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Forest Destruction, Wood Utilization and Mangrove Area in District Jailolo, West Halmahera Regency, Province Of North Mollucas and the Conservation Education

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Abstract:- Mangrove forest in the District Jailolo, West Halmahera, the Province of North Mollucas nawadays has rampant serious destructions; this condition is very worrying because people in that area are always utilize wood (timber) from mangrove forests for various daily purposes, including for firewood, home building materials, furnishings and other household purposes such as boats as well as parts of the boat. Moreover the mangrove area has been converted into fishponds, which are in the end left out to become an open field. This sea tide may flood and endanger the people near the coastal area as well as the marine biota surrounding the mangrove forests. This condition is urgent, requiring real actions from the government as well as relevant agencies, to make efforts in order to conserve mangrove forests in many ways, one of which is to integrate to enviromental conservation learning in some subjects in school, using two ways: (1) infusion method; and (2) block method, by developing learning modules about natural disaster mitigation that can be taught from the elementary school students (SD) to the high school (SMA). From this, the students are expected to be able to foster their sense of belonging and awareness to the environment, including mangrove forests.

Keywords:- Forest destruction, utilization of mangrove woods and area, conservation education

I. INTRODUCTION

Mangrove forest is categorized into tropical coastal vegetation community, which is dominated by a few species of mangrove trees that can grow in the muddy tidal areas. This vegetation community is generally grown especially in the intertidal area that gets enough water flow, and protected from waves and strong tidal. Because of this, we can see most of the mangrove forests are located on the shallow bay, estuaries, deltas, and coastal protected areas (Bengen, 2002).

In terms of ecology, mangrove vegetation is such ecosystem that is very unique and belongs to one of the natural resource potentials; it is as an integrated element of the mangrove forest area covering physical, biological, land and sea elements, thus creating a complex ecosystem combination between sea and land (Wikipedia, 2010).

Mangrove forests are tropical coastal vegetation communities, which are dominated by tree species such as mangrove: mangroves, *api-api*, *tanjang*, and *bogem*, making it useful for marine life that can grow and thrive in muddy tidal areas. In relation to this use, the impact of mangrove forest loss due to the activities of human (anthropogenic factor) in the form of clear-cutting on mangrove forest ecosystems may result changes in the composition of mangroves. The destruction or loss of the mangrove forests may no longer function as a foraging area for marine life and nursery ground. Mangrove forest which serves as the breeding area (nursery ground), foraging areas (feeding ground) and spawning areas as well as various types of marine life to be disrupted (Wikipedia , 2010) .

The conversion of mangrove forests into fishponds may threaten the regeneration of marine biota in that area, including fish and shrimp stocks in waters off the coast. People would never consider the side effect of this conversion that may cause the reduction in income of fishermen who depend on the extent of fish as well as crabs that become their haul from the sea (Bengen, 2002).

According to Kepetsky (1982) (in Saparinto, 2007), it is stated that such a destruction of mangrove estuaries in the coastal area will lead to the increased sedimentation rate which in turn will affect the lives of reef, fisheries, and seagrass. Because of the sedimentation would interfere with the penetration of sunlight and inhibit eutrophication which in turn will reduce the productivity of surrounding waters.

According Bengen and Adrianto (2008), most of mangrove areas in Indonesia were currently in poor condition, even in some areas the condition is very tormenting. The data has shown that the degradation rate even reaches 160-200 thousand hectares per year. Another data shown that the potential destruction of mangrove forests in Indonesia has reached 50%, the destructions occur due to improper plan and management toward the sustainable mangrove forest ecosystems.

In District West Halmahera, it is considerable potential for its extensive mangrove forests. The data was obtained extensive mangrove forests from Landsat 7 ETM+ in 2010 conducted by the Center for Watershed Management (BP DAS) Ake Malamo, it was 1,971.88 hectares or 12:20% of the total mangrove forests area in the Province of North Mollucas; according to the data, it is estimated that mangrove forest area in the District Jailolo is approximately 625 hectares (BP DAS Malamo Ake, 2010).

The threats to mangrove forests in Jailolo District West Halmahera are very intensive. The threats to the mangrove forests may come from the local communities who utilize the woods for firewood, fishing boat building and converse tge function of mangrove forest area into ponds for fish and shrimp; it is concluded that the destruction of the mangrove forests is very rampant and hard to prevent.

According to Saparinto (2007) that there are four major factors that may cause the destruction of the mangrove forest area in coastal area: (1) the density of population that demands the conversion of mangrove forest area is getting higher; (2) sustainable planning and management of the coastal resources in the previous years has been very sectoral; (3) the low public awareness and participation toward mangrove conservation and ecosystem function; and (4) poverty in the coastal communities.

Based on a survey through interviews in 2012 on several household as fishermen in the coastal area, there is a pattern of the utilization of the mangrove wood, indicating that the woods are utilized for firewood, house construction material, for boats as well as parts of the boats, for fence posts as well as the manufacture of poles post. With this significant utilization of the wood, the poor condition of the mangrove vegetation in this area cannot be denied.

Based on the observations on the field, there were indications that would allow an increase in pressure on the mangrove areas in this area. The indications are rooted by the increase of population growth; the icrease of the pace of urban development and housing, higher price for fuels that will trigger the use of the wood for firewood by the population, and on the other hand the government and public concern about the preservation of mangroves is still lacking.

II. METHOD

The research employed field observation and survey method. The method was conducted through some interviews to the local community who use the mangrove woods, those who have participated to the change of mangrove forest area into fishponds area. The number of the interviewees was 40 heads of families. The information that is expected to gather from the interview and observation covers their understanding of mangrove forests, the utilization of the mangrove woods, clearing of mangroves or the conversion. The results of the survey and interviews were used as the as a basis to consider a solution that will be proposed from this study.

III. FINDING AND DISCUSSION

The destruction of mangrove forest is mainly caused by the lack of understanding of the functions and benefits of the mangrove forests. The following is presented the pattern of the utilization of several types of mangrove woods by the local people in the District Jailolo West Halmahera.

Figure 1. Newly cut mangrove woods

Figure 2. Mangrove woods have been cut into pieces

Figure 3. mangrove woods are ready to sell

As presented on the figure 1-3 above, it is shown the common utilizition of the mangrove woods in District Jailolo West Halmahera, the widely utilized mangrove species (*Rhizopohora*) for firewood, their assumption of this type of mangrove wood; the local people believe that that kind of wood would generate high heat when it is burned. According to the research that has been conducted in the use of mangrove woods, the solid woods can be used as firewood and charcoal materials. In addition to that, that species of mangrove wood is also beneficial as a raw material of high quality paper. The mangrove wood for firewood, it may generate high heat upto 5,017 cal/gw (FAO, 1994).

The following is the description of the utilization pattern of mangrove wood species *Xylocarpus moluccensis* by the local people to serve as household furniture materials as well as boat-making bodies.

Figure 4. Mangrove woods of *Xylocarpus moluccensis* that have been cut into board and dried

Figure 5. The board from *Xylocarpus moluccensis* that is smoothened for house furniture and boat-making bodies

Another form of destruction of the mangrove forests in this area is the conversion of the mangrove area transfer into fishponds as well as for the shrimp. Moreover, the conversion is then abandoned to become such open land without any vegetation; the situation may endanger the local people and residency on the coastal area through flooding when the high tide comes through from the sea. The following are some activities of the communities on the mangrove land.

Figure 6. The cutting of mangroves may leaves an open area without any vegetation

Figure 7. The conversion of mangrove forest to become fishponds by the local people

Figure 8. The abandoned fishponds are flooded when the high tide comes from the sea

Figure 9. The housings of the local people where are regularly flooded when the high tide

In addition to the causes that may destruct the mangrove forests such natural factors such as the condition of substrate, the frequency of tidal, wind speed, pollution in the coastal areas and the possibility of other chemical factors. However, the mangrove forests may grow well if they are supported by appropriate physical and chemical factors those will be described as followes:

a. Temperature, mangroves breed in the average and optimum air temperature which is higher than 20 ^{0}C. The air temperature may affect the process of photosynthesis and respiration of the plants, temperature is an important function of regulating excretion, salt and root respiration (Hutchings & Seanger, in Tolangara, 2002).

b. Substrate (soil), most of mangroves grow well in the muddy ground/soil, especially the accumulated silt, the border between the rivers and sea. The soil in which the mangroves vegetation occurs has such characteristics as low oxygen but rich in organic matter. This organic matter is derived from the decomposition of plant remains produced by the mangroves themselves. In addition, the soil in mangrove forests also consists of fine sediments and particles of sand, coarse material derived from pieces of rocks, coral and shells fragments (Chapman & Turner, in Tolangara, 2002).
c. Salinity is the last factor that may affect zoning. The establishment of zoning, besides influenced by the physical factors, is also influenced by several factors namely the plant morphology, buoyancy and energy spread of the seeds as well as competition among the species. Mangrove forest formations are formed and usually preceded by a region of mangrove tree species such as kike (*peadada*) and *api-api* as pioneers of the mangrove land bordering the sea and wind conditions. These types are capable of living in a place that is unusual because they have high water submerged roots of the pegs. In the next area that leads to the mainland more prevalent types of mangrove (*Rhizophora, sp*). While *tancang* tree growing area is away from the sea, towards the mainland. This area of land is a bit harsh because only occasionally submerged during high tide and a higher sea level (Hutchings & Seanger, in Tolangara, 2002).
d. Tide, the ups and downs are primarily related to topographical influence on the growing expansion of mangrove area. The length of tidal water and the flooded area may lead to the formation of mangrove zonation (Steenis & Chapman, in Tolangara 2002).
e. Coastal area has become the places for the waste disposal from human activities, which both is derived from the coastal areas as well as outside it (over land and the high seas). Marine pollution (coastal waters) is defined as the "negative impact" to the sustainability of the marine lives, resources, and other marine ecosystems as well as the human health (Supriharyono, 2002).

The rampant destruction in the mangrove areas may lead into a variety of problems, especially those related to coastal erosion, seawater intrusion, changes in microclimate especially across the coastal area, and the fall of haul productivity depending on coastal waters. In addition, there are concerns of many parties to the possibility of the sinking of the 2,000 islands in Indonesia in 2030 due to rising sea levels due to global climate change (Dahuri, 2004).

According to Tomlinson (1986), the word mangroves means tropical plants and communities that grow in intertidal areas. Intertidal area is the area under tidal influence along the coastline, such as lagoons, estuarine, coastal as well as river banks. Mangrove is a specific ecosystem and generally is only found in a relatively small beach wavy or even free of waves, along the delta and estuarine inputs are affected by water and mud from the mainland.

Mangrove is a vegetation type that is found in coastal areas and always influenced by the tide, the beach area with muddy soil, sandy or sandy mud, so that the mangrove forest is a forest type that is typical for coastal waters thatare muddy and quiet (Eko, 2011).

Mangroves grow optimally across coastal region, major river estuaries and deltas that contain lots of mud flow. While there are no estuaries, mangrove vegetation might not growth optimally. Mangrove areas are difficult to grow in choppy and large steep with strong tidal currents because these conditions do not allow for the deposition of mud required for growth (Duhari, *et al.*, 2001).

Mangroves have a special physical shape that allows growing in shallow waters like having short root with a wide spread root buffer, or a special tip of the roots that grow from the trunk or branches. Mangrove forests are a group of plants that grow along tropical coastlines to the sub-tropics that has a special function in environment sectors containing salts and forms a coastal area with anaerobic soil reaction (Kathiresan, 2010).

Mangrove vegetation including shallow coastal ecosystem or community is very attractive especially which is found in tropical or subtropical waters. The vegetation of mangrove ecosystems that is more specific as it is compared with other ecosystems because it has rather uniform vegetation, as well as having a flat canopy, canopy layer does not have the typical form (Bengen & Ardianto, 2008).

Mangrove forest vegetation mostly grow over the tidal line so that the mangrove forests are in some occasion also called *tidal forests*. Mangrove forests can grow on the coral coast, namely *the dead coral* on which the overgrown coral with a thin layer of sand or mud or muddy. Coastal areas of mangrove forests occur continuously or sequentially submerged in sea water and tidally influenced, the soil consists of mud and sand. Literally, mangrove forest area is only about 3% of the entire forest area and 25% of the mangrove forests in the world. However, seeing the roles and benefits of mangrove forests, the vegetation area of mangrove forests need to be considered carefully (Saparinto, 2007).

1. Mangroves and the roles

Mangroves include the trees and shrubs covering consisting of 12 generations of flowering plants that *Avecennia*, *Sonneratia, Rhizophora*, *Aegiatilis*, and *Xylocarpus* belonging to eight families. Mangrove is a potential food source, unlike other ecosystems as the basic components of the food chain. Mangrove mangrove

ecosystem is not in itself, but derived from mangrove as a whole (leaves, twigs, fruits, and stems) (Musyimi, 2011).

According to Saparinto (2007), mangrove forests have some functions as follows:

a) **Physical function of mangrove areas**: (1) Keeping the shoreline in order to remain stable; (2) Protecting beaches and river banks from erosion or abrasion process; (3) Reducing or absorbing strong winds from the sea to the maindland; (4) Reducing the storm and withstanding tsunami waves; (5) Holding the periodic sedimentation as part of process to form new land; and (6) As the buffer zone intrusion or seepage of sea water into the mainland.

b) **Chemical function of mangrove areas**: (1) As the site of the recycling process that produces oxygen and absorbs carbondioxide; and (2) As the processing of waste materials exhausted from intrusion pollution from ships at sea.

c) **Biological function of mangrove areas**: (1) mangrove is believed as a producer of material weathering (decomposer) which is an important food source for small invertebrate creatures weathering material (*detritus*), which then acts as a food source for larger animals; (2) mangrove forests are also believed as breeding area for shrimps, fish, crabs, clams, and other marine biota, which the growing animales will go back to offshore; (3) mangrove as area for shelter and breeding for birds and other wildlife; (4) As nutfa plasma sources and genetic resources; and (5) As the natural habitat of various types of land and other marine biota.

d) **Socio-economic functions**: (1) Producing firewood, industrial raw materials, pharmaceuticals, home furnishings, cosmetics, food, textile, glue, tanning leather, and others; (2) Producing seedlings / seeds of fish, prawn, clams, crabs, birds' eggs, honey and others; and (3) As a tourist area, conservation, education and research.

2. Developing Environmental Conservation Education Curriculum

The problems in relation to mangrove forest degradation can be addressed through formal education programs in schools through curriculum development concerning with environmental conservation. The application of environmental conservation curriculum is fundamental since the early age as to increase the students' environmental awareness. Therefore, it is urgent that the knowledge about environmental conservation should be integrated into school curriculum, especially in District Jailolo West Halmahera in the Province of North Mollucas.

There are two ways on how to incorporate conservation learning into the school environmental education curriculum, namely: (1) infusion method, and (2) block method. These methods are also employed by Armanto, et.al. (2007) who have developed learning modules in mitigating natural disasters in Aceh.

a) Infusion Method

The infusion method is also called "insertion method", which integrates conservation and environmental education load with the existing curriculum. One example of learning how to insert a conservation and environmental education into their science subjects that has been already in the KTSP Curriculum by inserting soe basic competencies such as: (1) the knowledge of the relationship between humans and nature; (2) the knowledge of the potential and problems of coastal resources; and (3) the knowledge of the waste management; and (4) the knowledge of local biodiversity.

b) Block Method

Block learning method is environmental and conservation education throug a descrete or single lesson. There are two ways to block this learning method, such as by entering into the school curriculum and beyond the school curriculum. If this lesson is integrated into the school curriculum, it is usually in the form of local content lesson. Some schools have implemented environmental education and conservation lesson as the single lesson itself where it has been alreadu conducted at junior high schools in the District Sumur, Pandeglang where is directly adjacent to the area of Ujung Kulon National Park.

If this education is not integrated directly into the school curriculum, the environmental conservation education can be conducted during extracurricular session. There are several reasons why conservation and environmental issues should be put in extracurricular such as school system in Indonesia requires the students too many lesson being taught at school. From this consideration, the integration of the conservation and environmental education into school as single lesson (separate lesson) might add the burden to the students.

The application of the conservation and environmental education lesson requires careful planning. Every school should not be the same material as every region has different characteristics of the environmental issues. The first thing to be conducted is the need analysis toward environmental problems as well as the potential; this step will be beneficial to set the educational goals and environmental conservation. In addition, this preparation will be used as the basis to be considered with the conditions in the school. As a single lesson, the conservation and environmental education should have syllabus, teaching materials and worksheets that can be taught in one school year.

The following is an example of environmental learning and how to insert the environmental education, conservation and disaster mitigation into the existing lesson in the curriculum:

(a) Civic Education

On the subject of Civic Education (Civics), the teaching of environmental education, conservation and disaster mitigation can be intebrated into the basic competence covering (1) a sense of solidarity; (2) an understanding of disaster response; (3) an understanding of children's rights in emergency situations; (3) confidence; and (4) the ability of expression. While learning activities can be either (1) in the form of lecture and classroom discussion about the role of government in protecting biodiversity and mitigating disaster (2) simulation or drama with the theme of natural disasters.

(b) Mathematics

In Mathematics, the teaching environmental education, conservation and disaster mitigation can be integrated into the basic competence covering (a) the ability to compute; (2) the ability to understand the data mathematically; (3) ability to group the data; and (4) the ability to create graphs. While the learning activities can be either (1) to solve the stories of victims of natural disasters; (2) to create a graph of victims of natural disasters; (3) to introduce the forms of triangles, parallelograms, rectangles, rectangles with the images of flora and fauna typical of the region each each.

(c) Science

In teaching science, the teaching environmental education, conservation and disaster mitigation can be integrated into the basic competence covering (1) knowledge of the dynamics of natural and human-caused disasters; (2) knowledge of the relationship between humans and nature; (3) the ability to observe natural resources; (3) the ability to utilize natural resources; (4) the ability to express thoughts in writing; (5) the ability of the interviewing; (6) the ability of researching; and (7) knowledge about biodiversity.

The learning activities can be either (1) in the form of a lecture and classroom discussion on environmental issues, conservation and disaster mitigation. Teachers can play the movie or documentary made clipping and discussed in class; and (2) interview. The teacher invites students to interview experts or the public regarding environmental issues as well as the conservation and disaster mitigation in accordance with the place of residence; (3) Tourism study by inviting the students to the forest, disaster areas and disaster-prone areas, then the results of scientific work is made in the form of pictures or stories, comic books or poetry.

(d) Social Sciences

In Social Sciences, the teaching environmental education, conservation and disaster mitigation can be integrated into the basic competence covering (1) the knowledge of the dynamics of the community in response to disasters; (2) self-rescue skills; (3) confidence; and (4) the ability of expression. The teaching activities may include simulations and role playing; simulation for earthquakes, tsunamis and floods, and playing the role of students were asked to make a drama about the disaster.

IV. CONCLUSIONS

There are some conclusions to be proposed based on the study analysis above:

1. The destruction of mangrove forests in District Jailolo West Halmahera, the Province of North Mollucas today is very rampant and worrying. It is important for the local government and relevant agencies to take real actions to save and protect the remaining mangrove forests by establishing a network of capacity building center along the coastal area to help socializing and monitoring programs to be successful in the long-term target. Some mangrove rehabilitation are very useful in terms of: (1) improving the access of information to the public about the importance of mangrove rehabilitation because the roles of mangrove forests are very essential for the coastal areas; (2) conducting training in the planting the mangroves; and (3) conducting training in relation to the utilization of mangrove seedlings for rehabilitation especially on the land that has been damaged due to other conversion or local people's activities.
2. It is urgent to conduct such program to increase the awareness since the early age for the people who live in the surrounding mangrove forests, such as conservation and environmental education into the school curriculum in West Halmahera, the province of North Mollucas, starting from the elementary level, junior high and even senior high school. The way to incorporate conservation and environmental learning in school learning can be conducted through two ways, namely: (1) infusion method; and (2) block method.

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