulnerability to disasters in the cultivation area this does not
mean that the region cannot be built, but its use must be accompanied by efforts to anticipate / reduce the possibility of the impact of natural disasters (mitigation).

Earthquake prone areas scattered throughout the region in the city of Lhokseumawe. Utilization of cultivated area is located in disaster-prone areas should consider the level of the earthquake, especially to the toughness of the structure. As a reference in the toughness of the structure is to consider the level of power of the earthquake that occurred in 2004. In addition, a disaster prone area will abrasion, tidal waves, is Ujong Blang beach, Rancung, Meuraxa. While the area prone to floods are in the District of Banda Sakti, covering the village of Java, Java village of old, Lancang Garam and Tumpok Teungoh. Utilization of cultivated area is located in disaster prone areas should also pay attention to the potential for abrasion and tidal wave, and the potential and magnitude of the flooding.

Figure 1. Disaster-Prone areas in Lhokseumawe City

Lhokseumawe (5°11’17” N - 97°8’25”E) is the second largest city in Aceh Special District, in the north of Sumatra, Indonesia (figure 1). The city covers an area of 181.06 square kilometers, and had a population of 171.163 at 2010 Census. Being between Banda Aceh and the large southern city of Medan, the town is a key regional center important for the economy of Aceh. Lhokseumawe set the status of a city based on Law Number 2 of 2001, dated June 21, 2001. Lhokseumawe City is divided into 4 districts, 9 residents, 68 villages, and 259 sub-villages with the boundaries of the area: the north from Lhokseumawe is Malacca Strait; the south from Lhokseumawe is Kecamatan Kuta Makmur; the west from Lhokseumawe is Kecamatan Dewantara; and the East from Lhokseumawe is Kecamatan Syamtalira Bayu.

According to Ghuffran (2012) [2], mangrove forest referred to as mangrove swamp forest is an ecosystem that is constantly undergoing development pressure. Mangroves grow optimally in coastal areas that have a large river estuaries and deltas that flow of water contains a lot of mud. While in coastal areas that are not contained estuaries, mangrove forest growth was not optimal. Mangrove is difficult to grow in coastal areas are steep and large choppy with strong tidal currents, because these conditions do not allow the deposition of silt that is a substrate required for the growth of mangroves [3]. To maintain the sustainability of mangrove forest functions, integrated management effort required. Stages of conservation efforts through mangrove management can be done early, namely through the understanding of children and young people to know the various aspects related to the existence of mangrove forest as an ecosystem are important, which are in the neighborhood of their lives. According Saraswati, et al (2010) [4] basic education development of local content greatly affect the quality of schools and students in the region. Implementation of local content are integrated in environmental education curriculum has also been done by Susiloningtyas and Handayani (2007) [5]. The results showed that school activities based on local wisdom turns perceived positively and
contribute to improving the perception of the high importance of education in small island. Educational institutions are not only limited to fulfilling the education and research (research), but also plays an important role in supporting regional development through the development of the region in economic, social and cultural [6]. In this study, an assessment of the perception of the environment around the respondent in cases the teachers and students who are on the coastal environments and damage to mangrove forests on the environmental conditions.

In conducting this study, the authors use this line of thinking described in the figure below:

Figure 2. The decision how to improve the perception of teachers and students

Lhokseumawe city lies between 04°54'N - 05°18'N and 96°20'E - 97°21'E with an average altitude of 13 meters above sea level. Since forming in 2001, until now Lhokseumawe city is divided into four districts, 9 settlement, 68 villages and 259 hamlets. Lhokseumawe City is as follows:
• Northern Strait of Malacca.
• West of the slams Kecamatan Dewantara North Aceh.
• South side with Kuta Makmur sub-district, North Aceh regency.
• East side with Syamtalira Bayu Sub-district, North Aceh regency

The city covers an area of 181.06 square kilometers, and had a population of 171,163 at the 2010 Census; the latest official estimate (as at 2014) is 180,200. Being between Banda Aceh and the large southern city of Medan, the town is a key regional center important for the economy of Aceh.

Lhokseumawe City is an urban expansion of Aceh Utara Regency and is located on the east coast of Sumatra. Being between Banda Aceh and Medan, Lhokseumawe City holds a strategic position as a distribution channel for trading traffic in Aceh Special region.

When formed in 2001, the city was dividing administratively into three districts (kecamatan), since then, the creation of Muara Satu District (formerly part of Muara Dua District) has increased the number to four:
Table 1. Vast districts and the number of population

| District       | Area (km²) | Population at 2010 Census |
|---------------|------------|---------------------------|
| Banda Sakti   | 11.24      | 79,336                    |
| Blang Mangat  | 56.12      | 22,850                    |
| Muara Dua     | 57.80      | 46,646                    |
| Muara Satu    | 55.90      | 32,975                    |

Source: Lhokseumawe Dalam Angka 2013/Lhokseumawe in Figures 2013

Figure 2. Administrative boundary map of Lhokseumawe City Aceh Province

2. Methods
The research location is in the province of Aceh, Lhokseumawe, located between 04°54’N - 05°18’N and 96°20’E - 97°21’E. This research is done in April and Mei 2016. Sampling method for this study is purposive sampling. Purposive sampling is samples are carefully selected by taking the person or object research was selective and has specific characteristics. Samples taken have special characteristics of the population that is considered quite representative [7]. The samples in this study were selected to support the strengthening of the data or to clarify the data. In the study, emphasize on the perception of teachers and students to Education Local Wisdom Mangrove.

The sampling technique used purposive sampling with the following criteria:
1. Students and teachers at the Junior High School who were in school in the study area in accordance with a predetermined analysis unit.
2. Students and teachers who have a residence in accordance with a predetermined analysis unit.

Data needed in this research consisted of primary data and secondary data. Secondary data used in this study was obtained through the relevant agencies such as BPS, Bappeda Lhokseumawe City, the Department of Education and Culture in Lhokseumawe, Regional Disaster Management Agency Lhokseumawe and SPOT 5 satellite imagery acquired from Bappeda Aceh province. While at the stage of primary data collection, researchers use interviewing techniques and questionnaire, the questionnaire technique using a list of questions. In this study used a questionnaire with the aim that...
the respondent can answer the appropriate answer options are available, but some of the questions answered in accordance free respondents thought.

The processing data method for this study is quantitative descriptive analysis. Descriptive analysis is a behavioral sensory evaluation approach that uses descriptive panels to measure a product’s sensory characteristics. Panel members use their senses to identify perceived similarities and differences in products, and articulate those perceptions in their own words. Sensory evaluation is a science that measures, analyzes, and interprets the reactions of the senses of sight, smell, sound, taste, and texture (or kinesthesis) to products. It is a people science; i.e., people are essential to obtain information about products.

Descriptive research in this study is intended to get an overview and particulars of school conditions and quality of junior high school in the city of Lhokseumawe linked to local knowledge-based mangrove education and respondents’ perceptions of local knowledge based education mangrove. While the quantitative data was processed by SPSS (Statistical Product and Service Solutions).

Methods of data processing are spatial and tabular data processing with the Geographic Information System (GIS). The process is done through a phase of spatial data entry, editing, labeling, annotation, joint map, overlay, classification, data entry attribute to the output / output. Then performed to classify the degree of damage to the mangrove and the distance of the school. Steps being taken are as follows: Classification of mangrove destruction is done by looking at the average area is obtained from the Spot 5 satellite imagery analysis and observations from researchers in the field on the existing condition of mangrove. Then, Distance to school with mangrove is used to determine the spatial pattern analysis indigenous mangrove education, by looking at the distribution of schools and mangrove. The distance of the school and are grouped into three classes mangrove distance by using the same method with the classification of mangrove destruction, with the results of three classes: near, medium and far. After that, the quality of the school is the result of the calculation of scores of the quality of teachers, students and school infrastructure quality result school quality are also grouped in three classes, namely schools with high quality, medium and low.

Figure 3. Satellite image Lhokseumawe City, Aceh Province

Then, Distance to school with mangrove is used to determine the spatial pattern analysis indigenous mangrove education, by looking at the distribution of schools and mangrove. The distance of the school and are grouped into three classes mangrove distance by using the same method with the classification of mangrove destruction, with the results of three classes: near, medium and far. After that, the quality of the school is the result of the calculation of scores of the quality of teachers,
students and school infrastructure quality result school quality are also grouped in three classes, namely schools with high quality, medium and low.

![Figure 4. Distribution and thickness of mangrove in Lhokseumawe District, Aceh Province](image)

Then, Distance to school with mangrove is used to determine the spatial pattern analysis of mangrove education, by looking at the distribution of schools and mangrove. The distance of the school and are grouped into three classes: near, medium, and far. After that, the quality of the school is the result of calculating scores of the quality of teachers, students and school infrastructure quality result school quality are also grouped in three classes, namely schools with high quality, medium and low. Most of the junior high school level is close to the location of the mangrove, i.e., with a percentage of 78% of the total. Districts with the highest population are Kecamatan Banda Sakti and Muara Dua; the center of the city of Lhokseumawe. Both districts are also the districts with the largest mangrove are poor to moderate anyway. While schools with medium and far distances percentage of each of the 7 and 15% presented in picture below:

![Figure 5. Map of distance between school and mangrove in Lhokseumawe District](image)
3. Result and discussion

In this study, an assessment of the perception of the environment around the respondent in this cases the teachers and students who are on the coastal environments abrasion and damage to mangrove forests on the environmental conditions. There are 4 questions in the questionnaire which are about Insights and Knowledge about Mangrove, Perception of Teachers about Mangrove, Teacher Participation on Mangrove Local Wisdom and Learning Methods Local Content in Schools and Management.

For in this case, taken 3 teachers from 41 schools to be measured insight, perception and participation on the coastal environment and mangroves as well as to know the opinion of the teachers education based on local wisdom mangrove. And this is the result from the questionnaire.

![Figure 6](image)

Figure 6. (a) Insight and knowledge about mangrove from teachers. (b) Perception of teacher about mangrove management. (c) Teacher participation on mangrove management. (d) Local wisdom and learning methods local content in schools from teachers. (e) Local wisdom and learning methods local content in schools from teachers.

![Figure 7](image)

Figure 7. (a) Insight and knowledge about mangrove from students. (b) Perception of students about mangrove (c) Student participation on mangrove management.
After that, we discussed about the relationship between qualities of School with Student Perceptions. The analysis used to look at the relationship the perception of respondents (teachers and students) with distance and condition of mangrove is a simple correlation analysis. Simple correlation analysis is used to describe the strength and direction of the relationship between the two variables. The method used is the Pearson product moment. Figures correlation ranged from -1 s d +1. The closer to 1, the closer the correlation is perfect. While the negative and positive values indicate the direction of the relationship.

Hypothesis is:
H0: There is no relationship between the qualities of schools with student’s perceptions
H1: There is a relationship between the qualities of schools with students’s perceptions

Table 2. Correlation between the qualities of schools with student’s perceptions

|          | Quality of School | Students Perception |
|----------|-------------------|---------------------|
| Standard of School | Pearson Correlation | .352** |
| Sig. (2-tailed)    | .000              |
| N                | 410               | 410                  |

**. Correlation is significant at the 0.01 level (2-tailed).

From the analysis above correlation (r) obtained correlation between the qualities of schools with Student Perceptions (r) is 0.352. This shows that the relationship between the quality of schools with Student Perceptions is low because it is located between the range of 0, 20 to .399. While the direction of the relationship is positive, this means that if X goes up, then Y rises or in other words the higher the value the better the quality of schools Perception of Students. Correlation is significant at 0.01 which means that H0 is rejected or there is a relationship between the qualities of schools with student perceptions.

Then, we discussed about the relationship between qualities of School with Teachers perceptions. The method used is the Pearson product moment too.

Hypothesis is:
H0: There is no relationship between the qualities of schools with teachers' perceptions.
H1: There is a relationship between the qualities of schools with teachers' perceptions.

Table 3. Correlation between the qualities of schools with teachers’s perceptions

|          | Quality of School | Teachers Perception |
|----------|-------------------|---------------------|
| Standard of School | Pearson Correlation | .209* |
| Sig. (2-tailed)    | .021              |
| N                | 123               | 123                 |

*. Correlation is significant at the 0.05 level (2-tailed).

From the analysis above correlation (r) obtained correlation between the qualities of schools Perception of Teachers (r) is 0.209. This shows that the relationship between the quality of schools with teachers Perception is low because it is located between the range of 0, 20 to .399. While the direction of the relationship is positive, this means that if X goes up, then Y rises or in other words the higher the value the better the quality of schools Perception Teachers. A significant association was 0.05, which means that H0 is rejected or there is a relationship between the qualities of schools with teachers' perceptions.
Schools are prioritized for implementation of education based wisdom mangrove is a school with a close-range mangrove bad condition, then melee mangrove condition medium and close range mangrove good condition are divided into three classes of priorities, namely:

1. The school’s first priority is schools with a melee, with mangroves poor condition. There are 18 schools in Lhokseumawe City.
2. Educational priority 2 is schools with close proximity to the mangrove and mangrove condition with moderate levels of damage. There are 10 schools in Lhokseumawe City.
3. Schools with third priority are school with a close range, and mangrove good condition. There are 3 Schools in Lhokseumawe.

About the matrix of the infrastructure quality schools, the condition of mangrove and quality of schools, teachers and students can be seen in table below:

**Table 4. Matrix of research results**

| Number | School's Name                  | Quality of Teachers | Quality of Students | Infrastructure Quality Schools | Quality of School | Mangrove's Condition |
|--------|--------------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------|
| 1      | SMP NEGERI 1 LHOKSEUMAWE       | High                | High                | Good                            | High              | bad                  |
| 2      | SMP NEGERI 2 LHOKSEUMAWE       | Moderate            | High                | Good                            | High              | bad                  |
| 3      | SMP NEGERI 3 LHOKSEUMAWE       | High                | Low                 | Good                            | moderate          | good                 |
| 4      | SMP NEGERI 4 LHOKSEUMAWE       | Moderate            | Low                 | Good                            | moderate          | good                 |
| 5      | SMP NEGERI 5 LHOKSEUMAWE       | High                | High                | Good                            | High              | bad                  |
| 6      | SMP NEGERI 6 LHOKSEUMAWE       | High                | Low                 | Good                            | moderate          | moderate             |
| 7      | SMP NEGERI 7 LHOKSEUMAWE       | Moderate            | Low                 | Good                            | moderate          | bad                  |
| 8      | SMP NEGERI 8 LHOKSEUMAWE       | High                | Low                 | Good                            | moderate          | moderate             |
| 9      | SMP NEGERI 9 LHOKSEUMAWE       | Low                 | Low                 | Good                            | moderate          | bad                  |
| 10     | SMP NEGERI 10 LHOKSEUMAWE      | High                | Low                 | Good                            | moderate          | bad                  |
| 11     | SMP NEGERI 11 LHOKSEUMAWE      | High                | low                 | Good                            | moderate          | bad                  |
| 12     | SMP NEGERI 12 LHOKSEUMAWE      | Moderate            | low                 | Good                            | moderate          | moderate             |
| 13     | SMP NEGERI 13 LHOKSEUMAWE      | High                | low                 | Good                            | moderate          | good                 |
| 14     | SMP NEGERI 14 LHOKSEUMAWE      | Low                 | low                 | Low                             | Low               | moderate             |
| 15     | SMP NEGERI 15 LHOKSEUMAWE      | Low                 | low                 | Good                            | moderate          | bad                  |
| 16     | SMP NEGERI UJUNG PANCU         | Low                 | low                 | Low                             | Low               | bad                  |
| 17     | MTSN LHOKSEUMAWE               | Moderate            | moderate            | Good                            | moderate          | bad                  |
| 18     | SMP NEGERI ARUN                | High                | high                | Good                            | High              | moderate             |
| 19     | SMP SWASTA MUHAMMADIYAH 6      | Low                 | low                 | Good                            | moderate          | bad                  |
| 20     | MTSS AL-WASHLIYAH CUNDA         | Low                 | low                 | Low                             | Low               | bad                  |
| 21     | MTSS BATUPHAT                  | Moderate            | Low                 | Low                             | Low               | moderate             |
| 22     | MTSS IHYAAUSSUNNAH              | Low                 | low                 | Low                             | Low               | bad                  |
| 23     | MTSS MUHAMMADIYAH              | Low                 | low                 | Moderate                         | Low               | bad                  |
| 24     | MTSS ULMUDDIN                  | Low                 | high                | Good                            | moderate          | bad                  |
| 25     | MTSS BABUL HIDAYAH             | Low                 | low                 | Low                             | Low               | moderate             |
| 26     | MTS SWASTA HIDAYATULLAH        | Low                 | low                 | Low                             | Low               | bad                  |
| 27     | SMPS SUKMA BANGSA              | High                | high                | Good                            | High              | moderate             |
| 28     | MTS SWASTA AL – MUARIF         | Moderate            | low                 | Moderate                         | moderate          | moderate             |
| Number | School's Name                          | Quality of Teachers | Quality of Students | Infrastructure Quality Schools | Quality of School | Mangrove's Condition |
|--------|---------------------------------------|---------------------|---------------------|--------------------------------|-------------------|----------------------|
| 29     | MTs SWASTA BANDA MASEN                | Low                 | low                 | Low                            | Low               | bad                  |
| 30     | MTs SWASTA YAPENA                    | High                | high                | Good                           | High              | moderate             |
| 31     | MTSS DARUL FAIZIN                     | Low                 | low                 | Low                            | Low               | bad                  |
| 32     | MTSS SAFINTUSSALAMAH                 | Low                 | high                | Moderate                        | moderate          | moderate             |
| 33     | MTSS MISBAHUL ULM PALOH              | Low                 | high                | Good                           | moderate          | moderate             |
| 34     | MTSS BABURRAHMAH                     | Low                 | high                | Moderate                        | moderate          | bad                  |
| 35     | MTSN PUNTEUT                         | Moderate            | high                | Moderate                        | moderate          | bad                  |
| 36     | MTSS RAUDHATUL MUTA'ALAMIN           | Low                 | high                | Low                            | moderate          | bad                  |
| 37     | MTSS DARUL ULM                       | Low                 | high                | Moderate                        | moderate          | good                 |
| 38     | MTSS RAUDHATUL FATA                  | Low                 | high                | Low                            | moderate          | bad                  |
| 39     | MTSS RAUDHATUL JANNAH                | Moderate            | high                | Moderate                        | moderate          | bad                  |
| 40     | SMP SWASTA 1 SERAMBI MEKKAH          | Low                 | high                | Moderate                        | moderate          | bad                  |
| 41     | MTsS AL-MUNAWWARAH                   | Moderate            | high                | Low                            | moderate          | bad                  |

**Figure 8.** School priority map for mangrove local wisdom education in Lhokseumawe City

**4. Conclusion**

The distribution of mangrove in Lhokseumawe can be analyzed from mangrove location, and land use classification of mangrove destruction is done by looking at the average area is obtained from the SPOT 5 satellite imagery analysis and observations from research in this field about mangrove existing condition. The destruction level of mangrove measured from mangrove thickness and size of mangrove. The destruction level of mangrove divided into 3 classes such as the good condition, the moderate condition and bed condition.

Of the total number of junior secondary schools in the city of Lhokseumawe as many as 41 Public Schools, Private and Religious School, there are 31 schools with priority for local knowledge-based education implemented mangrove. Priority I as many as 18 schools, as many as 10 schools priority II
and III priority as much as 3 school. The main determining factor is the distance between the school and mangrove, it is because the local knowledge-based education involves students mangrove planting mangrove in mangrove nearest location of the school.

There are differences in standards of competence and basic competences indigenous mangrove education that will be imposed on each of the patterns formed. At the first priority school learning activities focused on mangrove planting activities of the students, as well as to the school with the second priority, but the priority II school students will also study the utilization and planning of mangrove. On the third priority school students focused on maintaining the sustainability of mangrove activities and get to know other economic benefits of mangrove.

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