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by Kehutanan turnitin

Submission date: 21-Jun-2024 12:09PM (UTC+0700)
Submission ID: 2406134130
File name: IJCS-17-16_Asyari.pdf (144.74K)
Word count: 3776
Character count: 21488

IJCS INTERNATIONAL JOURNAL OF CONSERVATION SCIENCE

ISSN: 2067-533X Volume 8, Issue 1, January-March 2017: 157-164 www.ijcs.uaic.ro

MANAGEMENT POLICY FORMULATION OF TELUK KELUMPANG NATURAL RESERVE RELATED WITH MANGROVE FOREST DEGRADATION AT SOUTH BORNEO, INDONESIA

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Abstract

Indonesia is an archipelago that has the largest mangrove forest in the world. Strategic role of forest resources encourages the need for sustainable management of mangrove forests. This study aims to formulate strategies for management of mangrove forests related with degradation of land use in Teluk Kelumpang Natural Reserve area at Kotabaru Regency, using Analysis Hierarchy Process (AHP) approachment. The results of study explained that the hierarchical structure I which consists of the supporting factors for socio-ecological, sosio-cultural and sosio-economic aspects got score 1.809; 1.682 and 0.239 respectively. It shows that the supporting factor which based on socio-ecological aspects, believe to be the most dominant factor for sustainable and sustainability Teluk Kelumpang Natural Reserve mangrove forest management policy formulation. Based on the hierarchical structure II, conclude that the socio-economic indicators, ie: utilization based to the absence of access to land ownership, capitalization of the business and source of livelihood got score 1.717; 0.781 and 0.874 respectively. On the socio-ecological indicators can be concluded that the understanding of mangrove forest conservation got score 1.027, environmental services is 0.753 and the ecological functions of mangrove forest is 0.735. Socio-cultural indicators which become the foundation supporting the utilization of sustainable and sustainability Teluk Kelumpang Natural Reserve mangrove forest, namely: the utilization for cultural function/local wisdom/pond got score 1.035. The utilization for entertainment functions/ recreation/beach tourism got a score 0.941 and the utilization for educational function got score 0.734.

Keywords: *Mangrove forests; Analysis Hierarchy Process; Teluk Kelumpang.*

Introduction

Indonesia is an archipelago that has the largest mangrove forest in the world [1]. Mangrove forests growing in locations that have a relationship with the influence of water tide (tidal) [2]. One of the mangrove forest conservation area is Teluk Kelumpang Natural Reserve which located at South Borneo with an area of ± 29.925,74 ha. These area 30.38% from total area of Kotabaru Regency mangrove forest and 45.01% from mangrove forest area included in conservation forest area [3].

Mangrove forests are the natural resources of coastal areas which have the function of production, protection and conservation. Mangrove forests ecosystem are a very unique

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ecosystem, because as an interface between the land ecosystems and marine ecosystems. The role is very great for people who live in coastal areas, both ecologically and economicly [4-6]. Some examples of mangrove forest use by the public, among other: as raw material of charcoal [4, 7, 8], organic materials, sources of food, cosmetics ingredients, material of tanner, (wood of mangrove species, *langadai* and *mirih*), medicinal, like leaves of *Bruguiera sexangula* for inhibitors of tumor, *Ceriops tagal*, and *Xylocarpus mollucensis* for toothache medicine [9-12]. Mangrove forests contribute organic detritus that very important as a source of energy [14], and feed resources [4, 10, 14, 15] for organisms that live in water. In addition, mangrove forests act as a buffer from heavy winds, abrasion prevention and sea water wave retainer [2, 16, 17].

The rate of degradation of mangrove forest resources is increasing, caused by the activity of the mangrove forest communities to meet the needs of everyday life. Indication of degradation of mangrove forests still ongoing in some coastal areas or beaches. Distribution of mangrove forests located in Kotabaru Regency covering an area of 86.000ha. Based on the function of the area, the level of damage of mangrove forests for non damaged condition covering an area of 9.910ha (11.52%), damaged condition an area of 56.427ha (65.61%), and heavily damaged condition an area of 19.663 ha (22.87%) [18]. Conditions of mangrove forest in the sanctuary area (includes nature reserves, wildlife reserves and natural park) relatively have higher level of damage, compared to the mangrove forest areas outside the forest area (like other land uses). The level of damage of mangrove forests in the sanctuary area reached 65.976ha (53.35%) which consists of medium damage an area of 36.338ha (42.25%) and heavily damaged an area of 9.549ha (11.10%). While the level of damage on other land uses achieved 19.304ha (22.45%), and heavily damaged an area of 8.613ha (10.02%). It is proved that the condition of mangrove forests which found in sanctuary area suffered the damage above 50%. Changes in these mangrove forest land use is due to land conversion or land use change resulting in uncontrolled exploitation activities. Forms of land conversion for the community needs, such as: residential development, agriculture, plantation, expansion of ponds for fish and shrimp, as well as the special port [18, 19].

Conditions of mangrove forests at the area of Teluk Kelumpang Natural Reserve in which the degradation occured encourages to conducted the sustainable and sustainability management form. Therefore, it is necessary the analysis based on socio-economic, socio-ecological and socio-cultural which is used as a basis for formulating public policies that support the sustainable and sustainability management of mangrove forests in the area of Teluk Kelumpang Natural Reserve Kotabaru Regency South Borneo Province.

Materials and Methods

Analitycal Hierarchy Process (AHP) is a functional hierarchy with the main inputs is human perception. Through the hierarchy, a complex and unstructured problems can be broken down into groups which are then organized into a hierarchical form. The working principle of AHP is a simplification of a complex problem that is not structured, strategic, and dynamic into a parts and arranged in a hierarchy. The level of importance of each variable given a numerical value, subjectively about the significance of these variables and relatively compared to other variables. After that, from the various considerations then performed synthesized to define the variables that have a high priority and contribute to affect the outcome of the system. Some of the process conducted in the analysis with the AHP, which is as follows:

1. Identification of the system is conducted to determine the issues to be resolved in the form of the target (goal) to be achieved. Factors/criteria that will be used, the actors involved in the system and its objectives, and strategic alternatives.
2. Preparation of the hierarchy performed by abstracting the components in the system. This abstraction must be interconnected, composed from the main goals down to factors, then to the actors the actors goal, then strategies and ultimately provide decision.

3. Preparation of a matrix of individual opinion for each criteria and the alternative conducted through pairwise comparisons. Each element of the system with other elements at each level of the hierarchy in pairs compared to obtain a quantitative value of the interest element. Rating scale which is used for the qualitative opinion quantified as shown in Table 1.
4. The values of comparisons that has been done should be obtained the level of consistency with CR ≤ 10%.
5. Preparation of the composite opinion matrix, then performed a vertical processing to determine the system priority vector.

Table 1. Scale for Filling Pairwise Comparison Matrix

Intensity of Importance	Definition	Explanation
1	Both elements are equally important	Two equally strong element in nature
3	One elements a little more important than other elements.	Experience and judgment slightly supporting one element over another element.
5	One element is a very important than other elements.	Experience and judgment strongly supporting one element over another element.
7	One element is clearly more important than other elements.	One element strongly supported and its dominance has been seen in practice.
9	One element is absolutely more important than other elements.	Evidence that supporting one element has the highest level of discernment which strengthen.
2,4,6,8	Values between the two considerations	A compromise is needed between the two considerations.
reverse	If the element of *i* scored *a* compared to elements of *j*, then *j* elements had a value of *1/a* when compared to elements of *i*.	

The research was conducted for six months from April to September 2013. Data collected consist of primary and secondary data and analyzed with analysis approachment of Analytical Hierarchy Process (AHP) with the number of questionnaires was 30. Through the hierarchy, a complex and unstructured problems can be broken down into groups which are then organized into a hierarchical form. Location of the study can be seen in Figure 1. Analitycal Hierarchy Process (AHP) is a functional hierarchy with the main inputs is human perception (Fig. 2).

Fig. 1. Research Location Map

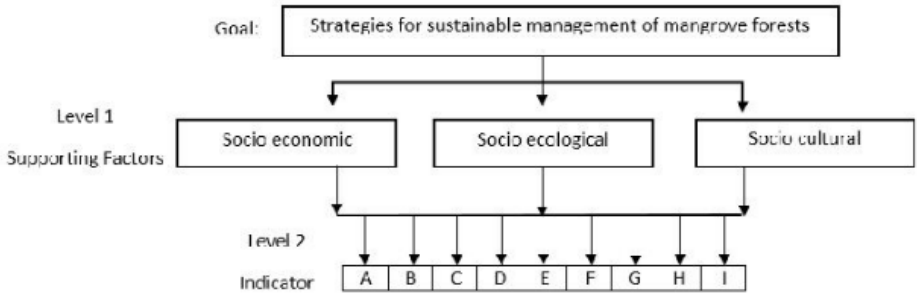

Fig. 2. AHP Hierarchy Scheme
Goal: Developing strategies of mangrove forest management policy of sustainable Teluk Kelumpang Natural Reserve.

Hierarchy Level 1:
Supporting Factors

1. Socio Economic: Utilization of mangrove forest of Teluk Kelumpang Natural Reserve based on the economic needs of society
2. Socio Ecological: Utilization of mangrove forest of Teluk Kelumpang Natural Reserve based on ecological factors
3. Socio Cultural: Utilization of mangrove forest of Teluk Kelumpang Natural Reserve based on the needs of the community Socio-Cultural

Hierarchy Level II:
Indicator

Indicator A : The Utilization which is based as a source of livelihood
Indicator B : The Utilization which is based on absence of access to land ownership
Indicator C : The Utilization which is based for business capitalization
Indicator D : The understanding of mangrove forest conservation
Indicator E : The understanding of mangrove forest environmental services
Indicator F : The understanding of ecological functions of the mangrove forest
Indicator G : The utilization for entertainment functions/recreation
Indicator H : The utilization for cultural function/local wisdom
Indicator I : The utilization for educational function

Result and Discussion

A hierarchy will sort out the aspects in determining the priorities of mangrove forest management strategy formulation at Teluk Kelumpang natural reserve area compiled based on the complex data and the conditions in the field. Hierarchy that has been prepared will be responded by the respondents to produce qualitative data which quantified (Table 2).

Calculation results can be translated in any hierarchical level. Each number represents the priority of several options proposed. Level one describe the assumptions of mangrove forest utilization policy formulation of Teluk Kelumpang Natural Reserve which supports sustainable and sustainability of natural reserve. Final synthesis on the hierarchical structure of level I which is the purpose of mangrove forest utilization policy formulation of Teluk Kelumpang Natural Reserve (Table 2).

The results of the data analysis based on perception of Agencies group associated with Teluk Kelumpang Natural Reserve, Group of Policy Makers in the area and Community leaders and NGO groups shows the differences in priorities. The supporting factors of socio ecological

aspect is the main priority or first ranking because it has the highest value (1.809) compared to the socio-cultural (1.682) and socio-economic (0.239). The supporting factors of socio ecological aspects are believed to be the most dominant factor for a of mangrove forest management policy formulation of Teluk Kelumpang Natural Reserve by respondents of Agencies group associated with Teluk Kelumpang Natural Reserve, Group of Policy Makers in the area and Community leaders and NGO groups. So that will be support the sustainable and sustainability of Teluk Kelumpang Natural Reserve.

Table 2. Results Hierarchy of Mangrove Forest Management Strategy Formulation at the area of Teluk Kelumpang Natural Reserve

Policy Formulation of mangrove forest Ecosystem Management at Teluk Kelumpang Natural Reserve	Agencies group associated with Teluk Kelumpang Natural Reserve	Group of Policy Makers in the area	Community leaders and NGO groups	Final synthesis The entire Group
Hierarchy Level I: Supporting Factors				
1. Socio Economic	0.141	0.056	0.042	0.239
2. Socio Ecological	0.722	0.772	0.315	1.809
3. Socio Cultural	0.486	0.592	0.602	1.682
Hierarchy Level II: Indicator				
Socio-Economic Indicators				
1. The Utilization which is based as a source of livelihood	0.242	0.421	0.211	0.874
2. The Utilization which is based on absence of access to land ownership	0.647	0.666	0.404	1.717
3. The Utilization which is based for business capitalization	0.601	0.657	0.311	1.569
Socio-Ecological Indicators				
1. The understanding of mangrove forest conservation	0.342	0.319	0.366	1.027
2. The understanding of mangrove forest environmental services	0.329	0.251	0.173	0.753
3. The understanding of ecological functions of the mangrove forest	0.241	0.392	0.102	0.735
Socio-Cultural Indicators				
1. The utilization for entertainment functions / recreation	0.344	0.228	0.369	0.941
2. The utilization for cultural function / local wisdom / catch fishermen	0.326	0.318	0.391	1.035
3. The utilization for educational function	0.296	0.297	0.141	0.734
Inconsistency Index	0.966	4.969	0.901	2.71

Source : Primary Data Analysis

Final synthesis on the hierarchical structure of level II is an indicator from the factors that supporting mangrove forest utilization policy formulation of sustainable and sustainability Teluk Kelumpang Natural Reserve. Utilization indicator which based on the absence of access to land ownership (1.717) is the main factor and determinant of the success from policy formulation support. Next is the utilization indicators based on the capitalization of business (0.781) and the last is utilization indicators which is based as a source of livelihood (0.874).

Final synthesis on the hierarchical structure of level II is an indicator from the factors that supporting mangrove forest utilization policy formulation of sustainable and sustainability Teluk Kelumpang Natural Reserve. The second Hierarchy is an indicator of socio-ecological

which became basis in preparing policy formulation that supporting the utilization of mangrove forest of sustainable and sustainability Teluk Kelumpang Natural Reserve. The main priority of the supporting of policy formulation that supporting the utilization of mangrove forest of sustainable and sustainability Teluk Kelumpang Natural Reserve is The understanding of mangrove forest conservation (1.027). While the understanding of mangrove forest environmental services (0.753) and the understanding of the ecological functions of the mangrove forest (0.735) occupies the second and third priority.

Final synthesis on the hierarchical structure of level II that is an indicator of socio-cultural which became basis in preparing policy formulation that supporting the utilization of mangrove forest of sustainable and sustainability Teluk Kelumpang Natural Reserve. Based on the score there can be concluded that the most prioritized indicators is the utilization for cultural function/local wisdom (1.035). In addition, other priorities, namely the utilization for entertainment function/recreation/beach tourism (0.941) and the utilization for educational function (0.734).

The process of policy taking basically is to choose an alternative strategy to support policy formulation that supporting the utilization of mangrove forest of sustainable and sustainability Teluk Kelumpang Natural Reserve. Implementation of the policy which have been formulated with unifying the vision, mission and the perception from the parties (local communities and institutions that involved in the utilization of mangrove forest of Teluk Kelumpang Natural Reserve) with the following programs:

1. Actively involve local communities by conducting regular meetings with Management Agency of Teluk Kelumpang Natural Reserve and NGO for mapping and identifying any issues relating to the application of the concept of sustainable and sustainabilty management of mangrove forests. Therefore it needed institutional/community organizations which can represent the interests of their potential.
2. Improving the public education and training related to the legislation and sectoral policy associated with the management of Teluk Kelumpang Natural Reserve. Educational method can be performed in non-formal using small groups in a way of face-to-face in order to obtain information in both directions and local knowledge can be collected for inclusion in the concept that supports the management of sustainable and sustainability Teluk Kelumpang Natural Reserve.
3. Enforcement of existing laws and regulations with objective that all the parties involved in the management of Teluk Kelumpang Natural Reserve can adjust its actions with applicable laws and regulations.
4. Aquaculture (pond), ports and settlements must maintain the mangrove forest and positioning mangrove forest as a filter, with the aim to reduce the abrasion of seawater so it can be maintained the coastal area of sustainable and sustainability Teluk Kelumpang Natural Reserve
5. The Plan for the development and management of the area of Teluk Kelumpang Natural Reserve must be based on the principle of sustainability, benefits and integration, with the aim of:
    a. ensure the existence of mangrove forest ecosystem with sufficient area and equitable distribution;
    b. optimize various area function, including conservation function, protection functions and production functions to achieve environmental benefits, social and well-balanced economic and sustainable;
    c. supporting capacity building and public participation and environmental friendly thereby creating social and economic resilience.
6. Rehabilitation of mangrove forest area function as well as the planning, implementation and supervision of mangrove forest conservation thus encouraging the formation of mangrove forest management of Teluk Kelumpang Natural Reserve which involves the community.

There are support policy formulation which has been formulated as above in the management of Teluk Kelumpang Natural Reserve accompanied by the implementation of bottom-up policy. Implementation of policies aimed to create a society which is responsible, feeling of belonging and feel the need to supervise, these mangrove forest. Coastal communities also felt to have rights and obligations as owner and maintainer in the effort of the mangrove forest management at the area of Teluk Kelumpang Natural Reserve. In the era of regional autonomy is supposed all mangrove forest maintenance activities should be handed over to the community. The success in the management of mangrove forests at the area of sustainable and sustainability Teluk Kelumpang Natural Reserve will result in an increase in local economic development (LED) especially in the field of fisheries (aquaculture and catch fishing), industrial, residential and recreational.

Conclusion

Mangrove forests in the area of Teluk Kelumpang Natural Reserve is an area of great potential environmental degradation of coastal areas if there is the lack of action to protect and conserve the mangrove forests intensively. Preservation of mangrove forests in the area of Teluk Kelumpang Natural Reserve involves local communities that are economicly, socially and environmentally dependent on the mangrove forest and government (local and central) through all aspects of planning, implementation, maintenance, monitoring and evaluation. Management policy formulation at the area of Teluk Kelumpang Natural Reserve need to pay attention to socio ecological aspects that is the main priority, which combined with socio-cultural and socio-economic that is not a major factor.

Suggestions given from the results of this study is that the government should continue to facilitate the local community at the area of Teluk Kelumpang Natural Reserve by providing guidance, counseling and intensive training and continuously on the sustainable and sustainability mangrove forest management. Attitudes, perceptions and participation of the parties related to the management of mangrove forests should continue to be developed and improved so that the purpose of preservation of mangrove forests in the area of Teluk Kelumpang Natural Reserve is achieved.

Acknowledgment

We would like to thank to Dr. Ir. Nurdin Harahap who has helped in the design of this study. We also thank Dr. CD Herman for his assistance in the data analysis of this study.

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Received: April, 25, 2016
Accepted: February, 24, 2017

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