



## COMPARING KNOWLEDGE ABOUT MANGROVE ECOSYSTEM BETWEEN STUDENTS LIVING IN MANGROVE ECOTOURISM AND NON MANGROVE ECOTOURISM AREA IN SERDANGBEDAGAI, NORTHERN SUMATERA

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### ABSTRACT

*This study aimed to compare the effect of ecotourism mangrove area and students gender on the knowledge of mangrove ecosystem. As much as eighty students from public junior high schools located in mangrove ecotourism area and another eighty students from mangrove area with no ecotourism program were randomly selected and surveyed in Serdangbedagai district, Northern Sumatra, Indonesia. Students were given 18 items of open knowledge test about mangrove ecosystem. The data were analyzed with t test and Two way Anova to compare students' knowledge between those two areas, assisted by SPSS v.21. Results showed that students' who are living in ecotourism mangrove area had higher knowledge score compared to students living in non mangrove ecotourism area. There is a significant effect of interaction between students' location and gender towards their mangrove ecosystem knowledge. In mangrove ecotourism area, female students knowledge were higher compared to male students. This study showed significant effects of mangrove ecotourism program on knowledge of residential students towards mangrove ecosystem. Mangrove ecotourism program helps to construct students knowledge about mangrove ecosystem and this result promotes alternative way to increase coastal students knowledge about their environment by accelerating learning program in the school with ecotourism program.*

**Key Words:** *Knowledge, Mangrove Ecotourism, Mangrove Ecosystem.*

### INTRODUCTION

Indonesia has about 3.2 million hectares of mangroves or nearly 21% of mangroves in the world with the number of species found about 75 species, but the recent data has indicated that a total ecosystems of mangrove in Indonesia within the last twenty years has reduced for the ecosystems of 1.1 hectares or about 75% due to some conversions (Onrizal, 2010 and Mangrove National Working Group, 2013). Reduction of mangrove area lowers the mangrove role for the environment. Balance environmental quality becomes compromised. Various pollutants cannot be neutralized so that environmental degradation in coastal areas being increased. Mangrove forest areas were also subjected to on the exploitation of natural resources and conversion of land into aquaculture area, residential, and industrial (Waryono, 2000).

Various rehabilitation and restoration of mangrove area has been done to maintain the sustainability of mangroves. Community involvement is necessary to



maintain, manage, and conserve mangrove forests in order to the function of mangrove forests can be fully utilized. Public awareness of the mangrove environment relies heavily on the community knowledge about the mangrove forest. Knowledge of communities in mangrove forest areas associated with an understanding of the types of plants in the mangrove forest, mangrove forest benefits for the environment as well as knowledge about the conservation efforts to preserve the mangrove forests. Such knowledge can be owned by various layers of community, ranging from children to adults.

The process of intensive interaction of coastal community with mangrove environment as part of their life gave rise to numerous patterns that regulate their interaction with the environment where they live. Local knowledge of mangrove management comprises knowledges, beliefs and management practices passed down from generation to generation, adapted from external sources, or derived from experience. Local knowledge is also strengthening the ability of the community to use their knowledge in managing their resources (Chottong et. al., 2009). Local knowledge possessed by coastal communities can be applied to a form of environmental management combined with tourism as ecotourism. Ecotourism as a well-managed coastal area can create the conditions necessary to support the process of conservation through productive planning and comprehensive management. Ecotourism interests can also convince local people that their resources are as, if not more, valuable when intact than when extracted from the ecosystem.

Ross and Wall (1999) outline five fundamental functions of ecotourism; namely: (i) protection of natural areas; (ii) education; (iii) generation of money; (iv) quality tourism; and (v) local participation. Ecotourism supports education of local community and enhancing local attitude to conserve their ecosystem. As mentioned that ecotourism is nature based, environmentally educated, sustainably managed and conservation supporting, the existence can increase local community understanding and attitude about their environment in order to support conservation function.

Sei Nagalawan village as known as Kampung Nipah located in Serdangbedagai district, Northern Sumatra, Indonesia has been declared as an



integrated local-based mangrove ecotourism. Ecotourism is managed by the local communities rely on mangrove forest tourism and processing of products derived from mangrove forests. All these activities run by local people making local communities have a good knowledge about how to utilize and maintain the sustainability of mangrove forest. Along with the conservation and rehabilitation of mangrove forests, the community then manage the area as a tourist attraction by the name of Kampoeng Nipah Ecotourism Mangrove.

Environmental knowledge of students showed the level of interest to issues in real life environments (Amyx, DeJong, Lin, Chakraborty, & Wiener, 1994). Environmental knowledge is also related to a care and understanding related to natural environments, and stimulate responsibility for environmental protection of people to be stronger (Huang and Shih, 2009). In this study, mangrove environment is to be the focused issue. Various aspects of knowledge regarding mangrove forest ecosystem and how to maintain its sustainability has been known by local people. Students who reside in the area of mangrove forest ecotourism being one of the components of the community which undertook interaction with mangrove forests. Students gain more profits as they acquire knowledge of mangrove ecosystems from the school and also from the interaction of everyday life in the region. As the younger generation, the students play an important role to continue the mangrove ecosystem conservation.

## RESEARCH METHOD

As much as 18 fill in the blank (open-ended) knowledge test questions and 20 item questionnaire were administered to 160 secondary students from public school in coastal area in Serdangbedagai district, Northern Sumatra from in August to November 2016. Opend-ended questions of knowledge were used to identify the specific knowledge of students about biotas name existing in mangrove, the practical utilization of mangrove and the way to conserve mangrove. This approach used to get richer responses and more specific knowledge (Altinay & Paraskevas, 2008, Whitmarsh, 2009). The test consists of 3 category such as knowledge of mangrove biotas, utilization and conservation.



Attitude questionnaire was using modified Likert scales consists only 4 option with no medium option to avoid neutral answer. The questionnaire about the attitude towards mangrove ecosystem were administered right after distributing knowledge test. The students was allowed to bring the questionnaire to home and returned it to the next meeting. Interview was conducted to students with high, medium and low level of knowledge score in order to reach explanatory factors to support the result of the test. The manager of ecotourism mangrove and students' parents were also interviewed. The quantitative data were analyzed with Parametric t test and Two way Anova to compare students' knowledge and attitude between those two areas, assisted by SPSS v.21. Analysis of qualitative data were performed by interpretation and triangulation conducted by researchers.

## RESULTS

### Students' Knowledge about Mangrove Ecosystem

t test at the level of significance  $\alpha=0.05$  and  $\alpha=0.01$  revealed that there was a significant difference on students' knowledge between the two samples. Students' living in ecotourism mangrove area have higher knowledge score about mangrove ecosystem compared to students living in non ecotourism mangrove area in general ( $t= 5.866$ ;  $P= 0.00$ ). Consistent result was shown for all knowledge categories (mangrove biotas, utilization and conservation).

Table 1. Students' Knowledge Mean Score

No	Indicator	Students Knowledge Scores		Significance Level
		Mangrove Ecotourism	Non Mangrove Ecotourism	
1	Biota of Mangrove Ecosystem	47.06 ± 17.32	38.26 ± 13.63	0,001**
2	Utilization of Mangrove Ecosystem	39.37 ± 29.21	16.60 ± 13.38	0,000**
3	Conservation of Mangrove	32.08 ± 14.86	19.44 ± 14.89	0,000**
	<b>Total Knowledge</b>	40.22 ± 15.93	26.65 ± 10.54	0,000**

\*\* The mean difference is significant at the 0.05 and 0.01 level

The computed data of #1, #2 and the total were transformed into Log10



## Students' Knowledge about Mangrove Ecosystem and Gender

A statistical Two Way Anova with interaction was performed to compare the effect of gender and school locations to students' knowledge. There was significant difference among students gender from both locations ( $F= 29.419$ ;  $P= 0.00$ ), where female students living in ecotourism mangrove area ( $48,36 \pm 13,14$ ) have higher score compared to male student ( $32,04 \pm 14,33$ ) but male students living in non ecotourism mangrove area ( $28,72 \pm 10,09$ ) have similar score with female students ( $24,45 \pm 10,67$ ). There was a significant effect of interaction between students location and gender towards their mangrove ecosystem knowledge ( $F = 28.558$ ;  $P = 0,00$ ).

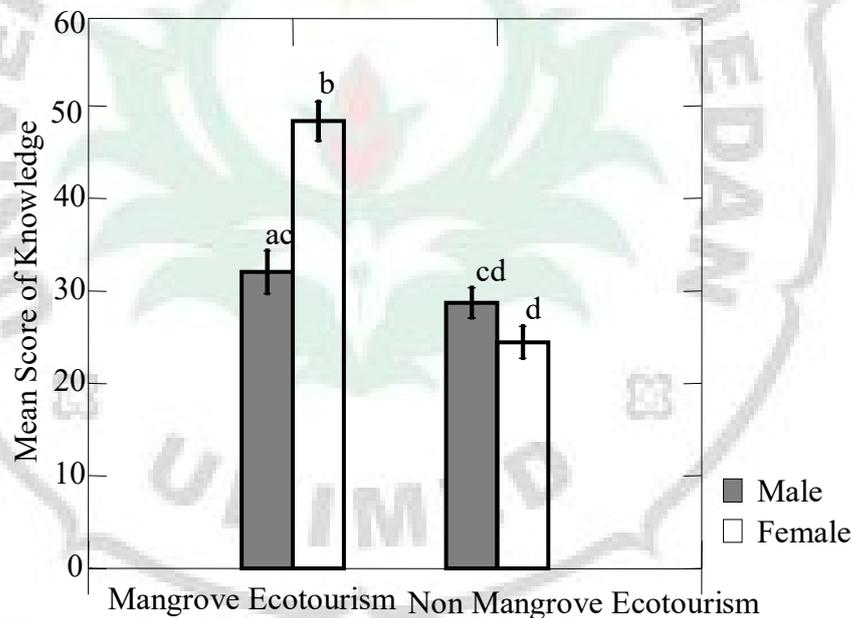


Figure 1. Difference in Mean score of Student Knowledge about Mangrove Ecosystem based on Gender that live in Mangrove Ecotourism and Non Mangrove Ecotourism Area ( $F= 29.419$ ;  $P= 0.00$ ).

## DISCUSSION

### Students' Knowledge about Mangrove Ecosystem

Students living in the area of ecotourism mangrove scored higher knowledge compared to students living in the area of non ecotourism mangrova. The presence of mangrove ecotourism had a significant impact on students' knowledge about mangrove ecosystems. Students in ecotourism mangrove area reached average score of 2,28 in item about plant species found in mangrove forest.



Students were able to answer more than 3 plants species which found in mangrove forest i.e. *Rhizophora apiculata*, *Sonneratia alba*, *Xylocarpus sp.*, *Achantus ilicifolius*, *Excocaria agallocha*, etc. The students wrote the local name of those plants in the answer sheets. In the other hand, students in non mangrove ecotourism area only gained average score of 1,75 which means that students were able to answer only 1 or 2 plants species. The common plants species that students in non mangrove ecotourism area mentioned were *Rhizophora apiculata* and *Nypa fruticans*. The result indicates that students living in ecotourism mangrove area had better knowledge about mangrove ecosystems compared to students living in non ecotourism mangrove area. Basic knowledge about the mangrove ecosystem, like plants name, fish' name, crabs' name etc., was low among the students living in non ecotourism mangrove area. The presence of ecotourism in mangrove increases the students interaction with mangrove ecosystems. These situation leads better students knowledge about biotas, uses and conservation about mangrove ecosystem.

Paisley et al (2008) connoted to the idea that activities roomates include contact with the natural and social environments were highly ranked as beneficial. The activities of students who live around mangrove ecotourism become more frequent in the mangrove forest areas and become more aware of the various components and benefits of the mangrove forest. Conservation activities undertaken by the management of mangrove ecotourism resulting in raising awareness of students. While students at non mangrove ecotourism site may still perform the activities surrounding the mangrove area, but do not have the motivation to understand the benefits and to identify the components of the mangrove forest.

Beaumont explained that experiences in the natural environment associated with learning about natural processes are said to be the stimulus for developing a rapport with nature and a desire to protect and care for it (Beaumont, 2001). Beyond this initial bond, outdoor experiences done through ecotourism can often showcase the degradation that human populations are responsible for, but also the change that conservation efforts can have on damaged land. Powell (2008) concluded that preliminary evidence which the type of ecotourism experience was capable of



increasing tourists' philanthropic support of conservation as well as positively influencing their knowledge and attitudes towards protected areas and general environmental behavioral intentions.

### **Students' Knowledge about Mangrove Ecosystem per Indicator**

In the category of knowledge about biota of mangrove ecosystem, students living in ecotourism mangrove area obtained higher scores compared to students living in non ecotourism mangrove area. Knowledge about mangrove ecosystem biotas as measured in this study are the types of plant, fish, crab, bird and snake found in mangrove forest. Students living in the area of ecotourism mangrove know more about those biotas from the information provided by the manager and organizers of ecotourism mangrove. Some of the knowledge is also coupled with their daily life. So the students are familiar with and understand about the biota types in mangrove ecosystem because they already knew its benefits. Students living in the area of non ecotourism mangrove reached a lower score about mangrove ecosystem biotas because they realize less benefits of mangrove ecosystems. With the absence of ecotourism mangrove, students do not oftenly interact with mangrove ecosystem. They also get less information about its benefits. They are not interested in knowing the existing biotas in the mangrove ecosystem.

For example, students living in mangrove ecotourism area gained average score 1,95 which means they identified more than 2 species of fish that found in mangrove ecosystem, while students living in non mangrove ecotourism area gained average score 1,11 which means they mentioned less than 2 species of fish. The answer of students in mangrove ecotourism area were varying such as *Periophthalmodon sp.*, *Mystus nigriceps*, *Cromileptes sp.*, *Eleutheronema tetradactylum*, *Sembilang*, *Belanak*, etc. Students living in ecotourism mangrove know more birds compared to students in non mangrove ecotourism area. Students living in mangrove ecotourism identified bird species like storks, swallows, eagles, white storks, *berunak*, *pikakah* etc., while students in non mangrove ecotourism area only mentioned storks, eagles, and swallows. About 5 species of snake species that exist in mangrove ecosystem were identified by students living in mangrove ecotourism area such as sea snakes, cobra snakes, land snakes, water snakes, and



*selimpat* snakes, while students in non mangrove ecotourism only mentioned sea snakes and water snakes.

It was found 2 types of mangrove crabs by students living in mangrove ecotourism area such as *Scylla serrata* and stone crabs (*Scylla* sp.), while students living in non mangrove area only found *Scylla serrata* and the wrong species of crabs i.e. sea crabs (*Portunus pelagicus*). Students living in non mangrove ecotourism area could not differentiate between mangrove crabs and sea crabs. The condition of less mangrove forest in their location is the main reason why they never see crabs in mangrove forest.

Beaumont (2001) explained the experiential form of environmental education provided by ecotourism is deemed more efficient in altering attitudes than classroom learning methods. Beaumont also stated that enjoyable experiences in the natural environment associated with learning about natural processes are said to be the stimulus for developing a rapport with nature and a desire to protect and care for it.

Students' knowledge about mangrove ecosystem utilization in ecotourism mangrove area were significantly higher than the students' living in non ecotourism mangrove area. Students living in ecotourism mangrove area have been taught about the process making that products. Training of mangrove food production was conducted in ecotourism mangrove area, especially for women. The products then sold to the visitors of the ecotourism mangrove area. The profits from the products then shared among the members of organization. While the mangrove food production does not conduct in non ecotourism mangrove area. The students living in non ecotourism mangrove area had never seen and do not know how to conduct the mangrove food production.

Students living in ecotourism mangrove area scored good result in knowledge about the advantages of mangrove for environment. They mentioned mangrove advantages as nursery ground for fishes and shrimps, and as habitat for mangrove crabs. Those advantages of mangrove were informed to every visitor. While students living in non mangrove ecotourism area mentioned only the advantages of mangrove as habitat of small fishes. Students in non mangrove area



confirmed that they received less information about mangrove. The only source of information is their parents.

Students' knowledge in the area of ecotourism mangrove for category the conservation of mangrove ecosystem was higher compared to students' living in non ecotourism mangrove area. Mangrove ecotourism has an impact on students' knowledge about various conservation activities which conducted in the area. Students involved in the activities and know its benefits. The conservation activities in ecotourism mangrove area are cultivating mangrove seeds, maintaining the stability growth of mangrove seeds, promoting prohibition in destructing mangrove, and stoping female crab exploitation to maintain crab' stability. While students living in the area of non ecotourism mangrove has lack knowledge about mangrove ecosystems conservation activities because they do not conduct the conservation activities. Students do not understand the purpose of mangrove conservation activities.

Fieldtrip study to mangrove area is not conducted in non ecotourism mangrove area because of the absence of ecotourism in their area, as confirmed by the biology teacher. Hill (2007) stated that ecotourists do in fact want to gain knowledge during their ecotourism experience. It demonstrated that knowledge, at least in the short term, can be gained and for the most part ecotourists want some form of environmental education during the experience. The result of this study showed the presence of ecotourism mangrove program provides a basis for future environmental fieldtrip study to students in order to enhance their environmental knowledge. The program is also promising knowledgeable flows to visitors to maintain environmental stability, in this case, mangrove ecosystem.

### **Students' Knowledge about Mangrove Ecosystem in General based on Gender**

Interaction between gender and school location significantly effected students' knowledge, female students living in mangrove ecotourism area have higher knowledge about mangrove ecosystem compared to male students' living in the area, and also higher compared to female students' living in non mangrove ecotourism area. While male students living in mangrove ecotourism area have similar knowledge score compared to male students living in non mangrove ecotourism area.



Generally, female students' knowledge about mangrove ecosystem were significantly higher than the male students' knowledge in mangrove ecotourism area. While, male students' knowledge about mangrove ecosystem were significantly higher than the female students' knowledge in non mangrove ecotourism area. In ecotourism mangrove area, based on observation, male students have more activity to catch crabs, shells and fishes to get economic advantages while female students collect shells and mangrove plants parts for food producing. The female students also interested in cultivation activities. Female students showed more interest in knowing mangrove plants name compared to male students. Female students were also involved in cooking process of fish and crabs for their daily consumption and this situation leads them know the name of fishes and crabs. In the area of non ecotourism, knowledge of male students tend to be higher compared with female students in all category of knowledge. Male students have more interaction with mangrove ecosystems through catching crabs, and fishing in the area of mangrove. While female students are less interested to the activities. The absence of mangrove ecotourism in the area causing the girls were not involved in activities that could increase their knowledge of the mangrove ecosystem.

The differentiation of knowledge along gender lines reinforces the need for gender awareness in development and policy interventions regarding natural resource management and conservation. Male cannot voice the knowledge of female, and neither boys nor girls alone can fully represent the knowledge of their community. Together, boys and girls form a knowledge system specific to local conditions and priorities (Grenier 1998). The implication of this results on the effects of gender on mangrove ecosystem knowledge is the need to disaggregate ecological information to highlight any differences between boy's and girl's knowledge to avoid undue generalization which may lead to wrong conclusions.

## CONCLUSION

Students living in ecotourism mangrove area had higher knowledge compared to students living in non ecotourism mangrove area. Ecotourism mangrove was giving positive impact on students' knowledge in all three indicators



such as biotas, utilization and conservation of mangrove. There is a significant effect of interaction between students location and gender towards their mangrove ecosystem knowledge, where female students living in ecotourism mangrove area have higher level of knowledge compared to male students but male students showed similar knowledge with female students in non ecotourism mangrove area. With the presence of ecotourism program, female students showed dominant knowledge in all three indicators. While, male students showed dominancy in knowledge with the absense of the program.

It is suggested that necessary to hold educational activities about the mangrove ecosystem of the students in the coastal area through cooperation based educational tour with the manager of the mangrove eco-tourism to increase knowledge and awareness about conservation of mangrove ecosystems. This study found that ecotourism mangrove program provides education-based information, facilitating interaction between visitors with ecosystem, recreation-based learning, an efective way to maintain mangrove conserved, and also provides financial benefits from mangrove-based food production. It implies the importance to develop mangrove ecotourism program in coastal area to conserve mangrove ecosystem and influence students knowledge and attitude towards mangrove ecosystem.

This study also showed that the availability of ecotourism mangrove program significantly effects students knowledge about mangrove ecosystem. For practical implication, it would be very good if biology teachers in coastal area implementing learning about mangrove ecosystem by adapting teaching materials to provide contextual examples in accordance with the concept that runs in ecotourism mangrove. It is also suggessted to do environmental fieldtrip study to ecotourism mangrove area to enhance student knowledge and awareness towards mangrove ecosystem sustainability. Theoritically, mangrove ecosystem-based educational environment that is implemented nonformally in ecotourism can increase students' knowledge about the conservation towards mangrove ecosystems.



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