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## The Evaluation of Incentive-Disincentive System in Tourism Development: A Case Study of Lake Linow Development, Tomohon, North Sulawesi

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### Abstract

The aim of the research is to evaluate the implementation of incentive-disincentive system which area implemented in Lake Linow in term of tourism development. This result confirm that there gaps between incentive and disincentive system. Based on the calculation, it is clear that the highest satisfaction index was found about direct funding support. Direct funding support policy is become the most preferred form of incentive systems. The second satisfaction was physical development. The highest problems and gaps related tourism development related to the social service. Stakeholder argues that social service of tourism planning and implementation facing problems, including service in legal permission in administration aspect to program implementation in the field. The development of tourism in Lake Linow potentially affects land use changes and therefore tourism development should be managed properly. The incentive-disincentive system is one of the instruments to maintain natural resources use in sustainable manner.

**Keywords:** Lake Ecosystem, Land Uses Changes, Sustainable Tourism, Tourism Satisfaction.

### INTRODUCTION

Tourism development in developing countries is facing challenges of environmental conservation issues. It is particularly important in the sustainable development agendas which are implemented globally, including in developing countries. Scholars point out that tourism growth has significant impact on environment. The uses of natural resources as tourism attractions have been identified contribute to the decline of environmental quality. It encompasses soil and water pollution, wildlife extinction, forest degradation and rapid land uses changes. Sustainable tourism seeks a formula which is able to integrated economic benefit, environmental conservation and social welfare objectives into development. Sustainable tourism development therefore becomes the crucial issues in local sustainable development [1,2,3].

In Indonesia, rapid tourism development in areas which are endowed by spectacular landscape and biodiversity grows significantly [4]. Mountain, river, savanna, tropical forest, cave, lake and other natural ecosystem recently widely explored as new natural tourism object and attraction. It is especially related to the recent trend of global nature-based tourism grows. The growth of tourism in natural environments should be viewed as local economic develop-

ment opportunities, but it is also potential contributor to the environmental degradation. Changes of land uses are the common problems in tourism destination area [5]. There are often conflict between tourism, agriculture, open space, and forest conservation in land resources usage. Land is critical resources in tourism development. In Indonesia, Governmental Law No. 26 of 2007 provides a legal document for spatial and land management, including area with highest value of biodiversity [6].

There are two concept namely incentive and disincentive system in order to control and manage land uses and space management. In such document, incentive is an instrument which is established to support development to meet basic principles of sustainable land uses. It encompasses decrease of tax, compensation, support of infrastructure, provides credit for any activities and rewards to the community that support sustainable development practices. Disincentive was established as a punishment instrument to countermeasure environmental degradation due to land use changes as an impact of rapid development. It encompasses applying high tax and limiting infrastructure grows and development.

Indonesian government argues that incentive-disincentive system will become the important key to manage development and land uses changes, and therefore contributes to the environmental conservation. It is particularly relevant to the recent rapid increase of land

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requirement for numerous tourism infrastructure and attraction development.

Recently, tourism is one of the important businesses in North Sulawesi, Indonesia. Tourism development especially addressed to meet local economic growth and providing opportunities for numerous tourism related works. There are also arguments that tourism is the key instrument for environmental conservation [7,8]. The development of Lake Linow in North Sulawesi province and its surrounding area as a nature based tourism has several consequences. One of the important consequences is rapid land uses changes surrounding lake's ecosystem. The need of new infrastructure and facility lead to the changes of numerous ecosystems disturbance, including Lake Linow. As far, tourism development in Lake Linow received a lot of attention from the local government, The Tomohon City. There are numerous incentives and disincentives aspects that have been implemented, but there are lack evaluations. The evaluation of gaps between incentive and disincentive aspect in Lake Linow provides significant information for the tourism planning, especially in term of land and ecosystem management. The aims of the research will evaluate the implementation of incentive and disincentive system in tourism development.

## **MATERIALS AND METHODS**

### **Study Site**

The field survey was conducted at Tomohon City and Lake Linow (Fig.1). This area located at North Sulawesi Province, Tomohon City area located at mountainous regions with some active volcanoes, namely Mt. Lokon and Mt. Mahawu. In North Sulawesi, Tomohon is considered as one of the famous tourism area which was visited by both national and international tourism yearly. There are natural tourism object and cultural festivals which are becomes tourism attraction in Tomohon City. According to National Planning for Tourism Development, this area has been included in National Strategic Area for Tourism Development. Consequently, in past decades this area received political and other national support in order to facilitate tourism grows and development. According to statistic record, tourism increase significantly and its contribution to local government revenue was significant.

Naturally, Tomohon area rich in term of natural tourism attractions such as Mt. Mahawu, Mt. Lokon, Tanonang Hills, Lake Tondano, Lake

Linow, Tumimperas Pinaras Waterfall, Tapahan Telu Tinoor Waterfall, Orchids villages in Kakas Kasen, Lahendong forest, Rurukan ecotourism area and others. Lake Linow is very famous natural tourism attraction because its geological phenomena. Lake Linow has high sulfur ingredients. In some part of the lake periphery, there are bubbling mud holes at the edge of the lake. The majority of the lake boundary was dominated by agricultural land. Some of the area has been managed using poly-culture systems. The colors of the water area were green and blue. These interesting phenomena are the interesting object among domestic and international tourist to come to Lake Linow [9,10].

### **Data Collection**

Methods consist of several stages. First, the official document related tourism development policy was collected from Tourism office of Tomohon City. Focus of the document research were addressed to identify the policy related Lake Linow tourism development and its policy. In this stage, the field survey to identify natural phenomena of lakes which are interested as tourism object and attraction was conducted systematically. The natural phenomena were listed and recorded using photograph for further analysis and discussion.

Second, we describe the Customer Satisfaction Index (CSI) and Importance Performance Analysis (IPA). The steps and calculation of importance-performance analysis and the measurement of service quality were evaluated [11]. In such evaluation, we distribute questionnaire to 100 respondents. Three critical aspects in sustainable development concept and issues, namely economic, social, and environmental, were asked to the respondent. The economic value of incentive system was analyzed by incorporating two aspect, namely direct and indirect funding. There are three components to assess social aspect, namely rewards, increase capacity, and social service. In order to assess the environmental factor, physical development and physical maintenance become two aspects which were assessed.

### **Customer Satisfaction Index (CSI)**

The first step to calculate CSI is identifying Mean Importance Score (MIS) and Weight Factors (WF) per variable. It was followed by calculating Mean Satisfaction Score (MSS) of each attributes. These were calculated using standard formula [12].

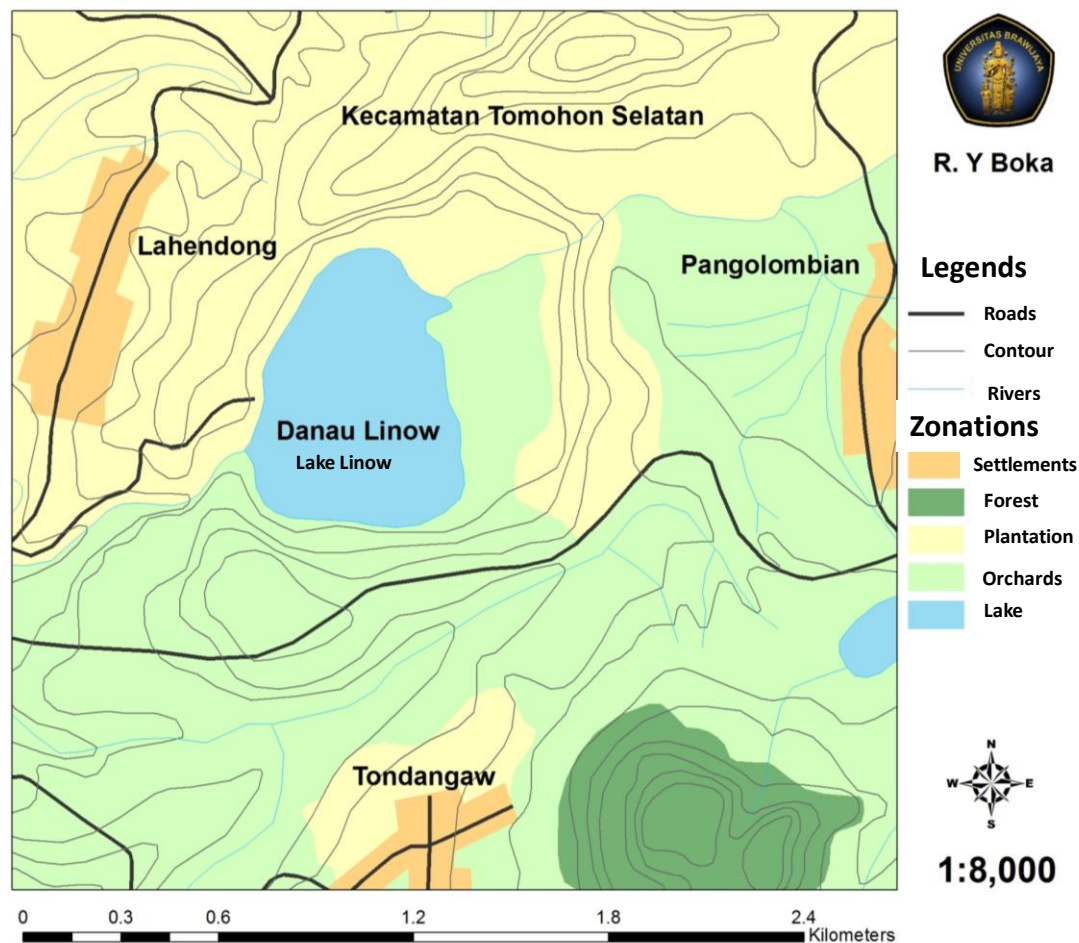


Figure 1. Land Uses Profile of Area Surrounding Lake Linow

$$CSI = \frac{\sum_{k=1}^p WS_k}{HS} \times 100\%$$

Description:

p = Importance attribute p  
HS = Highest scale  
WSi = WFi x MSS

#### Importance Performance Analysis

Importance Performance was analyzed using Cartesius diagrams. Importance Performance Matrix is divided into four quadrants based on importance-performance measurement result, namely Quadrant I Concentrate Here (High importance, Low satisfaction), Quadrant II Keep up the good work (High Importance, High Satisfaction), Quadrant III Low Priority (Low Importance, Low Satisfaction) and Quadrant IV Possible Overkill (Low Importance, High Satisfaction). Data was analyzed descriptively.

## RESULT AND DISCUSSION

### Lake Linow Tourism Attraction

Based on the field survey, it is clear that Lake Linow has abundance natural potential attractions. The main natural tourism object is the beautiful green and blue water with agricultural landscapes as a background. The beauty landscape of Lake Linow is the important driving factor in tourism industry in Lake Linow and its surrounding area. The geological phenomena of Lake Linow, i.e. active sulfur bubbling, become the few natural phenomena which found in North Sulawesi and therefore it is become the interested object to visit. Nowadays, the geological phenomena of the particular area have been promoted as an important tourism attraction to support local development. Throughout the world, the geological phenomena has been received a lot of attention from tourist and it is open opportunities for tourism-based geological phenomena to grows [13,14].

In line with natural phenomena of Lake Linow as a potential nature-based tourism attraction, the local government of Tomohon city released pro-tourism policy and strategy which is become the significant keys in local development. Clearly, the policy for tourism development has been cited in Regional Development planning (RPJMD of Tomohon City). There are several aspect of tourism development were accommodated in regional development planning, including road, city parks, tourism information centre, and city transport terminal. Local government also promotes numerous non-physical development program, including community development, tourism promotion, and human resources training. Increasing human resources and local people capacity related to tourism sectors has expected high, but in reality the implementation of capacity building was low. In this case, the accommodation of tourism development in regional development planning was common in many countries, including Indonesia. Regional development provides important frame work for tourism development in integrated methods, and therefore received a lot of support from related sector [15,16].

#### Stakeholder Perception

Stakeholder perception to the implementation of incentive-disincentive systems in Lake Linow was given in Table 1. Based on the calculation, it is clear that the highest satisfaction index was found about direct funding support (3.52%). Direct funding support policy is become the most preferred form of incentive systems.

Society argues that direct funding support is important for development. It can be accepted as a general views among local people in developing countries where direct funding support is preferred due to its flexibility in usage. Respondent argues that direct funding support is one of the representations of decentralization policy in development. The second satisfaction was physical development. Based on the field survey, physical development relatively done to complete and support city dwellers live in Tomohon City. In the local budget development (APBD) budget structure, the allocation for infrastructure development is one of the highest budget sector. Totally, it was about 25.72% of the local budget development (APBD) of Tomohon city.

The expectation of respondent was high, but in reality there are problems of tourism facility physical maintenance. Basically, it is the problem of development in developing countries [17,18]. Maintenance infrastructure is part of the long term strategy of sustainability, and therefore has important part in regional development. In many countries, however, it is very hard to get support for physical maintenance. In many developing countries, the problems of infrastructure maintenance was very complicated [19]. In Indonesia, infrastructure budget was limited while number of area which are need infrastructure was very large. The maintenance of infrastructure therefore are facing serious problems. In such a case, however, the contribution and participation of community surrounding tourism destination was important.

**Table 1.** Stakeholder Perception to the Implementation of Incentive-Disincentive Systems in Lake Linow

Aspects		Form	Average (%)		
Perception		Form	Aspect	Satisfaction	
Economy	Direct funding	3.52	3.00	2.72	
	Indirect funding	2.48			
Social	Rewards	2.62			
	Increase capacity	2.39	2.34		
	Social service	2.00			
Environment	Physical development	3.14	2.83		
	Physical maintenance	2.51			
Expectation		Form	Aspect	Interest	
Economy	Direct funding	3.64	3.66	3.75	
	Indirect funding	3.68			
Social	Rewards	3.75			
	Increase capacity	3.83	3.80		
	Social service	3.82			
Environment	Physical development	3.77	3.79		
	Physical maintenance	3.80			

**Table 2.** Tourism Performance Following Customer Satisfaction Index (CSI) Assessment

Incentive	Mean Importance Score	Weight Factors (%)	Mean Satisfaction Score (WF x MSS)	Weight Score	CSI
Direct funding	3.64	13.86	3.52	0.49	0.10
Indirect funding	3.68	13.98	2.48	0.35	0.07
Rewards	3.75	14.25	3.75	0.37	0.07
Increase capacity	3.83	14.57	2.39	0.35	0.07
Social service	3.82	14.51	2.00	0.29	0.06
Physical development	3.77	14.36	3.14	0.45	0.09
Physical maintenance	3.80	14.47	2.51	0.36	0.07
Total	26.28	100			<b>0.53 moderate</b>

The local government of Tomohon should be systematically plan the community based tourism in order to enhance sustainable tourism practices in Lake Linow. Scholar point out that human capacity development is the crucial aspect in tourism destination planning and development [20,21].

#### Customer Satisfaction Index (CSI)

Overall the Customer Satisfaction Index of Lake Linow tourism implementation was moderate (Table 2). This result is relevant with stakeholder's recommendations that local government should intensively increase quality of tourism infrastructure. In Tomohon, tourism is in the stage of initial development. In the stage of initial development, tourism has been grows but infrastructure support were limited. By far, the most significant triggering factors for the infrastructure development were the development of agribusiness, not tourism sectors. In Tomohon, the important economic and industrial activity is related to the agricultural activity

provide qualified services and attract investors. Local government should be increase social services as an integral strategy for tourism development.

Gap analysis is one of the important instruments in business strategy which allows government and industry to solve weaknesses in order to increase competition [24]. There are crucial issues on physical infrastructure maintenance which are important in sustainable tourism destination issues. In such a case, local government argues that limitation for infrastructure maintenance related to the limited budget to maintain infrastructure. There is widespread believed that the infrastructure maintenance is one of the responsibility of central government. However, the support of central government also limited. Funding for infrastructure maintenance has been a major uncertainty [25]. Other problems related to human capacity development are also important to increase tourism destination competitiveness.

#### Gap Analysis

The highest problems and gaps related tourism development is associated to the social service (2.00%) (Fig.2). Stakeholder argues that social service of tourism planning and implementation facing problems in multi sectors, including service of legal permission in administration aspect to program implementation in the field. Social services are the most fundamental problems in development, including in tourism industry. Poor social services is complex phenomena, bringing numerous issues such as poor infrastructure and facility, low capacity of human resources, and administration systems [22,23]. In case of Lake Linow tourism development, the problems of social service can be found in administration related tourism industrial permits. Social services are the mirror of local government capacity, commitment to

#### Importance Performance Analysis

Based on the Importance Performance Analysis diagrams, social services (social aspect), physical infrastructure maintenance (environment), and rewards (social aspect) need to be improved significantly. The highest expectation of stakeholder in social service were common aspect in tourism industry. Tourism is industry where it growth and success ultimately depend on the hospitality and standard value of services [26]. The low social service were shown related to the human capacity, i.e. limited number of capable and professional staff, well educated tourism practitioner, capacity and leadership. The low social services also related to the low community involvement and contribution in tourism development. The improvement of such sector is significant in order to create Lake Linow as competitive tourism destination, both in domestic and international tourist (Fig.3).



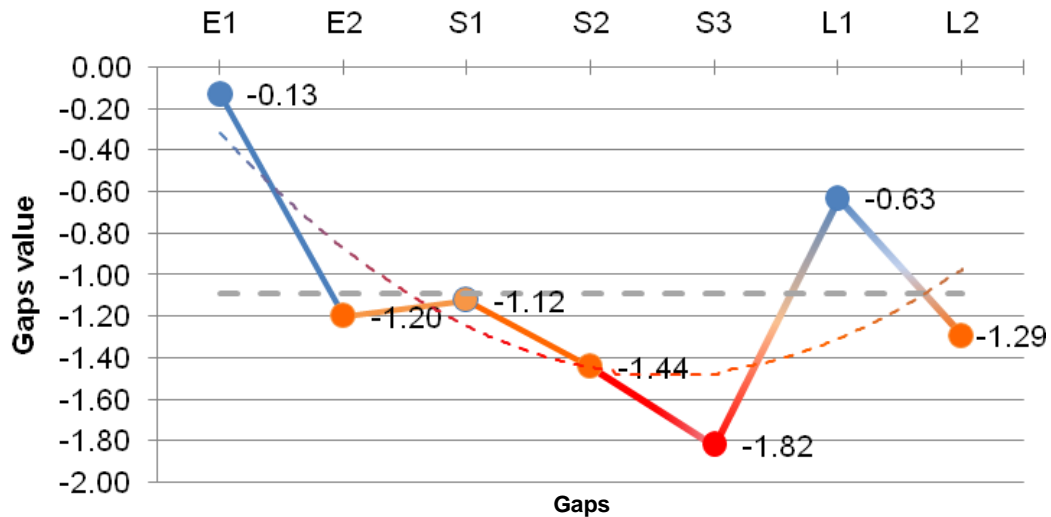


Figure 2. Gap Analysis between Perception and Expectation among Economy (E1, E2), Social (S1, S2, S3) and Environment (L1, L2) in Lake Linow

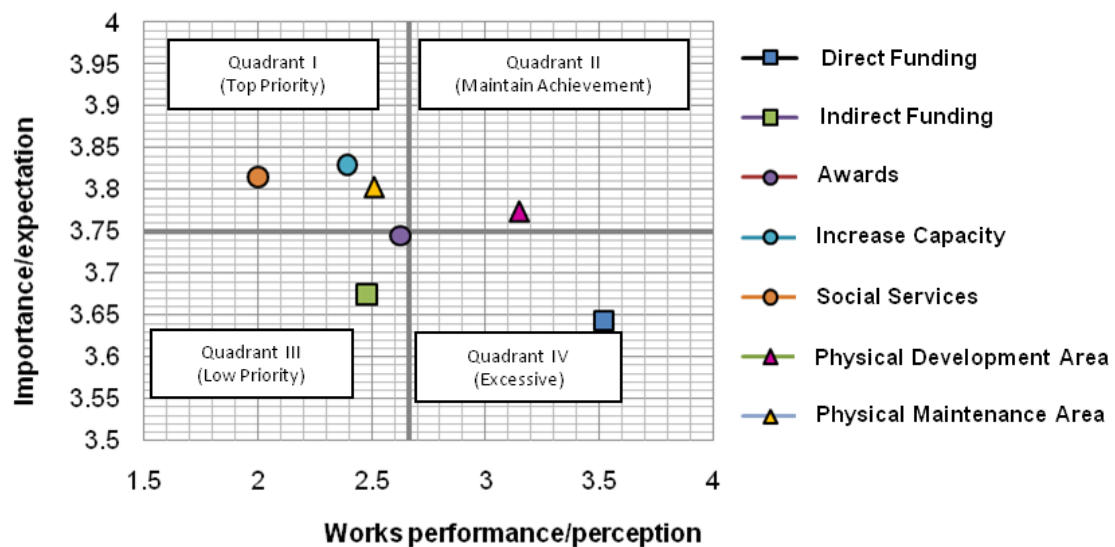


Figure 3. Importance Performance Analysis (IPA) of Tourism Development in Lake Linow

Overall, this study shows that there are gap between tourism planning and implementation in Lake Linow. In many developing countries, it is common as a result of complex problems, namely funding support, policy for sustainable development, human resources capacity, available technology, and lack of local community participation. The development of Lake Linow as a competitive and sustainable tourism destination has been received widespread support, especially from local government. The contribution of local people however, should be promoted intensively.

## CONCLUSION

The development of tourism in Lake Linow potentially affects land use changes and therefore tourism development should be managed properly. The incentive-disincentive system is one of the instruments to maintain natural resources use in sustainable manner. The highest problems and gaps related tourism development related to the social service. There is high expectation in social services, but low in perception. The highest expectation of stakeholder in social service was common aspect in tourism industry. Tourism is industry where it growth and success ultimately depends on the on hospitality and standard value of services.

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## REFERENCES

- [1] Neto, F. 2003. A new approach to sustainable tourism development: moving beyond environmental protection. *Natural Resources Forum* 27(3), 212-222. Blackwell Publishing Ltd.
- [2] Palmer, T. and A. Riera. 2003. Tourism and environmental taxes: with special reference to the *Balearic Ecotax*. *Tourism Management* 24(6), 665-674.
- [3] Spenceley, A. 2005. Nature-based tourism and environmental sustainability in South Africa. *Journal of Sustainable Tourism* 13(2), 136-170.
- [4] Walpole, M. J. and H. J. Goodwin. 2001. Local attitudes towards conservation and tourism around Komodo National Park, Indonesia. *Environmental Conservation* 28(2), 160-166.
- [5] Shalaby, A. and R. Tateishi. 2007. Remote Sensing and GIS for mapping and monitoring land cover and land-use changes in the Northwestern Coastal Zone of Egypt. *Applied Geography* 27(1), 28-41.
- [6] Republic of Indonesia Law. No. 26 of 2007 on Land Use Planning.
- [7] Ross, S. and G. Wall. 1999. Evaluating ecotourism: the case of North Sulawesi, Indonesia. *Tourism Management* 20(6), 673-682.
- [8] Hakim, L., Soemarno and Sk. Hong. 2012. Challenges for conserving biodiversity and developing sustainable island tourism in North Sulawesi Province, Indonesia. *Journal of Ecology and Environment* 35(2), 61-71.
- [9] Whitten, T., M. Mustafa and G. S. Henderson. 2002. *Ecology of Sulawesi Vol. 4*. Tuttle Publishing.
- [10] Pioh, D. D., M. L. Rayes, B. Polii and L. Hakim. The classification and characteristics of soil surrounding lake ecosystem as a basic consideration in agrotourism development in Linow Lake, North Sulawesi. *IOSR Journal of Agriculture and Veterinary Sciences* 7(5), 30-38.
- [11] Ennew, C. T., G. V. Reed and M. R. Binks. 1993. Importance-Performance Analysis and the measurement of service quality. *European Journal of Marketing* 27(2), 59-70.
- [12] Aritonang, R. L. 2005. *Pemasaran jasa dan kualitas pelayanan*. Bayumedia Publishing. Malang.
- [13] Newsome, D. and R. Dowling. 2006. The scope and nature of geotourism. *Geotourism*. Elsevier Butterworth Heinemann. Oxford, 3-25.
- [14] Farsani, N. T., C. Coelho and C. Costa. 2011. Geotourism and geoparks as novel strategies for socio-economic development in rural areas. *International Journal of Tourism Research* 13(1), 68-81.
- [15] Inskeep, E. 1991. *Tourism planning: an integrated and sustainable development approach*. Van Nostrand Reinhold.
- [16] Cawley, M. and D. A. Gillmor. 2008. Integrated rural tourism: concepts and practice. *Annals of Tourism Research* 35(2), 316-337.
- [17] UN. 1979. *Guidelines for rural centre planning*. UN - Economic and Social Commission for Asia and the Pacific. New York.
- [18] Jimenez, E. 1995. Human and physical infrastructure: public investment and pricing policies in developing countries. *Handbook of Development Economics* 3, 2773-2843.
- [19] Sohail, M., S. Cavill and A. P. Cotton. 2005. Sustainable operation and maintenance of urban infrastructure: myth or reality?. *Journal of Urban Planning and Development* 131(1), 39-49.
- [20] Baum, T. 1993. *Human resource issues in international tourism*. Butterworth Heinemann Ltd.
- [21] Aref, F. 2011. Barriers to community capacity building for tourism development in communities in Shiraz, Iran. *Journal of Sustainable Tourism* 19(3), 347-359.
- [22] Anand, S. and M. Ravallion. 1993. Human development in poor countries: on the role of private incomes and public services. *The Journal of Economic Perspectives*, 133-150.
- [23] O'Brien, R. (Ed.). 2000. *Contesting global governance: multilateral economic institutions and global social movements*, Vol. 71. Cambridge University Press.
- [24] Brown, S. W. and T. A. Swartz. 1989. A Gap Analysis of professional service quality. *The Journal of Marketing*, 92-98.
- [25] Ng, M., D. Y. Lin and S. T. Waller. 2009. Optimal long-term infrastructure maintenance planning accounting for traffic

- dynamics. *Computer-Aided Civil and Infrastructure Engineering* 24(7), 459-469.
- [26] Weiermair, K. 2000. Tourists' perceptions towards and satisfaction with service quality in the cross-cultural service encounter: implications for hospitality and tourism management. *Managing Service Quality: An International Journal* 10(6), 397-409.

## River, Culture and Tourism in Lok Baitan, South Kalimantan

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### Abstract

River become integral part of the Banjarese live in Lok Baitan, South Kalimantan. The economic value of the river has been reported very high. River is a habitat for numerous fishes which are important for local people along rivers. Rivers also provide corridor for people movement. Rivers also place for economic activity. Floating market is a market located at rivers with traditional trader and seller equipped by traditional boat called *Jukung*. Along the Barito River, floating market point found in two place, Muara Quin and Lok Baitan. Fruit and vegetables are become the main items in traditional floating market in Lok Baitan. Floating market has its special value for tourism attractions. Continued decrease of youngest generation to the river-based culture economic activity has been the central aspect of the future of floating market. This situation is different for modern market, which is interested among young generation in south Kalimantan. This issue is still present and will remain of great importance in the future of floating market.

**Keywords:** culture preservation, floating market, river conservation, South Kalimantan.

### INTRODUCTION

River is an important aquatic ecosystem in the earth. River in the earth is one of the important components of landscape with its wide ecological and social role in the daily life of human being. River is habitat for numerous aquatic fauna, ranging from micro-fauna to macro-fauna which are easily found and observed live in rivers. There are numerous animal, ranging from invertebrates to vertebrates environment. The earth gravity facilitates water movement from headwater in the mountains or high land to the ocean. The process, however, depends on the vegetation quality on earth surface. The conservation of forest therefore contributes significantly in water and rivers ecosystem existence on the earth [1].

In the perspective of anthropocentrism, rivers are important resources to support numerous human activities, ranging from pool of resources which are able to consume to aquatic ways to facilitate human movements. River provides special space for local economic activity. The uses of rivers, however, have been reported unsustainable and lead to the rivers ecosystem disturbance. Scholar point out that many rivers in the world have been widely polluted by numerous toxic substrate, solid waste and liquid waste. In the perspectives of river biology, these disturbances lead to the river species population changes in structure and composition, local spe-

cies extinction and invasion of exotic species. The pollution of numerous toxic substrate lead to the decrease of ability of river to provide fresh water for human and wildlife. Vegetation disturbance has been reported contributes to the decrease of water spring and therefore decrease ability of river to provide water [2,3].

The importance of rivers in human life have been reported by numerous authors. Rivers become part of basic aspect to construct community culture. River based culture can be found in every where in the world. For instance, in Indian culture, three rivers namely Gangga, Yamuna and Saraswati were viewed as a representative of the divinity trinity. Saraswati represents the existence of Brahma, Yamuna represents the existence of Vishnu, and Gangga represent the existence of Shiva [4]. In numerous traditional communities in developing countries, some part of the rivers believed as home of the unseen creature. In Java, river has special value and believed as home of unseen creature. Therefore, people should be respect to some place in the rivers ecosystem [5].

In this modern era, river still plays an important role for water-based transportation. Both in modern and developing countries, the role of river to facilitate people moving still dominant. In remote area, river replaces the role of terrestrial road which are costly to establish. Many city and human settlements located along the river flow represent the important value of rivers in human life. The benefit of the place location near the river is the availability of people moving from one site to other sites.

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River as a natural resource for tourism has been widely reported. Rivers is an important ecosystem to support tourism destination sustainability. Health river provides health water for tourism. Availability of water is crucial in tourism. In the urban area, river is one of the crucial components of urban landscape which area provides special place for urban recreation.

Lok Baitan floating market located at Lok Baitan Village in Sungai Tabuk Sub-district in Banjarese Regency, South Kalimantan. The market has been knows as one of the Banjarese culture in human-economic activity. The aim of the paper is describes the floating market of Lok Baitan, South Kaliman and its potential as tourism attractions. Focus of discussion was to describe the natural and cultural aspect of floating market at Lok Baitan.

#### Rivers in South Kalimantan

River is one of the important ecosystem in Kalimantan Island. The ecological function of river has been describes by numerous authors. The roles of river can be classified into three basic categories namely rivers as natural resources as habitat for biota, a media for connectivity, energy, materials, and organisms exchange, and an geomorphical agent for change and disturbance [6]. Rivers ecosystem contributes significantly in the high level of biodiversity in Kalimantan Island, especially aquatic biodiversity. Rivers also maintain wet environment of Kalimantan's land which area crucial for numerous plant species.

About 20 rivers were found in Province of West Kalimantan, 26 river in South Kalimantan, 8 river in Central Kalimantan and 11 rivers in East Kalimantan (Table 1). These rivers has been identified contributes to the daily life of local people and community in Kalimantan Island. The famous and well known rivers are encompasses Barito, Berau, Kapuas River, Kahayan, Lamandau, Mahakam, Martapura, Melawai, Sampit and Sekonyer. Among the ten list of longest river in Indonesia, four rivers were found in Kalimantan Island. It is encompasses Kapuas River (1,143 km), Mahakam River (920 km), Barito River (909 km) and Seruyan River (350 km) [7].

The biodiversity of Kalimantan's rivers was high. Survey by experts in Negara River found about 150 birds species. Mahakam River has received special attention among scholar as a crucial habitat of Pesut Mahakam (*Orcaella brevirostris*), an endemic animals in world. A conducted survey found that Sekonyer Rivers is

home of numerous fish species, including Cyprinidae with ten species, Belontiidae with seven species, Channidae with six, Hemiramphidae with four species and Siluridae with four species [9].

The river in South kalimanan has important value for biodiversity conservation. The rivers in South Kalimantan is home of endemic primate called *Nasalis larvatus*. This species has been known endemic to South Kalimantan. In some area, peat swamp forest which are related to the rivers ecosystem in South Kalimantan is home of numerous species such as *Xylopia* sp., Tarantang (*Comnaperma* sp.) and Nipah (*Nipah fruticans*). The river in Kalimantan is also important habitat for crocodile, an important predator in Kalimantan rivers and estuary ecosystem. These data shows that rivers in Kalimantan was important habitat that support biodiversity.

#### River and Human in Kalimantan

River is an integral part of human life in Kalimantan Island. The original local people in Kalimantan consist of five different groups of community based o the culture, namely Dayak, Banjar, Kutai and Paser [10]. The local people of Kalimantan, called Dayak, absolutely depend on rivers. There are six cluster of Dayaks, namely Ot Danum-Ngaju, Apokayan (Kenyah-Kayan-Bahau), Iban, Murut Klemnatan and Punan. Dayaks often found in the Central of Kalimantan Island. Banjarese occupied Southern area of Kalimantan regions and some coastal area of the island.

Traditionally, Dayaks is the semi nomadic indigenous group in Kalimantan forest. Agriculture become a central part of the Dayaks livelihoods systems. More recently numerous people from Java, Sumatra, Sulawesi and other region in Indonesia come to Kalimantan. Javanese migrates came in such substantial number that they now dominant population in some urban area, such as Balikpapan and Samarinda in East Kalimantan. They uses resources in varying degree, depend on the knowledge and skill levels. Local people in Kalimantan often uses traditional knowledge and local wisdom to use natural resources [11].

An interesting aspect of the local people in Kalimantan is its relationship with river. Rivers is one of the important corridors for Kalimantan local people in movement. Rivers connect numerous communities in Kalimantan Island and therefore contribute significantly in community relationships.



**Table 1.** The Rivers of Kalimantan Island

West Kalimantan	South Kalimantan	Central Kalimantan	East Kalimantan
Air Hitam	Aingbantai	Kahayan	Angisa
Beliang	Alalak	Kalanaman	Bahau
Embuan	Amandit	Katingan	Bani
Ensabal	Asam-asam	Lamandau	Berau
Jelai	Ayu	Mendawai	Kayan
Kapuas	Baharangan	Pembuang	Mahakam
Landak	Balangan	Sampit	Senyur
Melawi	Barabai	Seruyan	Sesayap
Meliau	Barito		Telen
Mengkiang	Batulicin		Wahan
Mempawah	Cegal		Sembakung
Muna	Lilin		
Kedukul	Gelombang		
Paloh	Haruan		
Pawan	Jaing Jangkung		
Sambas	Kurambu Kusan		
Saju	Martapura		
Sekajam	Negara		
Sengarit	Pitap		
	Riam		
	Satui		
	Tabalong		
	Tabuan		
	Tapin		

The remotes rural dwelling population along rivers live at great distance from city. Therefore has limitation in health, education, economic, and official infrastructure and facility [12].

The economic value of the river has been reported very high. Collecting fish is an important economic and subsistence activity among local dweller along rivers. The fishing methods practiced by local people were very traditional, without modern equipment. Among Dayaks community, man often spend a lot of time to collect fish in the river. Dayaks women involved in agriculture production, and sometimes collect fish in the river. Some of the collected fish from river are consumed by household, and the rest are sold locally in the near market. Some fishes were collected for subsistence. Some fish has the greatest market values, such as Patin (*Pangasius mahakamensis*), Saluan (*Rasbora* sp.), Sepat (*Trichogaster* sp.). Local people recognize the various fish species which have market value. Few studied has been conducted to document the fish collection by local people in Kalimantan's rivers.

River provides numerous resources to meet proteins. Compared to the mammals hunting, however, fishing provides less protein. In Kalimantan, however, fishing still become the important adaptation of human to get proteins. Some fish such as Pepuyu, Haruan, Lais (*Ompok hypophthalmus*), Patin (*Pangasius mahakamen-*

*sis*), Saluan (*Rasbora* sp.), Sepat (*Trichogaster* sp.), Belida (*Chitala chitala*), Jelawat (*Leptobarbus hoevenii*), Kendia (*Thynnichthys polylepis*), Pari (*Himantura polylepis*), Baoun (*Mytus nemurus*) and Galah Mahakam shrimp (*Macrobrachium rosenbergii*) are the preferred aquatic biota in rivers ecosystem. Fishing is mostly done by men. The local people who live along river followed the same fish collection strategies. It is characterized by the use of traditional equipment.

River has been viewed as home of the ancestors, unseen creators or supra-natural being. It is common among community in developing countries, including people in Kalimantan Island. Local people respect to the rivers represent the harmonious relationship between river and human. Some activity in rivers was taboo and will cause sickness. Some place in the river area guided by ancestor or supra-natural being. The proclamation of taboo area by elder or community leader was followed by community. It is significant to protect biodiversity of river. Permission to access taboo area may be granted to particular community member for special purposes. Flooding, disease and some problems related to the live in river ecosystems was perceived to be caused by the failure of community to keep harmonious live of the rivers. Recent modernization however, changes human and rivers relationship. The changes has

numerous impact, including less appreciation to the rivers. Recent indigenous people in Kalimantan shifting rapidly from traditional to modern life. The important of indigenous knowledge has been decreased significantly. Among young generation, this usually involve changing a spirit to nature and culture.

Many rivers in Kalimantan recently threatened mainly by sedimentation, pollution, and degradations. This is occurs in many big and important rivers which area interact with human life, such as Barito, Mahakam, Asam-asam and Sampit. Scholars point out that the recent industrialization contributes significantly to the water quality of river. This is especially occurs in along the urbanized area. Land uses changes dues to the rapid and massif mining also contributes to the rivers degradations. Most of the recent degraded forest area are located along rivers. The consequences of the logging in the central part of the island has been severe, especially to river quality [12,13].

#### **Floating market: the cultural aspect**

Banjarese is one of the dominant local community in South Kalimantan. Trading is an important activity for the Banjarese in Lok Baitan and its surrounding area. Many local people who live along river in South Kalimantan depend on trading and farming to supply numerous resources. The Banjarese along rivers, especially Barito River and Martapura River, has been involve in floating market system since fifteenth century.

Trade is an integral part of the local economic system, and trading activity on rivers is common in South Kalimantan. Several factors contribute to the development of floating market activity among Banjarese in South Kalimantan. There are the interrelationship among available space, transportation and movement media, economic and culture. The limited accesses to the land as market lead to the intensive use of rivers as market place. The floating market is the adaptation of Banjarese live in the limited market infrastructures in the past.

The Banjarese, who are reside along the Barito River in South Kalimantan are among the residential group involve in floating market activity. Selling point are located at some places, such as Muara Quin and Lok Baitan. Women play an important role in floating market. Women is dominant participant in floating market, both as trader or consumer. Women used traditional boat called *Jukung* to sell numerous commodity

which were produced from home garden. Some fruit commodity has highly depend on the season. Barter among trader are still common.

Fruit and vegetables are become the mains items in traditional floating market in Lok Baitan. Depending on the season, fruits are vary in species and number. Fruit and vegetables are by far is the most significant commodity. Trader sold self-produced fruit and vegetables from home-gardens. Depending on the amount of commodity, women spend between four to seven hour to sold their commodity in floating market.

#### **Rivers as Tourism Attraction**

Tourism widely recognized as an important factor to trigger local economic development. In the recent decades tourism grows significantly and it is become opportunities for countries with natural and cultural resources to involve in tourism industry. Numerous natural capital has been involved in tourism industry such as lake, mountain, waterfall, water spring, beach and ocean. Place with beauty landscape is the potential site for nature based tourism destination.

The use of rivers ecosystem in tourism industry widely reported. Rivers is an important natural resources for tourism. Some rivers have been used as part of the attraction of tourism destination. In Thailand, there are about 25 rivers with floating market attraction which are a able to generate economic income from tourism sectors. Thailand is very active to increase the environmental services for tourism development [14].

The development of rivers as tourism attraction should be following ecological and social principles. It is because river is a fragile ecosystem and habitat for people which area depend on rivers. The sustainable uses of rivers as tourism attraction are following three principles of development, namely considering social, economical and environmental aspects in the river development.

#### **River, Culture and Tourism in Lok Baitan Floating Market**

Understanding the relationship of river, culture and tourism is a key for sustainable tourism destination, especially in rivers ecosystem. An underlying assumption is that in tourism industry, rivers as part of the natural resources and culture provides unique attraction for destination. Destination without natural and cultural resources are likely to lack power in the recent

tourism destination competitiveness. More recently, a positive and mutual correlation between culture and tourism has been described [15]. An example of the integration of river, culture and tourism was found and observed in India.

Several aspect may alter river based culture via the decrease of local appreciation to the river and its human culture. The rapid modernization has created river based culture in the recent era, and therefore it is negative to the future tourism development. Several issues should be implemented are encompasses:

- Cooperation among stakeholder in planning the use and conservation of river
- Commitment among local people, government and stakeholder to share the cost and benefits of the effort to conserve rivers
- Increase local participation in rivers conservation
- Creation of more innovative economic activity
- Willingness among stakeholder to support local conservation

Community participation in community based tourism is very low. Provincial government institution generally fails to take any initiative and programs to ensure community participation in tourism development. Similar lack of attention for community based tourism concern also exist at the level of local government and tourism stakeholder. In developing countries, the most successful community based tourism implementation seem to have supported by both international and national NGOs.

A remarkable recent aspect of trade is its relationship with regeneration. Continued decrease of youngest generation to the river-based culture economic activity has been the central aspect of the future of floating market. Young women participation and involvement is very low. This situation is different for modern market, which is interesting among young generation in south Kalimantan. This issue is still present and will remain a great important issue in the future of floating market. There is lack of attention for river based culture education. Numerous NGOs that have worked in Kalimantan Island were primarily worked in nature conservation, especially forest protection. In the future, therefore, it is important for NGOs to preserve floating market in South Kalimantan.

## CONCLUSION

Rivers plays an important role in Banjarese community in North Kalimantan. The economic value of the river has been reported very high. River is a habitat for numerous fishes which area important for local people along rivers. River also provide corridor for people movement. Rivers also place for economic activity. Floating market is a market located at rivers with traditional trader and seller equipped by traditional boat called *Jukung*. Along the Barito Rivers, floating market point found in two place, Muara Quin and Lok Baitan. Fruit and vegetables are become the mains items in traditional floating market in Lok Baitan. Floating market has its special value for tourism attractions. Continued decrease of youngest generation to the river-based culture economic activity has been the central aspect of the future of floating market. This situation is different for modern market, which is interesting among young generation in south Kalimantan. This issue is still present and will remain of great important issue in the future of floating market.

## REFERENCES

- [1] Wetzel, R. G. 2001. Limnology: lake and river ecosystems. Gulf Professional Publishing.
- [2] Galay, V. J. 1983. Causes of river bed degradation. *Water Resources Research* 19(5), 1057-1090.
- [3] Karr, J. R. 1999. Defining and measuring river health. *Freshwater Biology* 41(2), 221-234.
- [4] Ramakrishnan, P. S. 2003. The sacred Ganga river-based cultural landscape. *Museum International* 55(2), 7-17.
- [5] Whitten, A. J. R. E. Soeriaatmadja and S. Afiff. 1996. The ecology of Java and Bali. Periplus. Singapore.
- [6] Sponseller, R. A., J. B. Heffernan and S. G. Fisher. 2013. On the multiple ecological roles of water in river networks. *Ecosphere* 4(2), 17.
- [7] Central Statistic Office. 2014. River in South Kalimantan. *Central Statistic of South Kalimantan*.
- [8] van Balen, B. and C. Prentice. 2011. Birds of the Negara River Basin, South Kalimantan, Indonesia. *Kukila* 9, 81-107.
- [9] Nurudin, F. A. 2013. Keanekaragaman jenis ikan di Sungai Sekonyer Taman Nasional Tanjung Putting Kalimantan Tengah. State University of Semarang. Semarang.

- [10] Syamsuddin, H. 2004. Desentralisasi dan otonomi daerah: naskah akademik dan RUU usulan LIPI. Yayasan Obor Indonesia. Jakarta, 188.
- [11] MacKinnon, K. 1996. The ecology of Kalimantan, Vol. 3. Oxford University Press.
- [12] Gastaldo, R. A. and A. Y. Huc. 1992. Sediment facies, depositional environments, and distribution of phytoclasts in the Recent Mahakam River delta, Kalimantan, Indonesia. *Palaos*, 574-590.
- [13] Douglas, I., T. Greer, K. Bidin and M. Spilsbury. 1993. Impacts of rainforest logging on river systems and communities in Malaysia and Kalimantan. *Global Ecology and Biogeography Letters*, 245-252.
- [14] Boonratana, R. 2010. Community-based tourism in Thailand: The need and justification for an operational definition. *Kaset-sart Journal: Social Sciences* 31(2), 280-289.
- [15] Butler, R. and T. Hinch. 2007. *Tourism and indigenous peoples: Issues and implications*. Routledge.

## Preference of Tourists toward Peace Tourism Product for Ground Zero Monument in Kuta Bali

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### Abstract

The purpose of this study is to analyze the preferences of tourists toward the development of Ground Zero Monument as a peace tourism product in Kuta Bali. Samples of research is determined by purposive sampling, as many as 100 tourists. Data was analyzed by method of conjoint analysis. The results showed that it is necessary to offer statue of monument (miniature) and the history book of monument as a souvenir for the tourists, provide adequate monument facilities, give a special place for tourists to pray, package products to accommodate the values of peace symbols, design package monument tour that is interesting for the tourist by providing interpreters (guides to explain the monument), and it is not necessary to provide the transportation for the tourist because they are more likely to use private transport. While the level of interest rates in the product of peace tourism in Monument Ground Zero from highest to lowest based on the attribute utility value is as follows: souvenirs (16.509%), physical attractiveness (15.775%), services (14.889%), non-physical attractiveness (14.461%), facilities (13.820%), attractions (12.648%), and transports (11.898).

**Keywords:** Monument, Peace, Preferences, Tourism, Tourists.

### INTRODUCTION

The development of peace through tourism in the history of academic is slightly created by tourism experts. One expert who studied peaceful tourism is Salazar in 2006 to focus his studies on Building a Culture of Peace through Tourism [1]. In addition to these ideas, opinions in building peace tourism also are proposed by the two national leaders: firstly, the former of President Megawati Sukarno Putri introduce peace through tourism in grand event ATF (Asian Tourism Forum) in Yogyakarta in 2005. While President Susilo Bambang Yudhoyono provides an appreciation of tourism, that peace can be achieved through the development of tourism. The presidential statement was delivered at the inauguration of the Institute of Peace and Democracy [2].

Tourism Destination of Kuta is one of the most famous of tourist attraction in Bali and is one of a magnet for foreign tourists who have been known since the early history of the development of tourism in Bali (since 1920). Kuta as excellent tourism destination in Bali is appropriate as a trade mark and a window in the international tourism in Bali (The Window of Tourism for Bali)[3]. Exploring and packaging of peace potential as a new tourist product that is

used to counterweight cover the condition of current Kuta tourism. Some research suggests that Kuta has a relatively high crime rate [4]. Besides these findings, there are some negative impacts of tourism on the Kuta communities are: people's lifestyles tend to imitate western style, collectivity replaced individual characters, transformation of land, and unfair competition in the business world [2].

Both study of tourism from the positive and negative impacts related to socio cultural and economic. Infact there are still opportunities in the Kuta area to build tourism that leads to wisdom (peacefulness) and uniqueness of the local communities. There are several reasons that reinforce those reasons, i.e. their history of inter-ethnic acculturation, the establishment of Ground Zero monument as a monument of peace, and the high activity of the traditions and the application of philosophical values of resident. Exploring the potential of new tourism particularly on community value and essence in tourism, showed fundamental change from the stage of tourism development which often popularized by the tourism style [5]. It used to lead to the development of mass tourism, furthermore became tourism treat which leads to utilization of culture quality (cultural tourism). This change does not stop at the central, but also experienced a shift towards creativity in new venture packaging business on tourism. The real packaging leads to new experiences based products of peace tourism.

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It is very necessary to conduct research related to humanitarian values (humanist) such as: solidarity, justice, harmony, democracy, and friendship through the utilization of Ground Zero Monument to serve as a symbol of peace for the development of tourism towards peace in tourism destination of Kuta. Thus the monument is not only longer remembered as the place gave rise to hatred and revenge, but it could be self-introspection to develop tourism in accordance with the values and culture of nation. It is also learn to a sense of compassion with echoes of peace through tourism development. Based on that systematic thinking, the aim of this study is to analyze the preferences of tourists through tourism products of peace in Ground Zero Monument Kuta Bali.

## **MATERIALS AND METHODS**

This research was conducted at Ground Zero Monument in Kuta, Badung Regency, Bali Province. There are several reasons for choosing the location of this research: this monument as the only memorial Bali bombing tragedy; Kuta as an excellent tourism destination in Bali, Kuta has heterogeneous society; Kuta known as a friendly and exotic destination; and the monument is visited by many tourists both domestic and foreign.

Preferences of tourists against peaceful tourist product are a package of products/services both physical and nonphysical which will be offered to tourists at Ground Zero Monument. The limitation of study variables tourists preference againts peacefully tourism products which can be divided into several parts such as: seven (7) variables and 14 (fourteen) indicators (Table 1). The number of variables included: (1) physical attractiveness (design and arrangement of the monuments and architectural monuments; (2) non-physical attractiveness (pluralism and harmonization and a symbol of peace); tourism activities (praying and sightseeing); facilities (public and monuments); transport (public transport and private vehicles); souvenirs (CD & t-shirt monument and miniature monuments and history); services (interpreter (guides) and individually.

The analysis used in this study is the conjoint analysis. A very precise conjoint analysis is used to examine the effects of the attributes of an object or service simultaneously to the person's preference for certain objects or services [6]. While other study explained conjoint is an attempt to evaluate the value of the product/

service/idea (real or hypothetical) by combining a number of value offered of each attribute [7]. Basically utility is the concept of measuring the value of conjoint analysis, the evaluation is unique from every individual subjectively. In the conjoint analysis, the utility is using the assumptions underlying the value in each level in every attribute and shows how the interrelationships utility formulated for combination of many attributes. To facilitate this research analysis process is assisted by using SPSS version 19.

**Table 1.** The Variables of Research

<b>Attribute</b>	<b>Level</b>	<b>Sub-attribute</b>
Physical	1	A1. Monument Design
Attraction	2	A2. Monument Architure
Non Physical	3	B1. Pluralism dan Harmonization
Attraction	4	B2. Symbol of Peacefullness
Tourism	5	C1. Prayer
Activities	6	C2. Sightseeing
Facilities	7	D1. Public
	8	D2. Monument
Transporta-	9	E1. Public Transport
tion	10	E2. Private Vehicle
Souvenir	11	F1. CD and Monument T-Shirt
	12	F2. Miniature of Monument and History
Services	13	G1. Interpreteter (Guide)
	14	G2. Individually

## **RESULT AND DISCUSSION**

### **Peace Tourism**

Peace cannot be seen directly and relatively is difficult for measuring. However, peace can be interpreted as an action/behavior that the absence of war, terrorism, and violence. This view is completed by giving a definition that peace of tourism (tourism peace) is a new concept in the scientific of tourism. Peaceful tourism can be defined as a freedom, peace and without wars are constructed from inner peace, natural environment and God [1].

Tourism is very potential made an effort to promote the value of peace to the local community. For example, the tourism activity was found to reduce inter-state conflict between South Korea and North Korea [8]. The good ways to create peacefulness is to build tourism through making combination strategy of government policy, political and cultural values [9].

Other finding about the definition of peaceful tourism is tourism development that accelerates mutual understanding in the society [10]. Tourism development that takes into account the strength of tourism will be able to help human kind to a life of peace and harmony.

### Tourist Preference for Peace Tourism Products

The main analytical tool used in this research is the conjoint analysis. The analysis assumes that peaceful tourist product can be defined as a series of level-specific attributes, as well as utilities tourists choice in all is determined by the partial utilities (part-worth) which further contributed by each level attribute in a peaceful tourist product. This analysis can provide a combination of attributes identifying a peaceful tourism of the most preferred by tourists and the identification of the relative importance of each attribute/variable.

The purpose to limit the number of attributes and the level used to avoid complications in processing the data. With a limited number of tourists it will be easier to choose a combination of stimuli in ranking. In this study, we used seven attributes/variables and 14 sub attribute (level) (Table 2). Possible combinations are formed from different of sub attribute are 128 stimuli.

Theoretically, we should assess 128 stimuli with a combination of attributes each of which is impractical and difficult for the respondent/tourists. Therefore, it is used in a way that is orthogonal procedure (SPSS) to help create a combination of stimuli of 8 possibilities, so not all combinations should be analyzed further (Table 3), thus we found eight stimuli. The stimuli are then represented into eight types of peace tourism products which each have different attribute combinations.

The perceptions of respondents are sorted to mark the types of tourism products peace most preferred (1) to the other tourism products peace least preferred (8). The choosing of tourist is referred to as utility expressed with numbers and forms the basis conjoint in tracking preferences. Tourist preferences in choosing a travel product peacefully found that the attributes and sub-attributes preferred by tourists are as follows.

**Table 2.** Orthogonal Procedure: Stimuli for Preferences of Peace Tourism Product

Stimuli	Physical Attraction	Non Physical Attraction	Activities	Facilities	Transportation	Souvenir	Service
1	Monument Design	Pluralism and Harmonization	Sightseeing	Public	Public Transport	Monument Miniature and History	Individually
2	Monument Architecture	Pluralism and Harmonization	Prayer	Monument	Private Vehicle	Monument Miniature and History	Interpreter
3	Monument Design	Symbol of Peace	Prayer	Monument	Public Transport	Monument Miniature and History	Individually
4	Monument Design	Pluralism and Harmonization	Prayer	Public	Public Transport	CD and Monument T-Shirt	Interpreter
5	Monument Architecture	Pluralism and Harmonization	Sightseeing	Monument	Public Transport	CD and Monument T-Shirt	Individually
6	Monument Architecture	Symbol of Peace	Prayer	Public	Private Vehicle	CD and Monument T-Shirt	Individually
7	Monument Design	Symbol of Peace	Sightseeing	Monument	Private Vehicle	CD and Monument T-Shirt	Interpreter
8	Monument Architecture	Symbol of Peace	Sightseeing	Public	Public Transport	CD and Monument T-Shirt	Interpreter

**Table 3.** Assessment Rating and Utilities General Preferences of Peace Tourism Product

Attribute	Sub-Attribute	Utility	Preference
Physical Attraction	Monument Design	-.067	Monument Design
	Monument Architecture	.067	
Non Physical Attraction	Pluralism dan Harmonization	.210	Symbol of Peacefulness
	Symbol of Peacefulness	-.210	
Tourism Activities	Prayer	-.257	Prayer
	Sightseeing	.257	
Facilities	Public	.302	Facilities of Monument
	Facilities of Monument	-.302	
Transportation	Public Transport	.042	Private Vehicle
	Private Vehicle	-.042	
Souvenir	CD and Monument T-Shirt	.330	Miniature of Monument and History
	Miniature of Monument and History	-.330	
Services	Interpreter (Guide)	-.050	Interpreter (Guide)
	Individually	.050	
(Constant)		4.490	

First, souvenir attribute has the highest percentage of the relative importance (16.51%). Associated with tourists sub attribute that like statues and historical monuments (score of -0.33) more compared with CD and T-shirt Monument (0.33). Second, physical attractiveness with relative importance value 15.78% is the design and arrangement of the monument (0.069) compared with the architecture of the monument (-0.067). Third, the service attribute with 14.89% relative importance, respondents preferred the interpreter services (guides) (-0.050) than self-service by tourists (0.050).

Fourth, non-physical attractiveness relative importance value 14.46% of the respondents preferred the peace symbol (-0.210) than pluralism and harmonization (0.210). Furthermore, the attribute of facilities (13.82%) was preferred the monument facilities (-0.302) than public facilities (-0.302). Sixth tourist attraction with 12.65% value relative importance, respondents prefer to pray (-0.257) compared with the sightseeing (0.257). Lastly, transport attribute with a value of 11.89% interest, respondents preferred private vehicles (-0.042) compared with public transport (0.042). For more details see Table 3 and Table 4.

Pearson and Kendall correlation (Table 5) are above 0.5 indicate a strong relationship between the estimated and factual variable. It means that the regression model strongly correlate with the opinion on the choice of travel products. Significance test obtained below 0.05 (Table 4), means the correlation is significant.

**Table 4.** Importance Values of Peace Tourism Product

Attribute	Importance Values (%)
Physical Attraction	15.78
Non Physical Attraction	14.46
Tourist Activities	12.65
Facilities	13.82
Transportation	11.90
Souvenirs	16.51
Services	14.89

**Table 5.** Correlations between observed and estimated preferences

Method	Value	Sig.
Pearson's R	1.000	.000
Kendall's tau	1.000	.000

## CONCLUSION

The tourist preferences towards product on a peace tour Ground Zero Monument Kuta Bali suggest that it is necessary to provide statue of monument (miniature) and the history book of monument as a souvenir, provide adequate monument facilities, Provide praying place for

travellers, package products to accommodate the values of peace symbols, design and arrange good and interesting pack, need to provide interpreters (guides to explain) of monument. It is unnecessary to provide the transportation vehicles because tourists are more likely to use private vehicles. The level of interest in the peaceful tourist product in Monument Ground Zero from highest to lowest based on the attribute utility value is as follows: souvenir), physical attractiveness, services, non-physical attractiveness, facilities, attractions, and transport.

## REFERENCES

- [1] Salazar, N. B. 2006. Building a culture of peace though tourism: reflexive and analytical notes and queries. Fcs, Facultad De Ciencias Sociales, 62. Available at: <http://www.javariana.edu.co>.
- [2] Ariana, N. 2011. The opportunities of peace tourism for Bali. In: Putra, D. and IG. Pitana (Eds). Hyperdemocracy on tourism development for appreciating Prof. Ida Bagus Adnyana Manuaba. Pustaka Larasan. Denpasar. 71-86.
- [3] Pitana, IG., N. Sirtha, A. A. G. P. Agung, W. S. Astiti, W. P. Artini, N. Sunarta. 2000. Kuta as a broken mirror of Bali tourism. Bali Post. Denpasar, Bali.
- [4] Mahagangga, O. 2011. The challenges of Bali tourism safety: criminal mapping studies in Bali tourism destination. In: Putra, D. and IG. Pitana (Eds). Hyperdemocracy on tourism development for appreciating Prof. Ida Bagus Adnyana Manuaba. Pustaka Larasan. Denpasar. 71-86.
- [5] Richards, G. and J. Wilson. Tourism, creativity and development. Rutledge. USA and Canada.
- [6] Gudono. 2012. Multivariate data analysis. BPFE. Yogyakarta.
- [7] Hair, J. F. and R. E. Anderson. 1998. Data analysis. Prentice Hall Inc. New Jersey. USA.
- [8] Kim, S. S., B. Prideaux, J. Prideaux. 2007. Using tourism to promote peace on the Korean Peninsula. Annal of Tourism Research 34 (2), 291-309.
- [9] Ki, L. C., L. J. Bendle, Y. S. Yoon and M. J. Kim. 2011. Thana tourism or peace tourism: perceived value at a North Korean Resort from indigenous perspective. International Journal of Tourism Research 14(1), 71-90.
- [10] Damore, L. 1998. Tourism-the world peace industry. Journal of Travel Research 27(1), 35-40.

## Action Plan in Developing Sea Turtle Conservation as Ecotourism Attraction in Sukamade, Meru Betiri National Park

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### Abstract

Sukamade Coastal Area located in Meru Betiri National Park has particular object as ecotourism attraction, i.e. Sea Turtle. On the other hand, national park management use the cross subsidy from ecotourism activities to promote the conservation action plans for the survival of sea turtle. This study was aimed to formulate action plans to develop the sea turtle conservation as ecotourism attraction in Sukamade Coastal Area. Field observation was conducted to evaluate the current activities of the sea turtle conservation and ecotourism activities in Sukamade. Semi-structured interview and secondary data collection was also conducted to support the formulation of the action plan. Data was analyzed by SWOT method to be developed into action plan. Results showed that the management of sea turtle conservation and ecotourism activities in Sukamade Coastal Area has been attempted to meet the conservation concept for sea turtle but also beneficial for the ecotourism implementation. However, we recommend a long term and short term action plan for the sustainability of the sea turtle conservation and ecotourism activities in Sukamade Coastal area. It includes the mangrove restoration, sea turtle feed development, mapping of sea turtle distribution and migration, the use of up to date biotechnology, workshop on conservation management, and the development of research facility in the area. Additional to the current policy on sea turtle conservation and ecotourism activities, the action plan that we recommended were expected to improve the sustainability management in Sukamade Coastal Area.

**Keywords:** Action Plan, conservation, ecotourism, Sea Turtle.

### INTRODUCTION

Tourism has major contribution in the economic development in Indonesia. Ecotourism as advanced concept of tourism deploy the sustainable tourism development which aimed to support efforts on environment conservation (nature and culture). Ecotourism also improve the community participation in its management implementation [1]. The ecotourism activities were attempted to direct economy motif towards the conservation of natural resources and create value added for community. It concerns the continuity of the natural resources as the tourism attraction and also considers the economic necessity [2].

Sukamade Coastal Area located administratively in the Regency of Banyuwangi, East Java and included in the area of Meru Betiri National Park (MB NP) [3]. Available tourism attractions are beaches, fauna, and famously sea turtle's egg laying. Sukamade Coastal Area has become one

of conservation area for sea turtle in Indonesia [4]. Several sea turtle species commonly found laying their eggs in the coast. MB NP and local community keep trying to optimize the sea turtle conservation. However, many obstacles whether natural or managerial is lead to less performance for the sea turtle conservation activities, thus also affecting the ecotourism in Sukamade.

Sea turtle in that found in the world these days is consisted of seven species, which six of them considered as threatened with extinction by IUCN Red List of Threatened Species [5]. It means that four species of sea turtle that found in the area of Sukamade Coast are also threatened by extinction. The species are green sea turtle (*Chelonia mydas*), grey sea turtle (*Lepidochelys olivaceae*), Hawksbill sea turtle (*Eretmochelys imbricata*), and leather back sea turtle (*Dermochelys coriacea*). Major hazards that threaten the sea turtle are poaching to get sea turtle's meat and their eggs (consumptive recreation/tourism). Thus, the most population of sea turtle was decreased.

Non consumptive wildlife recreation is recently popularized due to the growth of eco-

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tourism [6]; an alternative tourism that preserves the condition of nature. An example of this non-consumptive recreation was also developed in the efforts of sea turtle conservation in Sukamade. Meru Betiri National Park develops the sea turtle conservation as ecotourism attraction in Sukamade Coastal Area. The conservation activities towards the sea turtle, such as egg patrol, hatchery, and hatchling release are become the non consumptive uses for sea turtles [7]. Thus, the conservation activities of sea turtle itself become potential tourism attraction for Sukamade Coastal Area.

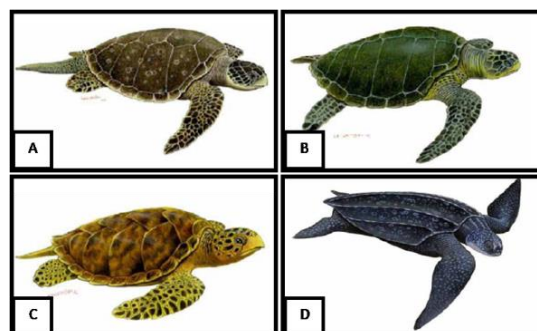
Therefore, this study was aimed to formulate action plans to develop the sea turtle conservation as ecotourism attraction in Sukamade Coastal Area. The output of this study is expected to improve the sustainability management for sea turtle conservation and ecotourism activities in Sukamade Coastal Area.

## MATERIALS AND METHODS

### Study area

Coastal Area/Resort of Sukamade is area of sea turtle conservation in the sub-village of Sukamade, Village of Sarongan, District of Pesanggaran, Regency of Banyuwangi and include in the management area of Meru Betiri National Park. Sukamade coastal area located at 113°48'42" - 113°56'22" East and 8°27'08" - 8°34'40" South with 10,417 ha area. The management of sea turtle conservation is under the supervision of UPKP (Unit Management of Sea Turtle Conservation) which established in 2010. It is a special unit which formed to implement the sea turtle management in the coastal area of Sukamade. The length of coastal area as the sea turtle's egg laying was about 3 km. Activities in this unit includes all attempt to conserve the sea turtle, e.g. tracking, semi-natural egg hatching, hatchling release, monitoring, the improvement of sea turtle habitat for the egg laying [8].

Acoording to the forest rangers and national park technician, there are 4 species of sea turtle that found in the area of Sukamade Coast (Fig. 1), i.e. green sea turtle (*Chelonia mydas*), grey sea turtle (*Lepidochelys olivaceae*), Hawksbill sea turtle (*Eretmochelys imbricata*), and leather back sea turtle (*Dermochelys coriacea*). The most frequent sea turtle that landed in the Sukamade coastal area is green sea turtle (*Chelonia mydas*) with total landing percentage 96%. Green sea turtle in coastal area of Sukamade lay their egg 5 times in a season, with 2-3 years interval [9].



**Figure 1.** Sea Turtle that found landed in Sukamade Coastal Area [5,10]

Description:

- (A). Green Sea Turtle (*Chelonia mydas*),
- (B). Slengkrah/Grey Sea Turtle (*Lepidochelys olivaceae*),
- (C). Hawksbill Sea turtle (*Eretmochelys imbricata*),
- (D). Leatherback sea turtle (*Dermochelys coriacea*)

## Data Collection and Analysis

Field observation was conducted to evaluate the current activities of the sea turtle conservation and ecotourism activities in Sukamade. Semi-structured interview was performed to obtain primary data on ecotourism activities related to sea turtle conservation in Sukamade (e.g. egg patrol, egg hatchery, hatchling release). Secondary data collection was also conducted to support the formulation of the action plan. Data was analyzed by SWOT (Strength, Weakness, Opportunity, and Threat) method to be developed into action plan.

## RESULT AND DISCUSSION

### Potential Tourism Attraction and Progress

The activities of sea turtle conservation that primarily offered to the tourist are patrol on sea turtle's egg laying, observation on the semi-natural hatchery, and hatchling release. Sea turtle commonly lay their eggs in the sand of Sukamade Coast at 6 pm to 6 am. A sea turtle will lay their egg 3-4 times in a season, with interval 14-30 days and 2-4 years seasonal interval. Sea turtle will initially observe the coast area from the surface of the sea, to determine the safety of the area for their eggs, from tidal wave or predators. After convinced with the area safety, sea turtle land and dig a body size hole in the sand with the hind flippers and a hole to lay the eggs with the back flippers. After the eggs lied, sea turtle will cover the hole and camouflage it before turning to the sea (Fig. 2). The times for this egg laying are about 2.5 hours [9].

The hatchery for the sea turtle's egg is semi natural, because the sand media was obtained from the coastal area with no additional treatments. Semi-natural egg hatchery of sea

turtle in Sukamade Resort is in a building with size  $\pm 4 \times 8$  m with substrate of coast sand (Fig. 3). Semi-natural hatchery was implemented to reduce the risk of hatching failure in its natural hatchery and prevent the predatory by wild pig, rats, lizard, etc. The eggs were obtained from the natural hatchery in the coast. The eggs will hatch in about 2 months. Each hatchery holes was marked by information board about the species, date of eggs taken, and the number of eggs. Succeeded hatched eggs and the mortality was recorded. The management also maintains the cleanliness of the hatchery. After hatched, hatchling should be incubated for 7-20 days before released (Fig. 4). Only 1% of hatchling will grow and develop into adult sea turtle [6]. The hatchlings was taken care in small tub with diameter  $\pm 30 - 50$  cm. Several hatchlings died from fungal or bacterial infection, ants'

predation, and stress from water maintenance, density, temperature, or it secretes.



**Figure 2.** *Lepidochelys olivacea* land to lay the eggs in Sukamade Coastal Area (Personal documentation)



**Figure 3.** Semi-natural hatchery of sea turtle's eggs in Sukamade Resort (Personal documentation)



**Figure 4.** Hatchling release in Sukamade Coastal Area (Personal documentation)



### Problems of Sea Turtle Conservation in Sukamade Resort

Many obstacles whether natural or managerial are lead to less performance for the sea turtle conservation activities, thus also affecting the ecotourism in Sukamade. Natural or environmental causes include the parasites and disease in sea turtle (Fig. 5), anthropogenic disturbances in the visitation (Fig. 6), and continuous irresponsible acts such as sea turtle's meat and/or egg consumption and handicrafts from sea turtle's body parts.

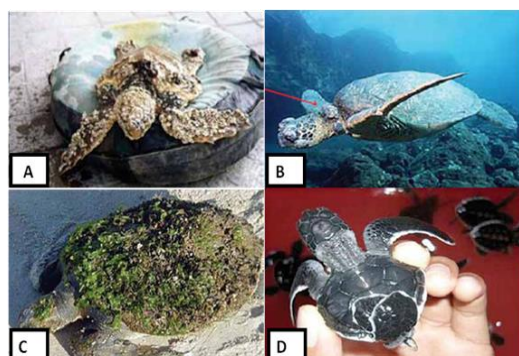


Figure 5. Parasites and disease in sea turtle [10]

Description:

- (A). Teritip parasites (Barnacle, *Sacculina*, etc.)
- (B). Tumor in sea turtle's body
- (C). Moss or algae covered sea turtle
- (D). Abnormal hatchlings



Figure 6. Cautions to anthropogenic disturbance during visitation (personal documentation)

Otherwise, the managerial problems are including following items. **Sea turtle's egg stealing** becomes the most found problem in the process of managing sea turtle conservation in Sukamade. The thieves conduct its crime especially at night, inadvertence of egg collector field officer. The management was also **lack of field officer** to collect the eggs and move it to the safe hatchery site. Egg hatching in the coast area has major predatory threat and thieves. Currently,

the field officer on the area was 6 personal, while the area of Sukamade Resort ranges for 10,000 ha has to be monitored and 2-3 person patrol in shift at night during the eggs laying seasons for 3 km ranges. Thus, the tourists that participate in the patrol help the officer a lot in collecting and transport the eggs. The process from the sea turtle gets to the seashore to laying their eggs is about 2 hours. The patrol officer competes with the natural predator such as wild pig and *Manis javanica* in getting the eggs.

**Wide monitoring area** in the coast of Sukamade extends about 3 km in length, with point of eggs laying changes. It becomes particular problem in collecting and found the eggs to be moved to the semi-natural hatchery site. **Predator** that consume or damage the eggs of sea turtle that commonly found in Sukamade Coast Area are rats, wild pig, *Manis javanica*, and Biawak (Varanidae). Although the field officer has already being caution, sometimes the predator gets to consume the eggs.

**Hatching ability** of the sea turtle's egg is fluctuating. Previous study mentioned that in April 2007, the hatching ability reached 87.5% while on March it only reached 77.1% [11]. This hatching ability has been ideal for the sustainability of sea turtle. Real condition of ideal hatching ability is up to 100%. The lower hatching ability of sea turtle eggs in Sukamade resort was assumed due to the process of collection, transportation to semi-natural hatchery, and hatching process itself.

**Hatchling viability** also problem faced after the hatching. Hatchling of sea turtle was taken care for one week and or for longer period for further caring procedure. Container for these hatchlings are small tubs with diameter  $\pm 30$ –50cm. several hatchling dead due to fungal disease in their eyes area, ants' attack, and stress from water replacement, density, temperature or pollution from their own excretion. Some death did not show any changes in their morphology.

**Absence of sea turtle conservation expert in Sukamade.** Sea turtle is a rare species in the world and the life of sea turtle in wild nature has not got certainty to be survived. Thus the efforts in conserving the sea turtle should involve the expert on sea turtle conservation to ensure its sustainability. The absence of expert on sea turtle conservation will lead to ineffective conservation management, e.g. none particular operational standard and activities not get any clear and appropriate evaluation for its development.

### Monitoring on Sea Turtle Conservation

Monitoring activities on the sea turtle conservation includes the activity of egg laying, tagging, parasites removal and body measurement. The aims of the monitoring are to ensure the sea turtle existence refer to the attached tag and attaching the tag to the sea turtle which has no tag, examine the health of the sea turtle by removing the parasites, observing the egg laying process and save the eggs to the hatchery. From this monitoring, we obtained the data base on the number of eggs from each sea turtle, sea turtle distribution, egg laying frequency, and egg laying behavior of sea turtle. Monitoring was conducted regularly every night by the patrol officer.

### SWOT Analysis

Strength, weakness, opportunity, and threat of the sea turtle hatchery conservation management were used to arrange the SWOT matrix (Table 1). Analysis of SWOT was used to determine strategy and formulate the action plan for development of sea turtle conservation efforts along with a better ecotourism destination.

### Recommended Action Plan

From the SWOT analysis, we obtain several root cause in the sea turtle conservation program in Sukamade. The root causes are natural predator and egg and/or hatchling stealing, pathogenic microbes which lead to decrease hatchling viability, and lack number of officer and experts in sea turtle conservation. Regarding this, thus we aimed to optimize the conservation efforts in MB NP. The action plan was expected to give outputs on optimum performance for sea turtle conservation to support the ecotourism in Sukamade.

Inputs for the action plan are all hatched sea turtle in Sukamade Coastal Area would be well covered, high percentage of egg hatching and hatchling viability, and field officer and competent expert on sea turtle conservation. Whereas the expected outcomes are efficient natural, human, and funding resources; qualified sea turtle hatchling to survive their life; and create habitat for egg hatchery with better and more stable environment condition.

**Table 1.** SWOT analysis on the sea turtle conservation in Sukamade Resort

<div>Internal Factors</div> <div>External Factors</div>		Opportunity	Threat
		<ul style="list-style-type: none"> <li>✓ Governmental funding</li> <li>✓ Potential ecotourism trend</li> <li>✓ High interesting from international and local tourists</li> </ul>	<ul style="list-style-type: none"> <li>✓ Natural predator</li> <li>✓ Egg or sea turtle stealing</li> <li>✓ Inappropriate semi-natural hatchery</li> <li>✓ Disease, parasites, stress affect the hatchling viability</li> <li>✓ Wide area for the egg laying incomparable with the number of field officer</li> </ul>
Strength	SO strategy	ST strategy	
<ul style="list-style-type: none"> <li>✓ Natural multi strata forest vegetation</li> <li>✓ It has 4 species of sea turtle that frequently come for egg laying (inter nesting area) hibernacula</li> <li>✓ MB NP monitoring on inter nesting area, tagging, sea turtle caring from parasites and disease, sea turtle population, size, and feed sources</li> <li>✓ Semi-natural hatchery to help the conservation efforts</li> </ul>	<ol style="list-style-type: none"> <li>1. Cooperation with universities on research about sea turtle conservation</li> <li>2. Applied up to date biotechnology to optimize the sea turtle conservation</li> </ol>	<ol style="list-style-type: none"> <li>1. Add the number of national park rangers</li> <li>2. Design appropriate condition for sea turtle's semi-natural hatchery</li> <li>3. Monitoring the area that vulnerable to predator and stealing</li> </ol>	
Weakness	WO strategy	WT strategy	
<ul style="list-style-type: none"> <li>✓ Lack number of field officers</li> <li>✓ No conservationist expert for the sea turtle conservation</li> <li>✓ Less knowledge on up to date technology in sea turtle conservation</li> </ul>	<ol style="list-style-type: none"> <li>1. Open recruitment for field officer for infrastructure and facilities in the area</li> <li>2. Dissemination/training about sea turtle conservation</li> </ol>	The recruitment of new officer or expert for monitoring the activities of sea turtle conservation	



Action plan that we promoted for the conservation of sea turtle in Sukamade is consisted a long term and short term program. It includes the mangrove restoration, sea turtle feed development, mapping of sea turtle distribution and migration, the use of up to date biotechnology, workshop on conservation management, and the development of research facility in the area. The mechanism and design of the action plan described in following Table 2. Resources required to implement the action plan are Dept. of Culture and Tourism Banyuwangi, officers in the sea turtle hatchery of MB NP, higher education institution, research center of sea invertebrate, the area of MB NP and sea turtle hatchery, and references on the development of sea turtle hatchery and conservation along with ecotourism [12,13,14]. As for the performance indicator (Table 3), we compare the initial condition to the final condition that we expected from the action plan.

For the sustainability of the action plan, we also recommend several activities related to the sea turtle conservation. The seedling and planting of mangrove surround the coastal area of Sukamade should be done to provide habitat for sponges, bivalves, mollusk, shrimp, seaweed, and alga as the food for sea turtle. This feed diversity should be assessed for further decision making for the development of the sea turtle conservation. In addition, it also necessary to assess the distribution of the sea turtle feed around Sukamade coastal area, e.g. by using GIS apps. For the feeding in the hatchery, we encourage to develop more micro and/or macro zooplankton culture.

It is also essential for the MB NP to build research center of sea turtle conservation in Sukamade. The funding proposal could be proposed to the regional and central government to develop the infrastructure of MB NP and research development about sea turtle in MB NP.

**Table 2.** Mechanism and Design of the Action Plan for the Sea Turtle Conservation Activities in Sukamade

Mechanism and design	Short Term	Long Term
Preparation	Literature Study, Discussion (e.g. FGD) and expertise consultation with higher education institution (universities) and related stakeholder, and research related to the sea turtle conservation.	
Initiation	<ul style="list-style-type: none"> <li>- Planning workshop for the field officer</li> <li>- Recruitment of expert field officer</li> <li>- Proposal for research and development for the area</li> <li>- Planning sustainable monitoring schedule</li> </ul>	<ul style="list-style-type: none"> <li>- Recommend available field officer for further study on the conservation , especially on sea turtle</li> <li>- Proposal for cooperated research</li> <li>- Planning design for hatchling incubation to support its viability</li> </ul>
Implementation	<ul style="list-style-type: none"> <li>- <i>Workshop</i> for the field officer</li> <li>- FGD with local community</li> <li>- Selection and appointment for field officer</li> <li>- Research on sea turtle conservation</li> <li>- Sustainable monitoring</li> </ul>	<ul style="list-style-type: none"> <li>- Appointment of field officer for further study on the conservation , especially on sea turtle</li> <li>- Conducting cooperated research, e.g. recovery method for ill hatchling</li> <li>- Manufacture of hatchling incubation and maintain the condition</li> </ul>
Monitoring & evaluation	<ul style="list-style-type: none"> <li>- Evaluate the performance of the officer after the workshop and selection</li> <li>- Record the egg or hatchling stealing</li> <li>- Test the results of the research</li> <li>- Record the data of monitoring</li> </ul>	<ul style="list-style-type: none"> <li>- Monitoring the study process of the officer's study</li> <li>- Sustainable application of research results</li> <li>- Evaluate the effectiveness of incubation container</li> </ul>
Action to improve	<ul style="list-style-type: none"> <li>- Provide reward to the officer with good performance</li> <li>- Persuade local community to modified the handicrafts with conservation theme, NOT with using the sea turtle body parts</li> <li>- Applied the research results on the area</li> <li>- Data should be processed with statistic standard</li> </ul>	<ul style="list-style-type: none"> <li>- Officer implement the obtained knowledge from the study</li> <li>- Develop and improve the research (e.g. molecular, genetic)</li> </ul>
Progress report	<ul style="list-style-type: none"> <li>- Egg hatching in Sukamade coastal area is well covered</li> <li>- Community has awareness on the importance of sea turtle conservation</li> <li>- Increased percentage of hatched egg and viable hatchling</li> </ul>	<ul style="list-style-type: none"> <li>- Increased research on sea turtle conservation</li> <li>- Complete and valid data base</li> </ul>

**Table 3.** Performance Indicators of the Action Plan for the Sea Turtle Conservation Activities in Sukamade

Orientation of the action plan	Before	After
Short Term	<ul style="list-style-type: none"> <li>- Patrol officer 2-3 persons with irregular shift</li> <li>- No expert officer for sea turtle conservation</li> <li>- Percentage of hatched egg 70%</li> <li>- Hatchling monthly mortality 25%</li> <li>- No efforts in handling the ill hatchling</li> <li>- Many eggs and hatchling were stolen</li> </ul>	<ul style="list-style-type: none"> <li>- Patrol officer 6-7 persons with regular shift</li> <li>- expert officer for sea turtle conservation available</li> <li>- Percentage of hatched egg 90%</li> <li>- Hatchling monthly mortality &lt; 5%.</li> <li>- Innovation to handle the ill hatchling</li> <li>- Less (and/or none) stolen eggs or hatchling</li> </ul>
Long Term	<ul style="list-style-type: none"> <li>- Officer has not applied biotechnology for the conservation efforts</li> <li>- Officer only take care the hatchling</li> <li>- Level of Sanitation quality 50%.</li> <li>- No specific vaccine/medicine for the ill hatchling</li> </ul>	<ul style="list-style-type: none"> <li>- Officer applied the biotechnology for the conservation efforts</li> <li>- Officer also able to formulate action plan on existing problems</li> <li>- Level of sanitation quality 100%</li> <li>- Specific vaccine/medicine for ill hatchling</li> </ul>

The results of the research on sea turtle conservation also need national and international dissemination to be recognized by the world, thus increase the awareness for sea turtle conservation and attract tourist to be involved in the conservation efforts as well as ecotourism in Sukamade coastal area.

## CONCLUSION

Action Plan consisted of a long term and short term for the sustainability of the sea turtle conservation and ecotourism activities in Sukamade Coastal area. It includes the mangrove restoration, sea turtle feed development, mapping of sea turtle distribution and migration, the use of up to date biotechnology, workshop on conservation management, and development of research facility in the area. Additional to the current policy on sea turtle conservation and ecotourism activities, the action plan that we recommended were expected to improve the sustainability management in Sukamade Coastal Area.

## REFERENCES

- [1] Atmoko, W. D. 2008, Studi prospek pengembangan ekowisata pada kawasan sekitar Kars Gombang Selatan dalam mendukung keberlanjutan wilayah. Thesis. Dipenegoro University. Semarang. [eprints.undip.ac.id/4363/1/Wisnu\\_Dwi\\_Atoko.pdf](http://eprints.undip.ac.id/4363/1/Wisnu_Dwi_Atoko.pdf).
- [2] Hedrick, L. W. 2008. Ecotourism sustainability. Available at: <http://digitalscholarship.unlv.edu/thesesdissertation/483>.
- [3] Diantoro, W. 2008. Pantai Sukamade. Available at: <http://www.wisatanesia.com/2010/05/pantai-sukamade.html>.
- [4] Nusantara. 2011. Pantai Sukamade. Available at: <http://nusantara.asia/jawa/jawatimur/pantai-sukamade/>.
- [5] IUCN. 2012. IUCN SSC marine turtle specialist group: about Marine turtles. International Union for Conservation of Nature. Available at: <https://iucn-mtsg.org/about-turtles/>.
- [6] Wilson, C. and C. Tisdell. 2001. Sea turtles as a non-consumptive tourism resource especially in Australia. *Tourism Management* 22, 279-288.
- [7] Hakim, L and N. Nakagoshi. 2006. Sea Turtles and its non consumptive uses in East Java. 3<sup>rd</sup> Coastal Zone Asia Pacific Conference, August, 29 – September 2, Batam, Indonesia.
- [8] Meru Betiri National Park. 2012. Information on Meru Betiri National Park. Office of Meru Betiri National Park. Banyuwangi.
- [9] Officer of Sukamade Resort. 2012. Sea turtle Conservation. Personal communication. Office of Meru Betiri National Park.
- [10] Dermawan, A., I.N.S. Naitja, D. Soedharma, M.H. Halim, M.D. Kusri, S.B. Lubis, R. Alhanif, M. Khazali, M. Murdiah, P.L. Wahjuhardini, Setiabudiningsih, A. Mashar. 2009. Pedoman teknis pengelolaan konservasi penyu. Directorate of Conservation and Sea National Park, Directorate General of Marines, Coastal and Small Islands, Department of Marine and Fisheries, Republic of Indonesia. Jakarta. 19-68.
- [11] Prihanta, W. 2007. Problematika kegiatan konservasi penyu di Taman Nasional Meru Betiri. Research Report. Faculty of Teaching and Education Sciences. Malang Muhammadiyah University.

- [12] James, M. C., Ottensmeyer C. A. and Myers R. A. 2005. Identification of high-use habitat and threats to Leatherback Sea Turtles in Northern Waters: new directions for conservation. *Ecology Letter* 8, 195–201.
- [13] Tisdell, C. and C. Wilson. 2000. Developing of Ecotourism for the survival of Sea Turtles. Working Papers on Economics, Ecology, and the Environment, No. 45. University of Queensland. Australia.
- [14] Tisdell, C. and C. Wilson. 2003. Does Ecotourism Contribute to Sea Turtle Conservation? Is the Flagship Status of Turtles Advantageous?. Working Papers on Economics, Ecology, and the Environment, No: 90. University of Queensland.

## Lakes as Natural Tourism Object in North Sulawesi

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### Abstract

Lake is one of the important natural resources in north Sulawesi and many lakes ecosystem in this province has been used and involved in tourism industry. The aims of the research is to describes the recent status of lakes in North Sulawesi and describes its opportunities for tourism development. The analysis was based on the secondary data and direct field observation. Four lakes, namely Tondano, Pangolombian, Linow and Tampusu have been used as tourism attraction in various degreed. The most intensive used was Lake Tondano, while Lake Linow recently grows as one of the favorites object. Lake Pangolombian and Tampusu receive few tourist visitations. The development of four lakes as tourism object will increase the attractiveness of North Sulawesi as ecotourism development. In such a case, the conservation of lakes becomes crucial.

**Keywords:** economy development, Lake tourism, North Sulawesi.

### INTRODUCTION

Lakes are one of the important ecosystems to support human lives in the earth. Lake resulted from natural geological process which is important in many natural ecological process and maintenance. Lakes has been used for numerous purposes in human being, from socio-cultural and ecological uses. Many communities in the globe depend on lake as crucial resources. Many lakes related to the traditional community live and these relationships between lake and community construct the special iconic of place. Today, lakes is an important resources for modern people, and many of lake become integral part of modern city architecture to create comfort live on crowded area [1].

In human history, lake has provided numerous important contributions to human life. In much traditional community, lake is media for human movement from one place to other place. Lake is source of water for agricultural industry. Lake is reservoir of water and very important resources to continuously provide water for agriculture and industry. Lakes also important attraction for leisure and visiting lakes in recreation programs recently grows significantly [2]. Scholar point out that lake has been visited by thousand of visitor and the contribution to generate local economic was considered important.

Lake, however, facing serious problems related to the future existence. Scholars resume that sedimentation, pollution, overexploitation and invasion of exotic species are the most common problem faced by lakes. Human activity surrounding lakes has been identified as a factors towards lake degradation. Globally, numerous programs was set up to conserve lakes with the special objective protecting lakes and promoting local sustainable development [3]. Lakes conservation recently becomes the important issues in biodiversity conservation.

Tourism in lake ecosystem is widely observed. Lake is an important tourism attraction in numerous countries. Lakes also used as a media promotion to promotes the tourism destination of particular countries [1]. In Indonesia many lakes is famous for tourism destination and attractions, namely Lake Toba in North Sumatera, Lake Batur and Lake Buyan in Bali, Lake Kelimutu in East Nusa Tenggara, and Lake Tondano in North Sulawesi. The area of fresh water lake, acid lake, and volcanic lake become tourism attraction [4,5]. The contribution of lakes as an important part of ecosystem to generated tourist come to particular destination was important. Some place was easy in accessibility, but there are numerous lakes with poor infrastructure

North Sulawesi, Indonesia, is an important area for future tourism development in Indonesia. North Sulawesi has abundance natural resources for sustainable tourism development, including lakes ecosystem [6]. Lakes are important for local development, especially in agricultural and tourism development. There are however, little discussion related to the lakes and

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tourism development in North Sulawesi. The aims of the research are to describes the recent status of lakes in South Sulawesi and describes its opportunities for tourism development. The analysis was based on the secondary data and direct field observation.

#### LAKE IN SOUTH SULAWESI

South Sulawesi can be said as landscape with diverse ecosystem, from coastal and small islands to mountain ecosystems. Geographically North Sulawesi province is located at 0°30"- 4°3" N and 121°127" E. The area has equatorial climate with two season, namely rainy season and dry season. North Sulawesi is one of the home of most active volcanoes, leading the soil in North Sulawesi with high fertile characteristic. The natural ecosystem was numerous [6,7].

Besides rivers, lakes is an important fresh water ecosystem in North Sulawesi. The lakes of North Sulawesi was presented in Table 1. Lakes ecosystem in North Sulawesi has relationship with the geological history of the northern tip area of Sulawesi Island. Geologically, this area is considered as one the very active volcanic area, resulting some lakes was exist with volcanic process impact. Many lakes, however, was the fresh water lake ecosystem which area important to support human activity surrounding lakes, especially in agricultural sectors.

**Table 1.** Lakes of North Sulawesi

No.	Lakes	Size (ha)	Regency
1	Tondano	4.278	Minahasa
2	Linow	35	Minahasa
3	Wungangaan	30	Minahasa
4	Bulilin	22	Minahsa
5	Kawelan	8	Minahasa
6	Mokobang	38	Minahasa
7	Pangolombian	2	Minahasa
8	Sendow	2	Minahasa
9	Makalehi	56	Sangihe-Talaud
10	Tampusu	3	Minahasa

Source: National Land Agency, North Sulawesi

In relationship with tourism industry, some lakes has been promoted and visited as tourism destination. The contribution of tourism based-lakes for local economic community development was significant. In Lake Tondano, there are growing restaurant in some area in the adjacent of lake ecosystem.

#### Lake Linow

Lake Linow located at Tomohon city and widely known as lake with spectacular water color (Fig. 1). Lake Linow was visited by

numerous tourist, both domestic and international tourism (Table 2). International tourist visit Lake Linow as part of the as of the tourism package to visit main tourism destination North Sulawesi such as Bunaken. The accessibility of Lake Linow was relatively easy, stimulates tourist from Manado and Tomohon come to Lake Linow. Daily number of tourism was few, lead visitor feel close to nature. Lake Linow represent the natural phenomena of active geological process which cause beautiful color of lake water. This geological aspects was identified few in the world and therefore such phenomena open oppor-tunities to Lake Linow become interested tourism object in the world [8,9,10].

**Table 2.** Tourism visitation in Lake Linow, Tomohon

Tourist	2011	2012	2013
Domestic tourist	2.780	2.380	2.575
International tourist	1.814	1.998	1.607

Problems facing Lake Linow is poor planning and development, especially in term of integrative planning and environmental protection in Lake Linow. The important issues related to the Lake conservation is the existence of geothermal plant which is potentially contribute to the degradation of lake ecosystem [9]. Lake Linow also facing potential serious problems of lake degradation caused by rapid agriculture development in an area adjacent to lake ecosystem.

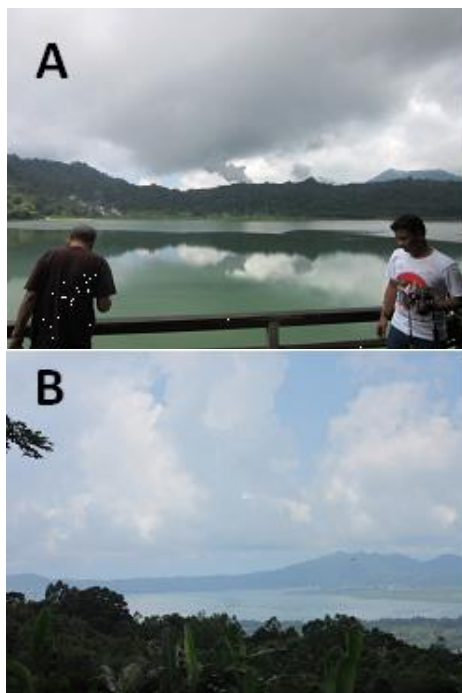
#### Lake Tondano

Lake Tondano is the biggest lake in North Sulawesi. This lake is very famous and has promoted as one of the tourism destination in North Sulawesi (Fig.1). Many brochure and tourism magazine introduce Lake Tondano as one of the recommended attraction in South Sulawesi to be visited by tourist in exploring nature of South Sulawesi [10]. In the perspective of national policy planning for tourism development, Tondano area is one of the strategic area for national tourism development. Based on the Law Number 50 of 2011 about National Planning for tourism development 2010-2025, Tomohon and Tondano has been declared as one of the 88 strategic area for national tourism strategic area (KSPN, *Kawasan Strategis Pariwisata Nasional*).

Administratively, Lake Tondano belong to the Regency of Minahasa. The lake occupy and area about 46 km<sup>2</sup> in dry season and water body able to occupy an area about 51 km<sup>2</sup> in rainy season. Normally the lake periphery was about 35.5 km

in length. There area about 35 rivers flows (inlet) to lake Tondano and one river outlet called Tondano River. The inlet rivers, lake and outlet (Tondano rivers) is important for community. The water resources has been used to provide water drink of community in Tondano and Manado, electricity plant of Tanggari dan Tonsea Lama, agricultural irrigation, fisheries and tourism [11]. About 14 aquatic plant species found n Lake Tondano, some of them are water invasive species, including *Eichornia crassipes*. The abundance of exotic species is the impact of nutrient rich in water body [12].

Problem faced by Lake Tondano recently very complicated, bring economic and social aspect into environmental problems. The classical problems of lakes such as sedimentation have been reported by authors as one of the consequences of unmanaged development following sustainable principles. Lake Tondano is one of the sites for aquaculture activity. There are many argument for lake conservation and protection.



**Figure 1.** Lake Linow (A) and lake Tondano viewed from Tampusu Highland (B).

#### **Lake Pangolombian**

Lake Pangolombian located at Pangolombian Village at Tomohon. Recently Lake Pangolombian grows as one of the alternative destination for nature-based tourism in Tomohon area. It is located at 911 m asl in the Minahasa highland ecosystem in geographic position 1°15'50.04" N and 124°50'27.24" E. As far, the data base for

flora fauna in Lake Panolombian was absent, indicated there are no research report has been published.

#### **Lake Tampusu**

Lake Tampusu located at the border of Pangolombian village and Tampusu Village. The water body located at the top of Tampusu highland surrounded by 80 ha of mountain forest. In the past, the highland has used as observation point for foreign ship arrivals which will landed in North Sulawesi from southern coastal. Some excursionist has been visited Lake Tampusu lead to the development of infrastructure from Pangolombian to Tampusu. Recently, about 300 m road to Lake Tampusu has been asphalted, while 100 remains road with stone and gravel. The tourism facility in Lake Tampusu was simple. There are no indication of environmental degradation, including aquatic exotic plant invasion, and sedimentation. Recent nature lovers arrivals in Lake Tampuso, however, should be considered as one of the important stage for tourism development in Lake Tampusu and its surrounding area. The proper planning and management therefore should be planned comprehensively.

#### **LAKE AND TOURISM**

Many lakes in the world have been visited by tourist, representing the important lake of lakes ecosystem as tourism resources. Lake in remotes area with poor infrastructure are often visited by limited number of tourist. Lakes without adequate infrastructure often less developed as tourist attraction and the common uses of lakes often related to the daily activity of local people. To become the tourist destination, lakes need support of tourism infrastructure to facilitate tourist flow to attraction complex. Corridors and transport availability is requested by the development of lake to become attractions

In North Sulawesi, lakes become interested object of tourism activity because lake offer some tourism product aspect which are absent in other attraction types [10]. Landscape sight-seeing and enjoying natural setting of lakes is one the favorite activities among tourist in lake. Boating is an alternative tourism activity in lakes. Generally, place with best panorama received a lot of attention from businessman and tourism developers [13]. As observed in some place in Lake Tondano periphery area, the place with good panorama and environmental setting is the spot for restaurant and cottage development.

**Table 3.** The Comparison of Lakes Characteristics in North Sulawesi

Characters	Lake Tondano	Lake Linow	Lake Tampusu	Lake Pangolombian
Size (ha)	4.278	35	3	2
Tourism-related uses	Medium-massive	Medium	Few	Few
Number of visitors	Medium	Medium	Few	Few
Accessibility from Manado	Accessible by public transportation	Accessible, supported by city roads	Accessible until Pangolombian village, continued by trekking	Accessible, supported by village roads
Volcanic aspect	No	Yes	No	No
Tourism Infrastructure	available	available	few	few

The growing popularity of tourism in lake environment has made the industry become priority among place with lake resources. The mutualism between lakes and tourism in many area in was reported by numerous authors. In Indonesia, Lake Toba provides clear evidence of the mutualism relationship between lake and local economic development. The similar case was found in Bali, with four lakes namely Lake Batur (Kintamani), Lake Beratan (Bedugul), Lake Buyan and Lake Tamblingan becomes famous tourism object [5].

In Indonesia, there are several types of lakes which are used as tourism attractions. First is fresh water lakes, such as Lake Toba (North Sumatera), Lake Poso (Central Sulawesi), Lake Tondano (North Sulawesi), and Lake Sarangan (East Java). Second is the mountain crater lake such as Lake Batur (Bali), Ijen crater (East Java), Lake Segoro Anak (West Nusa Tenggara), Lake and Kelimutu (East Nusa Tenggara). These lakes has been contributes to the tourism industry in each province [5].

In North Sulawesi, the comparative of three lakes namely Lake Tondano, Lake Linow and Lake Tampusu has been used in tourism in different levels and impact (Table 3). The different level of tourism used is related to the road infrastructure which are important to facilitate visitor movement and visit natural object. As mention by scholars, road is important factor for visitor movement, especially in tourism destination complex [14].

### **Lake Conservation and Sustainable Tourism Development**

The issues of sustainable tourism in lake ecosystem emerging as a crucial issues among scholars. Central to the concept of sustainable lake-based tourism destination is the equity of social, ecological and economical aspect in balance. Sustainable tourism practices in lake of North Sulawesi therefore has economic, social and environmental dimensions. There are at least three basic objectives of sustainable tourism in lakes, including North Sulawesi lake's ecosystems. Firstly, development of lake-based tourism should be able to become economic machine to increase business and generating fund to the local government and local community surrounding lakes. Secondly, tourism development should be able to contribute to environmental conservation. Tourism is an important instrument and tools to increase conservation program implementation with the objective protection environment from degradation. In such a case, a comprehensive planning and implementation following environmental standard was important. Thirdly, tourism should be able to increase local people welfare and community development [14,15].

Lake-based tourism development in North Sulawesi has its potentiality to be developed following sustainable destination principles. Through the secondary data analysis and field observation, some aspects related to the development of economy, environment and social aspect need to be highlighted (Table 4).

**Table 4.** Some Important Aspect Related To The Supporting System in Sustainable Tourism in Lake Environment

Aspects	Planning Direction
Infrastructure	Promote infrastructure development to facilitate numerous local people movement, including tourism. Infrastructure for tourist should be developed following safety standard; high quality to facilitate movement satisfaction
Accommodation	Setup following eco-accommodation standard. It should following basic principles such as build using local material, adopt local architecture, promoting reduce-reuse-recycle principles
Restaurant	Build following local architectural design, local receipt and material for cuisine, employing local people
Visitor centre	In many case ignored. Should be build to facilitate interpretation aspect of ecotourism

Economical aspect issues related to the lake development as tourism object related to the issues of:

- *Community involvement*; Planning involving community from the beginning of planning stage, implementation to share benefits should be fostered. As far, there are indications of poor local people involvements.
- *Community economic development*; Fostering numerous program to increase local people capacity to be active involved in economic activity in lake-based tourism development.

Ecological aspect issues related to the lake development as tourism object:

- *Proper land use planning*; Lakes is fragile ecosystem and easily degraded due to the rapid development of adjacent terrestrial ecosystems. Proper land uses planning was needed to ensure lake protection other ecosystem or sites development.
- *Environmental protection regulation* to enhance the integrity of ecosystem functions. Some aspect related to the potential threats to lakes ecosystem such as aquatic plant invasion, sedimentation and pollution should be minimized.
- *Environmental management*; to ensure the sustainable use of agricultural and industrial activity in surrounding lakes. It is important to minimize pollution impact of agriculture and industrial activity to lakes ecosystem.

Social aspect which area related to the development of lakes as tourism attraction are encompasses:

- *Promoting capacity development*. Tourism planning should accommodate local people interest in lake and development issues, including spiritual and social perceptions.

Tourism development socially should be promote social life, developing code and conduct and promoting local culture as an integral part of tourism attractions.

## CONCLUSION

Lake is an important resource for tourism development in North Sulawesi. Four lake in North Sulawesi namely Lake Tondano, Lake Linow, Lake Pangolombian and Lake Tampusu located at the potential cluster for further lake-based tourism destination. The development of lakes as tourism attractions should be allowed following sustainable principles with economical

social and environmental aspect become the key for development. The conservation of Lake in North Sulawesi is a crucial issue. It is especially important to create sustainable tourism area for sustainable human life and creative industry in the hearth of South Sulawesi.

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## REFERENCES

- [1] Hall, C. M. and T. Härkönen (Eds). 2006. Lake tourism: An integrated approach to lacustrine tourism systems Vol. 32. Channel View Publications.
- [2] Scheffer, M. 2004. Ecology of shallow lakes. Springer Science and Business Media.
- [3] Bruton, M. N. 1990. The conservation of the fishes of Lake Victoria, Africa: an ecological perspective. *Environmental Biology of Fishes* 27(3), 161-175.
- [4] Hakim, L. 2004. Dasar-dasar ekowisata. Bayumedia.
- [5] Ver Berkmoes, R. 2013. Lonely planet Indonesia (Travel Guide). Paperback. Lonely Planet.
- [6] Hakim, L., M. Soemarno and S. K. Hong. 2012. Challenges for conserving biodiversity and developing sustainable island tourism in North Sulawesi Province, Indonesia. *Journal of Ecology and Environment* 35(2), 61-71.
- [7] Whitten, T., G. Henderson and M. Mustafa. 2013. Ecology of Sulawesi. Tuttle Publishing.
- [8] Pioh, D. D., M. L. Rayes, B. Polii and L. Hakim. 2013. The classification and characteristics of soil surrounding lake ecosystem as a basic consideration in agrotourism development in Linow Lake, North Sulawesi. *IOSR Journal of Agriculture and Veterinary Science* 7(5), 30-38.
- [9] Boka, R. Y., W. R. Maryunani and L. Hakim. 2013. Local community perception toward the incentive system in the sustainable tourism quality development at Linow Lake, North Sulawesi. *IOSR Journal of Business and Management* 13(1), 1-6.
- [10] Tourism Office of Tomohon City. 2013. Jumlah kunjungan wisatawan (Tourists Visit in Tomohon City). Tomohon Tourism Office.
- [11] Sittadewi, E. H. 2011. Fungsi strategis Danau Tondano, Perubahan ekosistem dan



- masalah yang terjadi. Jurnal Teknologi Lingkungan 9(1).
- [12] Nebath, J. 2012. Kelimpahan tumbuhan akuatik di Danau Tondano. EKOTON 8(2).
- [13] Sampouw, O. G., A. E. Tungka and V. A. Kumorur. 2015. Hotel resort di tepi Danau Tondano, Minahasa "cultural identity". Jurnal Arsitektur DASENG 4(2), 61-70.
- [14] Inskeep, E. 1991. Tourism planning: an integrated and sustainable development approach. Van Nostrand Reinhold.
- [15] Fennell, D. A. 1999. Ecotourism: an introduction. Routledge. London and New York.

## Monitoring Water Quality Using Biotic Indices of Benthic Macroinvertebrates along Surfaces Water Ecosystems in Some Tourism Areas in East Java, Indonesia

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### Abstract

The research aimed to monitor surface water quality by using water quality index NSF-WQI and accurate biotic index of benthic macroinvertebrate. This study was conducted in September to November 2012 in some water tourism destinations in three regencies, i.e. Jember (three sites), Pasuruan (one site), and Malang (one site), East Java, Indonesia. Each site consisted of three stations (upstream, middlestream and downstream). Reference upstream and middlestream were located in the Meru Betiri National Park (MBNP) Jember. Water quality and benthic macroinvertebrates sampling were conducted in each site. While physical-chemical data consisted of TDS, DO, pH, NO<sub>3</sub>-N, TP and temperature were analyzed to determine the NSF-WQI index. Macrozoobenthic data were analyzed to determine three diversity indices and 11 biotic indices. Results showed that based on parameter of DO, TP, NO<sub>3</sub>-N, TDS and pH, water quality in downstreams were generally lower than upstreams. Upstream to middlestreams of two sites in Jember were good to excellent based on NSF-WQI water quality and biotic indices. Therefore, the water were qualified as drinking water resources and also served as safe recreational water. The accurate biotic indices to surface water quality in this study were % EPT, ASPT, HBI, FBI and % Gastropodes.

**Keywords:** biotic indices, benthic macroinvertebrates, water quality index, water tourism destination

### INTRODUCTION

Unpolluted surface water is important resources for drinking water, irrigation, industry, farming, recreation, and other usage. However, now days most of the rivers were severely polluted due to anthropogenic activities [1] and pollution of surface water became crucial environment issue all over the world [2]. Low water quality caused by pollution decrease water availability for directly or indirectly use, including for irrigation [3] or recreational water [4]. Natural process such as decaying, erosion, and flooding as well as anthropogenic activities like urbanization, industry and agriculture are the factors that causing pollution on the surface water [5].

Monitoring activity of river water quality is important to control, manage, and preserve these important natural resources. Ecosystem health of fresh waters determined from its physical, chemical and biological characteristics [6]. Thus monitoring activity of water quality was commonly determined by its physical, chemical, biological qualities [7]. To simplify presentation of monitoring results of water quality, utilization

of Water Quality Index (WQI) is more effective. WQI provides single value that express comprehensively water quality on particular site with several water quality parameters and transform complex water quality data into a more easily-understand information and useful for community. Water quality is difficult to comprehend if only based on numerous samples [8].

The results of monitoring on water quality also could be interpreted by biotic indices that determined based on benthic macroinvertebrates data. This organism groups has wide sensitivity range towards changes on habitat and water quality [9]. Benthic macroinvertebrates are important bioindicator that could inform the changes of water quality in a more accurate way compared to physico-chemical and microbiology parameters [10]. The benthic macroinvertebrates have been frequently used for assessing and monitoring water quality using diversity and biotic indices on the level of community structure [10] such as BMWP, ASPT, HBI, FBI and EPT [12-17].

Utilization of biotic and diversity indices of benthic macroinvertebrates can be profited to assess feasibility of water resources and impact of human activity on water quality in aquatic ecosystem of tourism area. Moreover these indices can further be used as a basis for

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management recommendations for tourism destination. For these reason, this study aimed to determine the accurate biotic index to assess the water quality in the lotic ecosystem as tourism destination. The ecosystems consisted of springs, waterfall, river, and tertiary irrigation channels.

## MATERIALS AND METHODS

### Study Area

The research was conducted in the Regency of Jember, Pasuruan and Malang, East Java, Indonesia. Study in Jember was located in three sites, namely Sanenrejo, Panti and Slawu, whereas in Pasuruan and Malang it was located in one site, i.e. Cowek and Lawang, respectively. Each site was divided into three stations, e.g. upstream, middlestream, and downstream. Upstream and middlestream in Sanenrejo are springs and river of Watu Gembuk, which are including in the management of Meru Betiri National Park (MBNP) and profited as reference site. The upstream in Panti is Tancak Waterfall, which its water stream down to the coffee plantation. Middlestream of Panti site is the River of Gunung Pasang. Upstream and middlestream of Slawu is Jompo River, while upstream and middlestream in Pasuruan site is Dam springs and river. Upstream and middlestream of Lawang as well as all downstream in all sites are tertiary irrigation channels (Fig. 1). Data sampling was taken on dry season of September to November 2012.

### Water Sampling, *in situ* Assessment and Water Physico-chemical Analysis

Water sampling and *in situ* measurement of physico-chemical parameters were conducted thrice in each station. Water sampling was taken in 1 L plastic bottle. The bottles of water sample was then stored in a cooler box with temperature 4°C. Physico-chemical parameters of *in situ* measurement are including conductivity (EC), pH, dissolved oxygen (DO), temperature. These measurements used CyberScan 600 series meters EUTECH Model PCD 650, HI 98127 pHep®4pH. Temperature Tester HANNA, DO meter Lutron Model DO5510 and thermometer. The width of channels or river, depth, and water flow rates were determined on each sampling points.

Water samples were then taken to laboratory to be analyzed. The analysis consisted of nitrogen nitrate ( $\text{NO}_3\text{-N}$ ), total phosphor (TP) and total dissolved solvent (TDS) refer to Standard Methods for Examination of Water and Waste Water [18]. Data of temperature, DO,  $\text{NO}_3\text{-N}$ , TP, and pH were analyzed to determine the value of National Sanitation Foundation Water Quality Index (NSF-WQI) [19]. Water sample analysis was conducted in the Laboratory of Anorganic Chemical, University of Jember. While benthic macroinvertebrates were identified in Laboratory of Ecology and Animal Diversity, Brawijaya University and Laboratory of Botany, University of Jember.

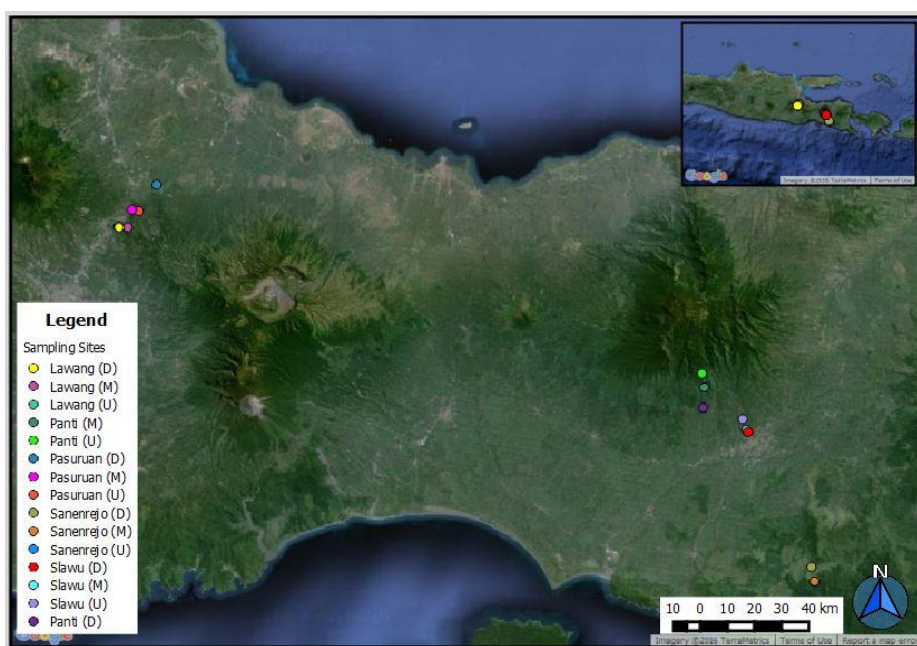


Figure 1. Location Sites in Regency of Jember, Pasuruan and Malang (15 sampling stations in five research sites)

### **Sampling, Identification, and Analysis of Benthic Macroinvertebrates Data**

Benthic macroinvertebrates were collected by using Surber net. Surber net was positioned on the bottom of flow with opened part of net against water flow, while net frame attached to the bottom of river. Basal substrates of the river include in the net frame were stirred thus the materials including benthic macroinvertebrates enter the net. Collected materials were poured into plastic container. Using pinset or pipet, benthic macroinvertebrates were separated from the debris. The number of individual for each taxa was counted and all microscopic specimen were taken for further identification in laboratory. Specimen was stored in bottle contained alcohol 70% [14]. Each specimen was then identified under microscope to determine the taxa.

Data of benthic macroinvertebrates were analyzed to determine the diversity and biotic indices. Three diversity indices used in this study were Shannon-Wiener (H), Simpson (D) and Margalef ( $D_{Mg}$ ) [9]. Eleven biotic indices were including EPT (Ephemeroptera Plecoptera Trichoptera), %EPT, %Odonata, %Choronomidae, %Diptera, %Gastropoda, Biological Monitoring Working Party (BMWP), Average Score per Taxon (ASPT), Family Biotic Index (FBI), and Hilsenhoff Biotic Index (HBI) [20-24].

### **Statistical Analysis**

Data of physico-chemical parameter were tested by analysis of variance to compare the average value of each parameter among five sampling sites. Multiple comparison of each parameter among sampling sites was determined by using the Games Howell test ( $p \leq 0.05$ ). Analysis of Pearson correlation was conducted for the value of NSFQI, diversity index, and biotic index of benthic macroinvertebrates to select accurate indices for the evaluation of surface water quality. All statistical analysis was conducted by using *software* SPSS 16.

## **RESULTS AND DISCUSSION**

### **Water Physico-Chemical Quality**

Monitoring water physico-chemical quality (EC, DO,  $\text{NO}_3\text{-N}$ , TP, TDS and pH) in the research sites were presented in Fig. 2. According to Indonesia Republic Government Regulation No. 82 of 2001 on Management of Water Quality and Water Pollution Control, water of three stations of Sanenrejo and Panti were grouped in the water category of Class I (qualified for drinking water resources). Upstream of Slawu categorized

as Class II (qualified for recreational water, fresh water fish farming, livestock farming, and irrigation). Pasuruan, middlestream and downstream of Slawu, and upstream of Lawang categorized in Class III (qualified for fresh water fish farming, livestock farming or irrigation), while middlestream and downstream in Lawang categorized in Class IV (qualified for irrigation); based on its concentration on DO,  $\text{NO}_3\text{-N}$ , TP, TDS and pH.

Water of the upstream and middle stream of Sanenrejo and Panti were qualified for drinking water resources, as well as met the requirement for recreational water. Sanenrejo is in the area of Meru Betiri National Park therefore the water quality was protected and undisturbed by waste form anthropogenic activities. Water quality of upstream in Panti where is waterfall of Tancak also was better protected from anthropogenic activities. It is located far from human settlements. Natural process was not significantly affected the concentration of  $\text{NO}_3\text{-N}$ , TP, and TDS. Previous study mentioned that natural processes and anthropogenic activities were responsible towards the water quality in fresh water ecosystem [25]. These three stations were often visited by tourists for recreational water. Water in Slawu, Pasuruan and Lawang were also meets the requirement for irrigation water (Class II, III, and IV), as well as water in Sanenrejo and Panti.

Water temperature in the study sites ranged 18.8-31.5°C. The lowest water temperature was recorded in the upstream of Panti, whereas the highest temperature was measured in the middlestream of Slawu. Water temperature is affected by the air temperature, and the air temperature in the upstream of Panti is the lowest (24°C) because this station is located at the highest elevation (851 m above sea level). Temperature of surface water is generally ranged 9-30°C [26]. Water temperature is essential in the growth, reproduction, and migration of fish and other aquatic organism. It also controls the rate of chemical and biochemical reaction in the water. It is also an important factor that affects water dissolved oxygen (DO) [27].

The range of average concentration of DO in research stations were 1.6-10.77  $\text{mg.L}^{-1}$ . Average concentration of DO in the upstream and middlestream of Sanenrejo was not significantly different to the condition in Panti. Average DO concentration in the five stations was higher and significantly different to the other three first sites (Fig. 2). Waters in three stations of Sanenrejo and

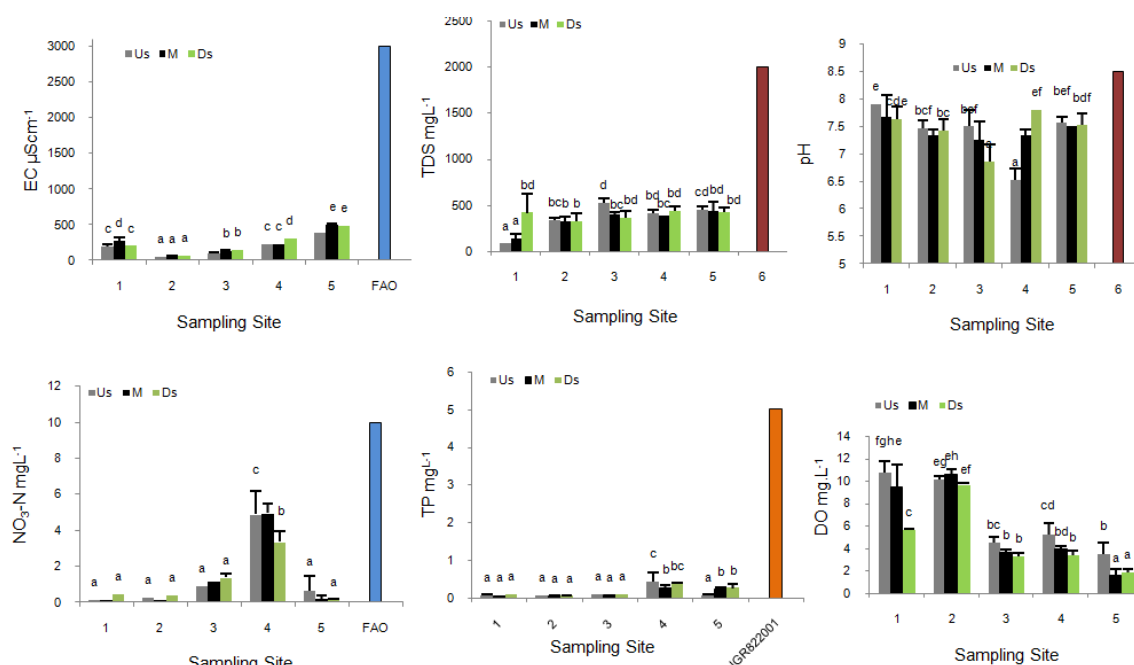
Panti as well as the upstream in Slawu and Pasuruan are capable to support the growth and activities of aquatic organisms because its DO value was higher than 4mg.L<sup>-1</sup>. Optimal DO for high water quality ranges 4-6 mg.L<sup>-1</sup> [28].

The average pH on the research sites ranged 6.5-7.9 (Fig. 2). The average pH on the research sites showed similar results to previous study [29]. Water on most of the stations is alkaline, except water of downstream of Slawu and upstream in Pasuruan is acidic (Fig. 2). Alkaline character generally indicates that water contains magnesium and calcium carbonate which imply the photosynthesis and decomposition occurred in the water [30]. Water in the research sites met pH requirement of aquatic organism. Water with pH range 6.09-8.45 optimally supports living aquatic organism [31].

Salinity of irrigation water is generally determined by value of EC and TDS. Both parameters describe water potential to raise salinity and soil infiltration [32]. The EC average on all stations ranged 48.6–503  $\mu\text{S.cm}^{-1}$ , whereas the concentration of TDS was 84-529 mg.L<sup>-1</sup> (Fig. 2). Based on the EC, water from Panti, Slawu, upstream and downstream of Sanenrejo, upstream and middlestream of Pasuruan was categorized as water with low salinity ( $\text{EC} < 250 \mu\text{S.cm}^{-1}$ ), while

other stations were medium salinity ( $\text{EC}$ : 250-750  $\mu\text{S.cm}^{-1}$ ). As the source of water for irrigation, water in all stations were grouped as non degree of restriction on use, because water EC value was less than FAO limit 700  $\mu\text{S.cm}^{-1}$  [32]. Therefore, water from all stations could be used for irrigation without any risk on salinity or infiltration.

Nitrogen and Phosphorus are essentials nutrition for aquatic organism. In the research, the average concentration of NO<sub>3</sub>-N in the water ranged 0.08-4.96 mg.L<sup>-1</sup> (Fig. 2). Concentration of NO<sub>3</sub>-N in this study showed similar value with other studies [4,33, 34]. Water on all stations in this study is included *non degree of restriction on use* because the NO<sub>3</sub>-N is less than FAO limit 5 mg.L<sup>-1</sup> [32]. Therefore, water from all stations could be used to irrigate field without any risk to plants growth. Average concentration of TP in all stations showed lower measurement, i.e. 0.044-0.369 mg.L<sup>-1</sup> (Fig. 2). Concentration of TP in this study showed similar results with other study [34]. Both NO<sub>3</sub>-N and TP concentration indicate nutrient enrichment of waters and potential eutrofication. TP enters to water body as a result of bed rock weathering, organic matter decaying, synthetic fertilizer, industrial and domestic wastes.



**Figure 2.** Mean values of NO<sub>3</sub>-N, TP, pH, EC, TDS and DO. Magnitude of the bar shows the SD (n=3).

Bars with different letters are significantly different (Games Howell test,  $p < 0.05$ ). 1=Sanenrejo, 2=Panti, 3=Slawu, 4=Pasuruan, 5=Lawang, 6=FAO (Food and Agricultural Organisation) and IGR82/2001 (Indonesia Government Regulation No. 82 of 2001).

Based on calculated water quality index NSF-WQI, the upstream water in conservation area of Sanenrejo was excellent (blue) quality. While middle stream and downstream in Sanenrejo and three stations in Panti were good (green) quality, while the other stations water were in medium (yellow) quality (Table 1).

**Table 1.** Variable value of NSF-WQI in the sampling sites

Location	Station	NSF-WQI	Water Quality Category
Sanenrejo	Upstream	91.8	Excellent
	Middle stream	87.2	Good
	Downstream	79.9	Good
Panti	Upstream	81.8	Good
	Middle stream	82.7	Good
	Downstream	82.8	Good
Slawu	Upstream	69.9	Medium
	Middle stream	68.4	Medium
	Downstream	69.3	Medium
Pasuruan	Upstream	64.5	Medium
	Middle stream	68.3	Medium
	Downstream	66.5	Medium
Lawang	Upstream	69.6	Medium
	Middle stream	66.4	Medium
	Downstream	66.8	Medium

**Notes:** NSF-WQI = National Sanitation Foundation Water Quality Index

The waters in Sanenrejo and Panti were excellent and good quality, because there was no settlement in its surrounding area, thus no domestic waste entered in the water body. For these reasons the waters of Sanenrejo and Panti, especially the upstream and middlestream, were good resources for drinking water and water recreational location.

Waters in Slawu, Pasuruan and Lawang showed medium quality. Two first sites are located in a middle of settlements, while the last is in a middle of semi-organic paddy field. Both domestic waste and agricultural waste contributed to raise water concentration of TDS, NO<sub>3</sub>-N, TP and pH. This medium quality confirmed that the water from Slawu, Pasuruan and Lawang were suitable for irrigation water. It is important notes that utilization of water for those purposes would negatively impact on the people health, crops, or environment quality.

#### **Qualification of Water Quality: Bioindicator of Benthic Macroinvertebrates**

We found 57 taxa of benthic macroinvertebrates which belong to the class of Insecta, Malacostraca, Gastropoda, Bivalvia, Clitella and an unidentified one (Table 2). The Insecta was found as the most (44 taxa) followed by

Gastropoda (10 taxa). The number of taxa in each station varied, the richest was found in the upstream of Pasuruan (31 taxa) and the lowest was in the downstream of Panti (7 taxa). Sensitive taxa of Ephemeroptera, Plecoptera, Trichoptera (EPT) were found mostly in upstream and middlestream of Sanenrejo, Panti, Pasuruan and Lawang. These taxa were found in Slawu except Hydropsyche (Trichoptera) (Table 2). High percentage of EPT taxa was strongly correlated to the good water quality, high concentration of and low nutrient [22]. Therefore, water quality in eight stations where the sensitive taxa found were still in a good quality, even with different level of taxa density and richness. The absent sensitive taxa in Slawu indicated that water quality decreased and affected by anthropogenic activities.

Based on the taxa richness, diversity index of Shannon-Wiener (H'), Simpson (D), ASPT, FBI, HBI and EPT, water in 15 stations showed variable quality (Table 3). It revealed that a station could be qualified into more than a category of water quality. As example, water in the upstream of Sanenrejo classified as fair and good; water in the downstream of Pasuruan categorized as excellent, fair and good quality. Therefore, it is very important to select the accurate biotic and diversity indices to avoid missinterpretation in water quality assessment [24].

In this study, water quality was also determined by using diversity index of Shannon-Wiener (H') and Margalef (D), biotic indices of BMWP, % EPT, % Odonata, % Chironomidae, % Diptera and % Gastropoda. However, water quality category could not only be determined by an index, except BMWP. Water quality is considered as good if BMWP is greater than 100 and as very poor if it is less than 10 [35].

Based on index of BMWP, water quality in 14 stations was considered as fair, ranged 11-93, while the downstream water of Lawang was categorized as very poor water quality because the BMWP was less than 10.

Indices of % EPT, % Odonata, % Chironomidae, % Diptera and % Gastropoda were presented in Fig. 3. EPT and Odonata are sensitive taxa towards water pollution. If the station has fairly high value for both indices, thus the station is still considered as good quality. Although percentage of EPT and Odonata were not higher than tolerant taxa, the existence of sensitive taxa showed that habitat was less disturbed or there was only a slight disturbance. This condition was found in three station of

Sanenrejo and Pasuruan, upstream, middle stream of Panti and Slawu. Percentage of tolerant taxa (Diptera) was higher than sensitive taxa (EPT). If percentage of tolerant taxa was high or very high, it indicated polluted water.

In the downstream of Panti, Slawu, Pasuruan and three stations in Lawang, % Gastropodes showed high percentage (100% on downstream of Slawu and more than 50% on other stations). Whereas % EPT or Odonata was very low (Fig. 3), therefore the stations were disturbed or polluted. The abundance of EPT taxa was significantly affected by pollutant. Organic

pollution was reported to be cause of decreasing abundance of EPT taxa [36, 37].

Determination of accurate diversity and biotic indices for quality of surface water (NSF-WQI) in 15 research stations was conducted by correlation test of Pearson. Correlation test showed that NSF-WQI correlated significantly to % EPT (0.454), % Gastropoda (-0.451), ASPT (0.528), FBI (-0.495) and HBI (-0.463). Index of water quality NSF-WQI was positively correlates to %EPT and ASPT, higher of both values, better water quality was.

**Table 2.** Spatial distribution of benthic macroinvertebrates in the study sites

Class/Ordo/Family	Genus/Species	Sampling Sites														
		Sanenrejo			Panti			Slawu			Pasuruan			Lawang		
		Us	M	Ds	Us	M	Ds	Us	M	Ds	Us	M	Ds	Us	M	Ds
Insecta																
Ephemeroptera																
Baetidae	<i>Baetis</i> , <i>Acentrella</i> , <i>Centroptilum</i>	B,A	B,A	B,A	B,A	B,A,C					+	+		B,A	B,A	B,A
Leptophlebiidae	<i>Leptophlebia</i> , <i>Paraleptophlebia</i> , <i>Traverella</i>				P						P,T	P		P,L	P,L	+
Heptageniidae	<i>Ecdyonurus</i>		+		+	+										
Caenidae	<i>Caenis</i>		+	+							+	+		+	+	
Plecoptera																
Perlidae	<i>Perla</i>	+	+		+	+										
Trichoptera																
Hydropsychidae	<i>Hydropsyche</i> , <i>Cheumatopsyche</i>	H	H		H	H		H	H		H	+		H	+	
Rhyacophyllidae	<i>Ryacophila</i>	+	+													
Polycentropodidae	Undetermined					+					+	+				
Glossomatidae	Undetermined											+				
Hydroptilidae	<i>Hydroptilae</i> , <i>Ithytrichia</i> , <i>Oxyethira</i>	I	U		U	O Hy,U					Hy,O	I		I		
Limnephilidae	Undetermined				+											
Lepidostomatidae	Undetermined				+	+					+	+				
Beraeidae	<i>Bera</i>										+					
Coleoptera																
Elmidae	Undetermined				+	+		+	+	+						
Dryopidae	Undetermined				+	+		+	+							
Hydraenidae	Undetermined	+				+		+	+		+	+	+			
Lampyridae	Undetermined															+
Neuroptera																
Osmalyidae	Undetermined				+											
Odonata								+		+	+	+		+	+	
Libellulidae	Undetermined	+	+		+					+	+					
Euphaeidae	Undetermined				+						+	+				
Cordulidae	Undetermined				+						+	+		+	+	
Aeshnidae	Undetermined			+						+				+	+	
Diptera																
Chironomidae	<i>Chironomus</i> , <i>Symbiocladius</i> , <i>Undetermined</i> 1, 2		Ch,S	S,U <sub>1,2</sub>	Ch, S,U <sub>1,2</sub>	S,U <sub>1</sub>		U <sub>1</sub>	U <sub>1</sub>	U <sub>1</sub>	+	+		U <sub>1,2</sub>	U <sub>1</sub>	U <sub>2</sub>
Blephariceridae	Undetermined				+	+										
Culicidae	Undetermined			+												
Tipulidae	<i>Anthoca</i>	+	+	+		+						+				
Rhagionidae	<i>Atherix</i>	+	+		+	+		+	+							
Simuliidae	<i>Simulium</i>	+	+		+	+					+					
Psychodidae	<i>Psychoda</i>			+		+										
Dixidae	<i>Dixa</i>			+							+					
Malacostraca																
Decapoda																
Palaemonidae	<i>Macrobrachium</i>				+						+					
Parathelphusidae	<i>Parathelphusa</i>													+	+	+
Gastropoda										+	+					
Lymnaeidae	<i>Lymnaea</i>			+							+	+				
Bithyniidae	<i>Wettedia</i>															
Viviparidae	Undetermined						+				+				+	
Thiaridae	<i>Terebia granifer</i> , <i>Thiara scabra</i> , <i>Melanoides tuberculosa</i> , <i>Melanoides riquerti</i>	Mr, Tg, Ts					+	Mr, Tg	Mr, Tg, Ts	Mr, Tg, Ts	+	Mr, Tg, Ts	Mr, Tg, Ts	Mt Mr Tg	Mt Mr Tg	Mt Mr Ts
Pachychilidae	<i>Sulcospira testudinaria</i>	+					+	+	+	+	+		+	+	+	+
Planorbidae	<i>Gyraulus</i>												+			
Buccinidae	<i>Anentome helena</i>													+	+	
Bivalvia														+	+	+
Cyrenidae	<i>Corbicula javanica</i>			+									+	+	+	+
Citellata																
Haplotaenidae																
Lumbricidae	<i>Lumbricus</i>			+		+		+	+				+	+	+	
Phylum	Undetermined					+	+									
Platyhelminthes																

**Notes:** B = *Baetis*; A = *Acentrella*; C = *Centroptilum*; P = *Paraleptophlebia*; T = *Traverella*; L = *Leptophlebia*; H = *Hydropsyche*; I = *Ithytrichia*; O = *Oxyethira*; Hy = *Hydroptilae*; Ch = *Chironomus*; S = *Symbiocladius*; Mr = *Melanoides riquerti*; Mt = *Melanoides tuberculosa*; Tg = *Terebia granifera*; Ts = *Thiara scabra*; U = Undetermined; Us = Upstream; M = Middle; Ds = Downstream.

High NSF-WQI index indicate good water quality. Otherwise, the index of NSF-WQI was negatively correlates to % Gastropoda, FBI and HBI. Therefore lower % Gastropoda, FBI and HBI, better water quality was.

Water quality assessment based on the indices of FBI and HBI showed that category of water quality in the research stations were

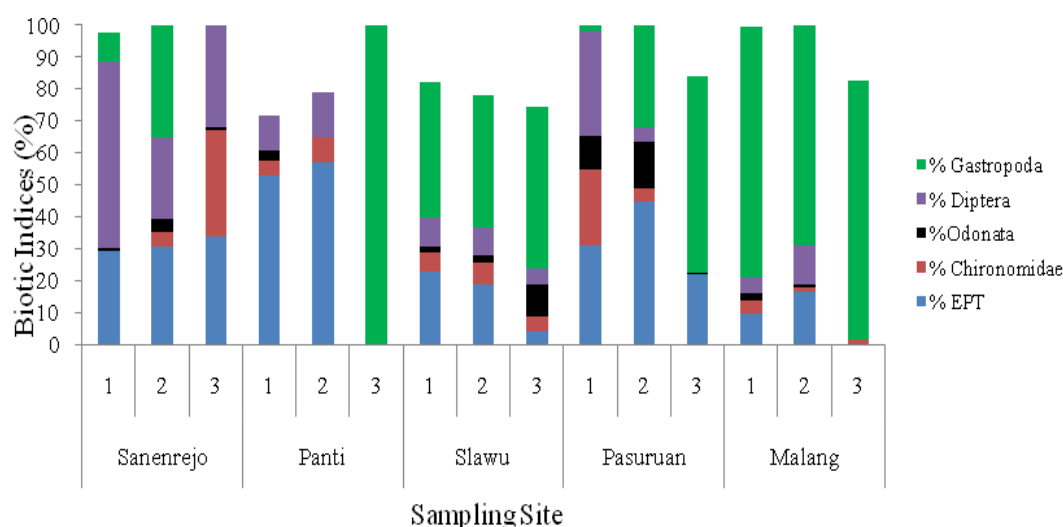
excellent (no apparent organic pollution), good (possible slight organic pollution) and fair (significant organic pollution). Based on both biotic indices, 11 stations showed the same water quality, while four other stations were found different water quality, i.e. downstream of Slawu and three stations of Pasuruan (Table 3).

**Table 3.** Mean values of taxa richness, H' diversity index, D diversity index, ASPT, HBI, FBI and EPT in the study sites

Locations/ Stations		D <sub>Mg</sub>	BMWP /Water Quality	TR/ Water Quality	H'/Water Quality	D/Water Quality	ASPT/Water Quality	FBI/Water Quality	HBI/ Water Quality	EPT/ Water Quality
Sanen-rejo	Us	2.5	47/F	14 / F	1.7 / G	0.66 / F	5.88 / G	5.05 / G	4.75 / G	7 / G
	M	3.4	61/F	18 / F	2.5 / E	0.89 / E	6.10 / E	5.32 / G	5.53 / G	8 / G
	Ds	3.4	43/F	17 / F	2.4 / E	0.86 / E	4.78 / F	5.45 / G	5.52 / G	3 / F
Panti	Us	4.2	87/F	22 / G	2.3 / E	0.83 / E	6.69 / E	3.71 / E	4.42 / E	5 / F
	M	4.1	67/F	22 / G	2.6 / E	0.88 / E	5.80 / G	3.78 / E	4.17 / E	12 / E
	Ds	1.2	11/F	7 / VP	1.6 / G	0.77 / G	5.50 / G	7.02 / F	6.96 / F	0 / VP
Slawu	Us	2.0	35/F	10 / VP	2.0 / G	0.89 / E	5.00 / F	4.66 / G	4.81 / G	1 / VP
	M	2.5	36/F	13 / F	2.2 / E	0.87 / E	4.50 / F	4.74 / G	4.86 / G	1 / VP
	Ds	2.4	32/F	12 / F	2.3 / E	0.89 / E	4.57 / F	5.88 / F	5.83 / G	1 / VP
Pasuruan	Us	5.7	91/F	31 / E	2.9 / E	0.92 / E	6.07 / E	5.83 / F	5.51 / G	12 / E
	M	4.6	93/F	24 / G	2.7 / E	0.92 / E	5.81 / G	5.89 / F	5.32 / G	11 / E
	Ds	2.8	38/F	15 / F	1.7 / G	0.67 / F	5.43 / G	6.14 / F	6.49 / G	6 / G
Malang	Us	3.7	42/F	6 / VP	2.0 / G	0.77 / G	5.25 / G	6.72 / F	6.67 / F	6 / G
	M	3.5	36/F	18 / F	2.1 / E	0.79 / G	5.14 / G	6.51 / F	6.6 / F	6 / G
	Ds	1.2	2/F	7 / VP	1.5 / F	0.73 / G	2.00 / VP	7.16 / F	7.16 / F	0 / VP
<b>Water Quality Category:</b>										
Excellent (E)				>30	>2	1-0.8	>6	0-3.75	0-3.50	>10
Good (G)			>100	21-30	2-1.6	0.70-0.79	5.1-6.0	3.76-5.37	3.51-5.99	6-10
Fair (F)			10-100	11-20	1.5-1.0	0.60-0.69	4.0-5.0	5.38-7.25	6.01-8.5	2-5
Very Poor (VP)			<10	0-10	<1	<0.6	<4	7.26-10	8.51-10	0-1

**Notes:** Us, M, Ds = upstream, middle stream, downstream;

ASPT = Average Score per Taxon; BMWP = Biological Monitoring Working Party; D<sub>Mg</sub> = Margalef diversity index; D Simpson diversity index; EPT = Ephemeroptera, Plecoptera, Trichoptera; H' = Shannon-Wiener diversity index; FBI = Family Biotic Index; HBI = Hilsenhoff Biotic Index; TR = taxa richness



**Figure 3.** Mean value of % EPT, % Odonata, % Dptera, % Chironomidae and % Gastropoda Indices

**Notes:** 1,2,3 = upstream, middle stream, downstream



Category of water quality based on ASPT index consisted of excellent, good, fair and very poor. Water assessment in the upstream of Sanenrejo and Panti using indices of ASPT, FBI and HBI proved the similar conclusion (Table 3). This different accuracy among indices was found due to each index gave a particular tolerant score for each taxa. Besides that, not all taxa had been already fixed their tolerant score and included into calculation of biotic index. Three biotic indices grouped the upstream and middlestream of Sanenrejo and upstream of Panti as excellent and good quality respectively. Thus this conclusion was still consistent to the assessment of NSF-WQI and Indonesia Government regulation.

This research results proved that some biotic indices of benthic macroinvertebrates could be used for monitoring impact of human activity on water quality in the tourism area. This evaluation could then be served as a basis for management recommendations of recreational water in tourism area.

## CONCLUSION

Based on monitoring on the physico-chemical characters and biotic quality of surface water in research sites and refer to Indonesia Regulation Government No. 82 of 2001 we concluded as follows: Water in Sanenrejo and Panti was in class I (for drinking water), upstream of Slawu is class II (for recreational water, fresh water fish pond, livestock farming, and irrigation), Pasuruan and upstream of Lawang is class III (for fresh water fish pond, livestock farming, and irrigation), middle stream and downstream of Lawang is class IV (for irrigation). Water quality based on the NSF-WQI showed that water in upstream of Sanenrejo was excellent. Moreover, water of middle stream and downstream of Sanenerejo and three stations of Panti was good, while the other nine stations were medium. Therefore, the water in Sanenrejo and Panti were qualified as drinking water and also used as recreational water especially the springs and river of Watu Gembuk, and Tancak Waterfall. Water in all research sites also met the requirement of irrigation water. Relevant Biotic indices that appropriate to assess the quality of springs, waterfall, river, and irrigation channels are HBI, FBI, ASPT, % EPT and % Gastropoda. Category of water quality in the research stations based on the indexes of FBI and HBI consisted of excellent (no apparent organic pollution), good (possible slightorganic pollution) and fair

(significant organic pollution). Based on index of ASPT, water quality was qualified into excellent, good, fair and very poor.

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## REFERENCES

- [1] Altansukh, O. and G. Davaa. 2011. Application of index analysis to evaluate the water quality of the Tuul River in Mongolia. *Journal of Water Resource and Protection* 3, 398-414.
- [2] Salah, E. A. M., A. M. Turki and E. M. Al-Othman. 2012. Assessment of water quality of Euphrates River using cluster analysis. *Journal of Environmental Protection* 3, 1629 -1633.
- [3] Simsek, C. and O. Gunduz. 2007. IWQ index: a GIS-integrated technique to assess irrigation water quality. *Journal of Environmental Monitoring and Assessment* 128, 277-300.
- [4] Şen, F. and A. Aksoy. 2015. Chemical and physical quality criteria of Bulakbaşı Stream in Turkey and usage of drinking, fisheries, and irrigation. *Journal of Chemistry* 2015, 1-8.
- [5] Carpenter, S. R., N. F. Caraco, D. L. Correll, R. W. Howarth, A. N. Sharpley, V. H. Smith. 1998. Nonpoint pollution of surface waters with phosphorus and nitrogen. *Ecological Applications* 8(3), 559-568.
- [6] Venkatesharaju, K., P. Ravikumar, R. K. Somashekar and K. L. Prakash. 2010. Physico-chemical and bacteriological investigation on the River Cauvery of Kollegal Stretch in Karnataka. *Journal of Science Engineering and Technology* 6 (1), 50-59.
- [7] Tyagi S., B. Sharma, P. Singh and R. Dobhal. 2013. Water quality assessment in terms of water quality index. *American Journal of Water Resources* 1(3), 34-38.
- [8] Behmanesh, A. and Y. Feizabadi. 2013. Water quality index of Babolrood River in Mazandaran, Iran. *International Journal of*

- Agriculture and Crop Sciences 5 (19), 2285-2292.
- [9] Abel, P. D. 1989. *Water Pollution Biology*. John Wiley and Sons. New York.
- [10] Ikromi, R. B. F., O. Arimoro and O. K. Odi-hirin. 2005. Composition, distribution and abundance of macroinvertebrates of the upper reaches of River Ethiopie Delta State, Nigeria. *The Zoologies* 3, 68-81.
- [11] Rosenberg, D. M. and V. H. Resh. 1993. *Freshwater Biomonitoring and Benthic Macroinvertebrates*. Chapman and Hall. New York.
- [12] Moskova, G, R. Soufi and Y. Uzunov. 2008. Application of the EPT-index for ecological status assessment of the river water bodies within the basin of Kamchia River. *Bioautomation* 11, 73-79.
- [13] Gonçalves, F. B. and M. S. Menezes. 2011. A comparative analysis of biotic indices that uses macroinvertebrates to assess water quality in a coastal river of Parana State, Southern Brazil. *Biota Neotropica* 11(4), 1-10.
- [14] Kalyoncu, H. and M. Zeybek. 2011. An application of different biotic and diversity indices for assessing water quality: A case study in the Rivers Çukurca and Isparta (Turkey). *African Journal of Agricultural Research* 6 (1), 19-27.
- [15] Zeybek, M., H. Kalyoncu, B. Karakaş and S. Özgül. 2014. The use of BMWP and ASPT indices for evaluation of water quality according to macroinvertebrates in Değir-mendere Stream (Isparta, Turkey). *Turkish Journal of Zoology* 38, 603-613.
- [16] Tan, K. W. and W. C. Beh. 2015. Water quality monitoring using biological indicators in Cameron Highlands Malaysia. *Journal Sustainable Development* 8(3), 28-42.
- [17] Retnaningdyah, C. and E. Arisoelaningsih. 2014. Indication of Pollution in Some Springs Located in Upstream of Brantas Watersheds Using Benthic Macroinvertebrates Biotic Indices. *Proceedings of Biodiversity National Seminar UNS Solo* 3(1), 210-213
- [18] Clesceri, L. S., A. E., Greenberg and A.D. Eaton. 1998. *Standard Methods for the Examintaion of Water and Waste Water*, 20<sup>th</sup> Ed. American Public Health Association, American Water Works Association, and Water Environment Federation. Washington.
- [19] Abbasi, S. A. 2002. *Water quality indices. State of the Art*, Pondicherry University. Centre for Pollution Control and Energy Technology. Pondicherry.
- [20] Lenat, D. R. 1988. Water quality assessment using a qualitative collection method for benthic macroinvertebrates. *Journal of North American Benthological Society* 7, 222-233.
- [21] Plafkin, J. L., M. T. Barbour, K. D. Porter, S. K. Gross and R. M. Hughes 1989. *Rapid Bioassessment protocols for use in stream and rivers: benthic macroinvertebrates and fish*. U.S. Environmental Protection Agency. EPA 440/4-89/001. 8 chapters. Appendices A-D.
- [22] Barbour, M. T., J. Gerritsen, B. D. Synder and J. B. Stribling. 1999. *Rapid bioassessment protocols for use in streams and Wadebele Rivers: periphyton, benthic macroinvertebrates, and fish*, 2<sup>nd</sup> Ed. EPA 841-B-99-002. U.S.Environmental Protection Agency. Washington, D.C.
- [23] Mackie, G. L. 2001. *Applied aquatic ecosystem concepts*. Kendall/Hunt Publishing Company. Dubuque.
- [24] Mandavilles, S. M. 2002. *Benthic macroinvertebrates in freshwater-taxa tolerance values, metric and protocols*. Soil and Water Conservation Society of Metro Halifax. New York.
- [25] Samsudin, M. S., H. Juahir, S. M. Zain and N. H. Adnan. 2011. Surface river water quality interpretation using environmetric techniques: case study at Perlis River Basin, Malaysia. *International Journal of Environment and Pollution* 1(5), 1-8.
- [26] Chapman D. and V. Kimstach. 1996. *Selection of water quality*. In: Chapman D. (Ed). *Water Quality Assessment - A Guide Use Biota, Sediments, and Water in Environmental Monitoring*, 2<sup>nd</sup> Ed. UNESCO/WHO/ UNEP.
- [27] Shah, A. and G. S. Joshi. 2015. Evaluation of water quality index for River Sabarmati, Gujarat. *Applied Water Science* 7, 1-10.
- [28] De, A. K. 2003. *Environmental chemistry*, 5<sup>th</sup> Ed. New Age International Publisher. New Delhi.
- [29] Aris, A. Z., W. Y. Lim, S. M. Praveena, M. K. Yusoff, M. F. Ramli and H. Juahir. 2014. Water quality status of selected rivers in Kota Marudu, Sabah, Malaysia and its suitability for usage. *Sains Malaysiana* 43(3), 377-388.

- [30] Mokhtar, M. B., A. Z. Aris, M. H. Abdullah, M. K. Yusoff, M. P. Abdullah, A.R Idris and R. I. Raja Uzir. 2009. A pristine environment and water quality in perspective: Maliau Basin, Borneo's mysterious world. *Water and Environment Journal* 23(3), 219-228.
- [31] Boyd, C. E. and Lichtkoppler. 1979. *Water quality management in pond fish culturing. Research and Development Series No. 22.* Auburn University. Alabama.
- [32] Ayers, R. S. and Westot, D. W. 1994. *Water quality for agriculture. FAO Irrigation and Drainage Paper. 29 Rev 1.*
- [33] Binkley, D., G. G. Ice, J. Kaye and C. A. Williams. 2004. Nitrogen and phosphorus concentrations in forest streams of The United States. *Journal of the American Water Resources Association* 40(5), 1277-1291.
- [34] Effendi, H., Y. Romanto, Wardiatno. 2015. Water quality status of Ciambulawung River, Banten Province, based on pollution index and NSF-WQI. *Procedia Environmental Sciences* 24, 228 – 237.
- [35] Mason, C. F. 2002. *Biology of Freshwater Pollution*, 4<sup>th</sup> Ed. Prentice Hall. New York.
- [36] McCabe, D. J. and N. J. Gotelli. 2000. Effects of disturbance frequency, intensity, and area on assemblages of stream macroinvertebrates. *Oecologia* 124, 270-279.
- [37] Kartikasari, D., C. Retnaningdyah, E. Arisoesilaningsih. 2013. Application of Water Quality and Ecology Indices of Benthic Macroinvertebrate to Evaluate Water Quality of Tertiary Irrigation in Malang District. *The Journal of Tropical Life Science* 3(3), 193-201.

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Competitiveness of destinations, products and Indonesian tourism business; Diversification of tourism products; Incentive system of business and investment in tourism; Information, promotion and communication in tourism; Tourism supporting infrastructure; Security and convenience in tourism; Tourism policy; Unique tourism community life (living culture); Local knowledge, traditions, and cultural diversity; Diversity and attractions in ecotourism; Diversity of natural attractions in ecotourism; Pluralistic diversity of ecotourism society; Diversity of ecotourism activities; Hospitality of the local resident; The quality of tourism services; Quality of HR in tourism (Standard, accreditation and competence certification); The market share of tourism and integrated marketing system; Package of tourism attraction; Development of tourism regions; Community based Eco-Tourism.

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**INTRODUCTION** (Calibri 10 Bold, Left, Capslock)

All submitted manuscripts should contain original research which not previously published and not under consideration for publication elsewhere. Articles must be written in ENGLISH and manuscripts may be submitted for consideration as research report articles, short reports or reviews.

The introduction explains the background of the problem, the study of literature and research purposes. Some initial introduction paragraphs explain the problem and background to these problems [1]. The next few paragraphs explain the study of literature that contains recent knowledge development which is directly related to the issues. The last paragraph of the introductory section contains a description of the purposes of the study. (Calibri 10 Justify)

**MATERIAL AND METHOD** (Calibri 10 Bold, Left, Capslock)

This section describes the types of methods (qualitative, quantitative or mixed-method) with details of methods of data collection and data analysis [2]. This section also describes the perspective that underlying the selection of a particular method. (Calibri 10 Justify)

**Data Collection** (Calibri 10 Bold, Left)

Explain the data collection methods, i.e. surveys, observations or archive, accompanied by details of the use of such methods. This section also describes the population, sampling and sample selection methods. (Calibri 10 Justify)

The use of English language should followed proper grammar and terms. Name of organism should be followed by its full scientific name in the first mention, in *italic* [3]. Author of the scientific name and the word of “var.” typed regular. Example: *Stellaria saxatilis* Buch. Ham. First abbreviation typed in colon after the abbreviated phrase.

Author must use International Standard Unit (SI). Negative exponent used to show the denominator unit. Example: g l<sup>-1</sup>, instead of g/l. The unit spaced after the numbers, except percentage [4]. Example: 25 g l<sup>-1</sup>, instead of 25gl<sup>-1</sup>; 35% instead of 35 %. Decimal typed in dot (not coma). All tables and figures should be mentioned in the text.

**RESULT AND DISCUSSION** (Calibri 10 Bold, Left, Capslock)

This section contains the results of the analysis and interpretation or discussion of the results of the analysis. Describe a structured, detailed, complete and concise explanation, so that the reader can follow the flow of analysis and thinking of researchers [5]. Part of the results study should be integrated with the results of the

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Address : affiliation address include post code

analysis and the results and discussion are not separated.

### Table

Table should be submitted within the manuscript and in separated file of *Microsoft Excel* (xls.). Table should not exceed 8 cm (one column) and 17 cm (two columns). Table should be embedded in different page after references.

Table should be numbered in sequence. Table title should be brief and clear above the table, with uppercase in initial sentence. Vertical line should not be used. Footnote use number with colon and superscripted. Symbol of (\*) or (\*\*) was used to show difference in confidence interval of 95 and 99%.

**Table 1.** Example of the Table (Calibri 8.5 Left)

No	Point (Calibri 8.5 Justify)	Description
1		
2		
3		
4		
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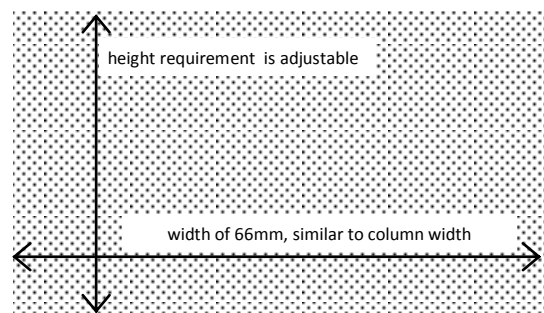
Sources: Journal of PPSUB (Calibri 8.5 Left)

### Figures

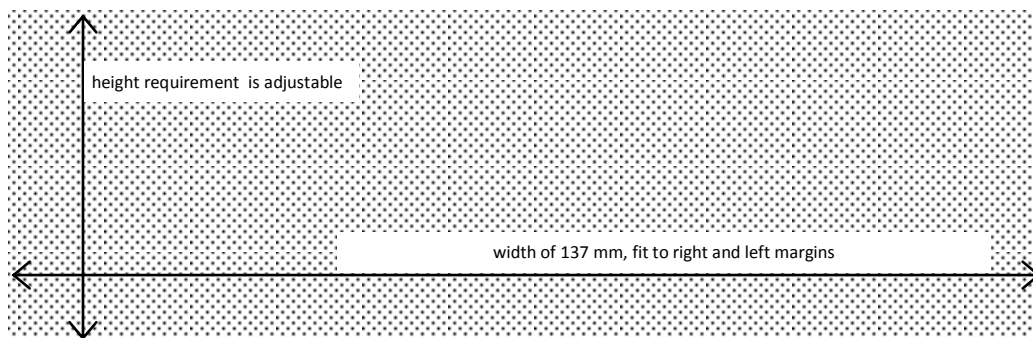
Figures should be in high resolution and well contrast in JPEG or PDF with the following conditions:

- Monochrome image (line art), figures of black and white diagram (solid/no shades of gray), resolution 1000-1200 dpi (dot per inch).
- Combination Halftone, combine figure and text (image containing text) and coloured graphic or in grayscale format. Resolution 600-900 dpi.
- Halftone, coloured figure or grayscale format without text. Resolution 300 dpi.

- Black and white figure should be in the grayscale mode, while coloured figures should be in RGB mode.
- Figure should not exceed the width of 8 cm (one column), 12.5 cm (1.5 columns) or 17 cm (two columns).
- Figures title typed clearly below the figure.
- Figure with pointing arrow should be grouped (grouping).
- Figures were recommended in black and white.
- Legend or figure description should be clear and complete. If compressed, the figure should be readable.
- Statistic graphic should be supplemented with data sources.
- If the figures come from the third party, it should have the copyright transfer from the sources.



**Figure 1.** Illustration of Dimensional Figure of one column width. Figure dimension adjusted to the width of one column. Name the figure (diagram) written below the image. (Calibri 8.5 Justify)



**Figure 2.** Illustration of Dimensional Figure of two column width. Figure dimension adjusted to the width of two columns (137 mm). Figure were align top or bottom of the page. (Calibri 8.5 Justify)

## References

1. Primary references include journal, patent, dissertation, thesis, paper in proceeding and text book.
  2. Avoid self citation.
  3. Author should avoid reference in reference, popular book, and internet reference except journal and private ana state institution.
  4. Author was not allowed to use abstract as references.
  5. References should been published (book, research journal or proceeding). Unpublished references or not displayed data can not be used as references.
  6. References typed in numbering list (format number 1,2,3,...), ordered sequentially as they appear in the text (system of Vancouver or author-number style).
  7. Citation in the manuscript typed only the references number (not the author and year), example: Obesity is an accumulation of fat in large quantities which would cause excessive body weight (overweight) [1]. Obesity is a risk factor of diabetic, hypertension dan atherosclerosis [2].
- [4].Syafi'i, M., Hakim, L., dan Yanuwiyadi, B. 2010. Potential Analysis of Indigenous Knowledge (IK) in Ngadas Village as Tourism Attraction. pp. 217-234. In: Widodo, Y. Noviantari (eds.) *Proceed-ing Basic Science National Seminar 7* Vol.4. Universitas Brawijaya, Malang. (Article within conference proceeding)
- [5].Dean, R.G. 1990. Freak waves: A possible explanation. p. 1-65. *In* Torum, A., O.T. Gudmestad (eds). *Water wave kinetics*. CRC Press. New York. (Chapter in a Book)
- [6].Astuti, A.M. 2008. The Effect of Water Fraction of *Stellaria* sp. on the Content of TNF- $\alpha$  in Mice (*Mus musculus* BALB-C). Thesis. Department of Biology. University of Brawijaya. Malang. (Thesis)

## CONCLUSION (Calibri 10 Bold, Left, Capslock)

Conclusion of the study's findings are written in brief, concise and solid, without more additional new interpretation. This section can also be written on research novelty, advantages and disadvantages of the research, as well as recommendations for future research. (Calibri 10 Justify)

## ACKNOWLEDGEMENT (Calibri 10 Bold, Left, Capslock)

This section describes gratitude to those who have helped in substance as well as financially. (Calibri 10 Justify)

## REFERENCES (Calibri 10 Bold, Left, Capslock)

- [1].(Calibri 10 Justify, citation labelling by references numbering)
- [2].Vander, A., J. Sherman., D. Luciano. 2001. *Human Physiology: The Mecanisms of Body Function*. McGraw-Hill Higher Education. New York. (Book)
- [3].Shi, Z., M. Rifa'i, Y. Lee, K. Isobe, H. Suzuki. 2007. Importance of CD80/CD86-CD28 interaction in the recognition of target cells by CD8<sup>+</sup>CD122<sup>+</sup> regulatory T cells. *Journal Immunology*. 124. 1:121-128. (Article in Journal)



**Cover :**

Wae Rebo Village, Flores Island  
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