Remote sensing and GIS-based site suitability analysis for tourism development in Gili Indah, East Lombok

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Abstract: Gili Indah area, located in Jerowaru, East Lombok Regency is a region that classified as farm area in spatial layout planning map of West Nusa Tenggara province. Gili Indah area has a potential as a new tourism attraction within its gilis (local term for ‘small island’). Assessment should be done to prevent ecological disturbance and infringement towards spatial layout planning map caused by incorrect landuse. Land suitability assessment will be done using remote sensing approach whilst satellite imagery being used to get information about ocean ecology and land physical spatial distribution that will be the parameter of tourism land suitability, such as water clarity, ocean current, type of beaches’ substrate, and beach typology. Field observation then will evaluate the accuracy of data extraction also as a material to do reinterpretation. The actual physical condition will be pictured after the spatial model built with GIS by tiered qualitative analysis approach. The result of assessment and mapping of tourism land suitability is that parts of Gili Indah Area (Gili Maringkik, Greater Gili Bembeq, and Small Gili Bembeq) are suitable for archipelago tourism while the others is not.

1. Introduction
Tourism is form of exploitation natural resource which prioritize on tour interset services for human satisfaction [4]. Ecotourism according to Ceballos-Lascurain [1] is a trip to natural place that area relatively undisturbed or contaminated wit objective of studying, admiring, and enjoying the scenery, vegetations, and wildlifes, as well as other form of cultural aspect from surrounding society, both past and present. This definition continues to grow, from original purpose which was initialy only for studying, admiring, and enjoying the scenery becomes conserve the environment and to preserve the life and welfare of the local population [2]. Definition of ecotourism still evolving and create a concept for which travels to natural area aiming to build tourism industry (Eplerwood on [2]).

East Lombok regency is one of regencies located on West Nusa Tenggara Province and has local potential that could be developed. One is potential of the sea, but the utilization of natural resource is more focus on natural resource product than economic value in tourism aspect. Though West Lombok has quite appealing potential on tourism aspect like beach and dyke or small island. Based on available spatial map, majority of land in in the area of the dyke in East Lombok district is used as farmland.
2. Tourism in geographic study

2.1. Remote Sensing

Interpretation and object identification in remote sensing is done manually or digitally. Manual interpretation involves visual interpretation process that uses human eye to interpret. Interpretation by this method is performed by image with image or photo format, depending on the sensor used in data collection. Remote sensing image can also be displayed in digital format with structure of pixels with each of pixel representing digital number (DN). When the image presented in digital format, analysis process including interpretation can also be done with computer device. The analysis process is digitally insert the object identification and information extraction of information automatically. However, the accuracy of digital interpretation can not be said can replace visual interpretation. Digital interpretation still serves as a supplement and assistance purpose for visual interpretation (Campbell, 1987 dalam CAMFER, 2013; NRCan, 2015).

2.2. Geographic Information System

Geographic information system is an outgrowth of the use of computer, where the computer originally used for map digitization. There are several definition of geographic information system, but Tomlinson reiterated in the International Geographical Union Commission on Geographical Data Processing and Sensing that GIS “is not a field that stand alone but rather a similarity between information processing and various field using spatial analysis techniques.” (Tomlinson, 1972 dalam Cowen, 1988) another definition of GIS, among others: (1) “information system with database of objects, aktivites or phenomenon that can be spatially observed, where it can be described by a point, line, or polygon,” (Dueker, 1979 on [3]), (2) “the comprehensive collection of tools for capturing, storing, calling, transformation, and visualization of spatial data from the real world for a particular use,” (Borrough, 1979 on [3]).

2.3. Tourism

Tourism is considered as a geographical phenomenon because of the pattern that looks like the impact of tourism activities that occur in the area. Butler developed a model of regional development of tourism based on the impact of tourism activities that occur in the area. Butler made models consists of seven phases, phase (1) exploration, when a small number of tourist visiting the area; (2) involvement, when the locals start providing facilities for tourist; (3) development, when the country of destination began to develop and promote the tourism area; (4) consolidation, as tensions between the country of destination and tourist also the number of the tourist who visit the area are not increased significantly; (5) stagnant, when the facilities in the tourist area is aging and damaged; (6) rejuvenation, during an investment from outside and the unkeep of the facility; and (7) decline of the current phase of rejuvenation failed, and people losing jobs related to tourism.

3. Methodology

The process of assessing the level of suitability of land for tourism activities at Gili Indah Area divided into three stages; pre-processing stage, field observation, and post-analysys. At pre-processing stage value parameter water depth, type of beach and land use in order to obtain extensive information Gili Indah land use area and the beach area as well as shallow sea. The process of interpretation is done with the aid of imagery and topographical map of Indonesia. From this stage land use map, sea and beach area map, can be obtained.

Field observation is done with the purpose of reviewing the location of the beach and shallow sea in the area of Gili Indah and to obtain information that can not be obtained from the process of interpretation. In this stage the data clarity of the water, flow velocity and depth of water measured. These data can be used to complete the assessment process to acquire land suitability value more accurately. Taking photos Gili Indah overview of the region also is done, for consideration and documentation.
The last stage is done after all field observation is done. At this stage all data measurement parameters processed as well as repeating the process of interpretation to fit with the results of field observations which is needed to processed a land use suitability map through assessment of each parameter and by utilizing geographic information systems or GIS.

4. Result

Mapping process for tourism activity at Gili Belek and Gili Maringkik divided into two objectives, namely marine tourism and beach tourism. marine tourism mapping result shows that the dyke is suitable for tourism activity especially for sea tourism activity because due to the crystal clear waters and currents are not strong, so there is little possibility of an accident when tourists want to do snorkeling in both dyke. It is a minus value for sea tourism at Gili Maringkik and Gili Belek is absence of coral which is usually become tourist destinations for snorkeling, and no attractions that can be enjoyed besides seagrass. On the other hand, the slowly current allow tourist to swim at the waters of Gili Belek or Maringkik. Beach tourism activity show different results, which is in not all parts of the land of Gili Belek and Gili Maringkik that suitable for tourism activites. Digital analysis results from a combination of parameters such as the typology of the beach, the substrate, and so on provide results that bit of beach in Gili Maringkik which allows for tourism activites. On Gili Maringkik, because most of the dyke is a rugged coast while on Gili Belek, there are several beaches which is used as a docked and landfills.
With analysis using tiered qualitative approach, can be seen that the Region Gili Indah has the potential of marine tourism, especially for swimming and the like, but do not have beach for beach tourism. This statement is somewhat less satisfactory because of the qualitative analysis and observations, the Gili Indah also has the potential of beach tourism. This occurs because of the used method can only assess the suitability of a place to travel, but it can not assess the potential for tourism activity because tourism itself is activity that is very dynamic and is influenced by many things instead of just the physical parameters such as current speed, water clarity, substrate, and etc. There is a possibility, although a place deemed fit to travel based on tiered qualitative analysis, without the support of adequate infrastructure, it will hinder the suitability and make tourism activities to a halt.

Then there are factors which will affect the promotion and be the driving factor for tourists to go to the tourist area that is still not well known.

5. Conclusion and Recomendation

1. Conclusion
   a. Gili Belek and Gili Maringkik have marine tourism potential, instead of beach tourism, as a result of tiered qualitative analysis and output map, more regions in Gili Belek and Gili Maringkik which has high compatibility level in the tourism sector water.
   b. Determination land suitability classes at Gili Indah area is not enough just to use a tiered quantitative tiered approach only consider the physical parameters, but also requires an understanding and comprehensive analysis of the various viewpoints of science, from economics, politics, anthropology, sociology, and so forth up to the science of tourism that own.

2. Recomendation
   a. Need to do further research and study on methods to assess the tourism potential of an area, then there is distinction between tourism land, sea, mountains, and so forth.
   b. Field observation and confirmation is needed to ensure that all data can be accurately obtained and the corresponding desired target.

References

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