

Indigenous Knowledge and Biodiversity Conservation in Sabah, Malaysia

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Abstract—Feasibility of existing indigenous knowledge that maintain customary practices are relevant for management, conservation and sustainable use of biological diversity in Sabah. The status of knowledge among indigenous communities involving both practical and embedded spiritual beliefs, i.e. indigenous people is still maintaining their hunting seasons. These seasons are upheld based on the knowledge about breeding seasons, patterns of different species and also particular about hunting areas. The purpose of this paper is to assess the indigenous system towards agricultures, river and resources management. This paper also aims to report the level of the indigenous people towards biodiversity and their perceptions of biodiversity conservation in general.

Index Terms—Biodiversity, indigenous knowledge, Sabah.

I. INTRODUCTION

Environment is an invaluable award from God and it is our responsibility to manage the natural resources with a good care. Over centuries, human being is facing substantial challenges to perpetuate and nurture the environment which results from the increase of consumerism and the development of a nation. The challenge to conserve sustainable ecosystem and protected environment has lead to some debates concerning conservation and biodiversity issues elsewhere. Biodiversity has emerged at the centre of one of the most contentious global debates of this century. Critical to the debate are questions of how biologically endowed countries can achieve economic progress while balancing environmental and social concerns [1]. This argument is closely related to the question of how biodiversity and traditional knowledge among indigenous people could establish meaningful collaboration towards biodiversity conservation of a mega diversity country, such as Malaysia.

Malaysia is among the world's twelfth biodiversity-rich countries in terms of the number of species, and fourth in Asia, behind China, India and Indonesia. The flora and fauna of Sabah, Malaysia is one of the notable natural features and the number of wild plant species is likely to be approximately of 10,000 species [2]. The natural ecosystem of Sabah supports a diversity of animal life including orang-utans, elephants and diverse of jungle animals, bird species and diverse marine which can be found off Sabah's coast. Moreover, the existence of large percentage (60%) of indigenous communities in Sabah also supports the natural resources and sustainable environment [3]. In this context,

the indigenous people of Sabah have their own mechanism of traditional system and whether they realize or not, have contributed towards biodiversity conservation.

The indigenous people of Sabah have developed their own unique indigenous systems that have safeguarded their communities, a peaceful existence, a sustainable livelihood and use of the resources within their surroundings [4]. This indigenous knowledge (i.e. agriculture, forestry, and fish resources) contributes directly to the biodiversity conservation of a country. However, this knowledge has been lost or denigrated due to lack of knowledge of the importance of indigenous system. Consequently, that there does not seem to be enough efforts in recording and applying those indigenous systems in documentation, publication etc. Nevertheless, there is now a growing awareness on indigenous systems as a valuable resource for development and for maintaining indigenous people identity.

Thus, the objective of this paper is to assess the indigenous system namely, agricultures, river and resources management among indigenous people of Sabah. This paper also aims to report the level of the indigenous knowledge of biodiversity conservation in general.

II. DEFINITION OF TERMS

This section articulates the keywords of the paper, i.e. biodiversity and indigenous knowledge (IK).

Biodiversity – Biodiversity can be defined as 'variation of life at all levels of biological organization'. In other word, biodiversity is a measure of the relative diversity among organisms present in different ecosystems [5]. 'Diversity' in this definition includes diversity within a species and among species, and comparative diversity among ecosystems. A third definition that is often used by ecologists is the "totality of genes, species, and ecosystems of a region". An advantage of this definition is that it seems to describe most circumstances and present a unified view of the traditional three levels at which biodiversity has been identified, namely: genetic, species and ecosystem diversity [6].

For ecologists, biodiversity is also the diversity of durable interactions among species. In each ecosystem, living organisms are part of a whole, interacting with not only other organisms, but also with the air, water, and soil that surround them [7]. In sum, biodiversity can be defined as all living organisms, their genetic material, and their ecosystems.

Indigenous knowledge (IK) – IK refers to the unique, traditional, local knowledge existing within and developed around the specific conditions of women and men indigenous to a particular geographical area. IK was used synonymously with traditional and local knowledge to differentiate the knowledge developed by a given community from the knowledge generated through universities, government

Manuscript received December 24, 2011; revised February 5, 2012

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research centers, and private industry [8] Furthermore, the development of IK systems covers all aspects of life, including management of the natural resources and etc. Such knowledge systems are collective and representing generations of experience with a careful observation.

Moreover, IK is stored in peoples' memories and activities and is expressed in stories songs, folklore, proverbs, dances, myths, cultural values, beliefs, rituals, community laws, local language, agricultural practices, plant species and animal breeds. IK is shared and communicated orally, by specific example through culture [9]. In other words, IK is inherited from generations to generations which include traditional knowledge, innovations, beliefs and practices of indigenous peoples and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity. Hence, next discussion on the system of indigenous knowledge will elaborate more on this.

III. THE SYSTEM OF INDIGENOUS KNOWLEDGE

This section discusses in brief some practices of the indigenous system namely, agriculture, river management and resource management among the indigenous communities in Sabah. It is important to note here that there are also other themes of the indigenous knowledge i.e. belief, health, cultural, economic systems etc which are included in this paper.

A. Agriculture

The key principle in the agricultural system among the indigenous people is to inculcate harmonious relationship with nature, dignity of all things, subsistence and sustainability. The indigenous people have their own traditional calendar based on the movement of the moon. In many ways, this lunar calendar influenced the agricultural practices of the indigenous groups. These communities also carry out some kind of rules or regulations, for example during the practice of shifting cultivation on hills. These rituals are usually performed by the farmers themselves with the help from a *bobohizan* or a priest [10].

During shifting cultivation, soil texture and the fertility are usually maintained naturally by allowing the land a fallow (crop-free) period. After a field for one or two years it is left to fallow between 7-10 years until the trees have grown back to a certain size [11]. Consequently, a certain length of growing time is required by the tree to be able to eliminate and suppress existing weeds. To accelerate the rejuvenation of the soil, certain leguminous root crops are planted immediately after the rice is harvested. Even during the clearing of the field some special trees are left standing to provide shade for the wood crops and later for the smaller trees. During the process of weeding, the farmers are selective in the types of weeds and plants that they pull out. Unwanted grasses or small plants are not thrown away but spread out on the ground and left to rot as humus. This provides a natural mechanism to control soil moisture, reduce soil erosion and later provide the much-needed nutrients for the growth of trees. Certain types of fast-growing trees (e.g. watermelon, sweet potato, and corn) are allowed to grow among their crops to speed up the growth of the vegetative cover of the field one left to fallow [12].

Meanwhile, the practice and belief of *Maganu Totuo/Montok Kosukopan* refers to the activity of collecting food and materials (for building, handicrafts, medicines etc.) from the forest. Only mature ones should be taken with the amount that is required for the family daily needs. It is an acceptable norm to take only what is needed when collecting foods and materials in the forest. The purpose of this practice is to maintain the forest resources and avoid wasting the natural resources of the woodland [13]. Moreover, the practice of *Tuwa di Pogiwan* aims for the purpose of fertilization and continuity of the plant. In this practice, forest users are not allowed to take the last fruit from a tree in order to make sure the circulation and propagation of the species fruit.

In addition, the Murut scatters the pounded sour fruit of the tree called *liposu* in the field to prevent pest and disease infestation. Similarly, the leaves of the tree called *babas*, are soaked overnight, and the water sprinkle over the affected rice plant. This is believed to prevent maggot infestation.. Traditionally, the Kadazandusun stick a red palm leaf in an affected by the red deasese caused by fungus. In order to control insect infestations, the Kadazandusun practices the burning and hanging of the skin of buffalo and the shell of a king crab, in order to attract the insects away from the rice plant. Similarly, the Bajau uses frogs and the skins of crabfish to keep insects' way from the rice [14].

B. River Management

The key principle for indigenous river management system is sustainability and inter-relationship of all things. Indigenous communities understand that there is a limit to what can be extracted from the natural environment and they are only custodians of God's gift. One example of the well-known practice of river management among indigenous people is *managal*.

The ceremony of *managal* is proclaimed through a mutual understanding when the number of fish is on the decline in rivers [15]. *Managal* is the mark that the rivers are proclaimed as no-fishing zone for the certain period of time (about six months to one year time). The practice of *managal*, originally meant as a collective responsibility to ensure the sustainability of the fish resource in the river. This *managal* practice can allowed the reproduce and increase in numbers of fishes [16]. Recently, the efforts by Sabah Fisheries Department to practice the activity of *managal* into a purely eco-tourism project, especially during harvesting seasons. The exemplary of this eco-tourism event can be found in Penampang district other selected places. Furthermore, when someone goes fishing they must ensure that only safe devices are used such as *bubu* and net. *Tuba-fishing* are not permitted at all. Only matured fish can be caught whereas the small ones are returned to the river.

C. Resource Management

Natural resources such as land, forest and wildlife are sources of living for indigenous communities. Therefore, the conservation of natural resources has to be taken with a great care to ensure its sustainability and lifelong survival.

The practice of *meminting* refers to one-way technique of hunting activity among indigenous groups. The hunters have to choose only those mature animals by using traditional hunting methods such as blowpipe, spear and trap.

Meanwhile, devices e.g. trap, snare, sling and net are traditional methods for hunting smaller animals. The traps are usually used to catch particular wildlife species. Blowpipes are mainly used for hunting squirrels, birds and monkeys [17].

Telinting is another way of hunting particularly to frighten away the birds from paddy field. It is made from a can that tied with a long rope and will be hang from across the paddy field or garden. This is to keep away the birds, monkey or others animal from causing damages to farmers' crops and paddy.

Furthermore, the men's hunting activities are controlled by taboos and principles which guide the natural resource utilization. These rules and taboos have been integrated into a regulation called Community Hunting Protocol. Consequently, among the indigenous communities themselves there are taboos called *sogit*. The concept of *sogit* or compensation is practiced as the principles of collective indemnity and communal solidarity. The concept of *sogit* gives the wrongdoer an opportunity to ask forgiveness from the aggrieved party and to the whole community. The ritual meal serves like rice, pigs, goats and chicken to symbolically restore harmony in the village and reestablish its integrity. Occasionally individuals who do not show any remorse and deep regret for the wrong that he/she has done to a party is disowned by the community or temporarily banished from the community. For example, recently in the district of Keningau, 11 people were fined RM20 each by the Village Native Court for poisoning a river to catch fish. Further, a brief description regarding the system of the indigenous knowledge is shown in Table 1.

TABLE I: THE INDIGENOUS KNOWLEDGE SYSTEM

Indigenous system	Practice and belief
Agriculture	- <i>Tuwa di Pogiwian</i> (the last fruit is not taken for the purpose of propagation and continuity)
	- <i>Maganu Totuo/Montok Kosukupan</i> (only mature ones should be taken, and only the amount which would suffice for the family's daily needs are relevant to maintain our forest resource)
	- <i>Liposu</i> fruits is using for prevent pest and disease
	-Burning of tree roots to ward of insects and rats
River management	-Hanging buffalo skin or king crab to attract insects away from the rice
	- <i>Tagal</i> ('No-fishing' zone opens up for fishing for a limited period of time and zone)
	-Bubu and net (device that used in fishing that are safe for used)
Resource management	-Meminting (one of the way in hunting that used trap)
	-Telinting (a pratise to keep away creatures like bird and monkeys from attacking the crop and paddy)
	-Sogit (ompensation)

Source: [18]-[19]

IV. METHODOLOGY

In brief, this research employs two methods of data collection, i.e. library research and survey. The bulk of the study is library research where the main references are confined to the books, journal articles and intellectual contributions which related to biodiversity, indigenous knowledge (IK), ethnic relation, history of Sabah and other relevant areas.

The survey of this research carries out two procedures, i.e. questionnaire and interview. The respondents for the survey are groups of indigenous people (90 respondents) located in the west-coast of Sabah, namely Beauford, Membakut and Penampang. Furthermore, in-depth interview sessions are held with six key-informants and representative from Sabah Biodiversity Centre (SBC) in Sandakan, Sabah Agriculture Department, Sabah Fisheries Department, Pacos Trust (a proactive NGO in Sabah), Museum of Sabah and Institute of Biology Tropical and Conservation, University Malaysia Sabah.

In terms of the data analysis, the quantitative data from the close ended questions are analysed using SPSS version 13.0. The results of the reliability test from the pilot study are presented in Table 2. The results show that the alpha value for the peoples' knowledge of the concept of biodiversity is 0.780 and perceptions towards biodiversity (0.743). Generally, the results of the internal consistency are satisfactory dan Cronbach alpha values are greater than 0.7. These suggest that the reliability indices were acceptable.

TABLE II: RESULT OF RELIABILITY TEST

Variable	Cronbach alpha
Knowledge of biodiversity	0.765
Perceptions towards biodiversity	0.743

V. THE FINDINGS

A. Respondents' Profile

TABLE III: RESPONDENTS' PROFILE

Item		%
Gender	Male	64.4
	Female	35.6
Religion	Islam	75.6
	Christian	24.4
Ethnic	Bajau	33.3
	Kadazan-Dusun	26.7
	Murut	4.4
	Rungus	1.1
	Brunei	5.6
	Bisaya	2.2
	Iranun	11.1
Status	Suluk	1.1
	Sungai	1.1
	Others	13.3
Education	Married	84.4
	Single	15.6
Job	No formal education	27.8
	Primary	20
	Secondary	31.1
	Diplome	11.1
	Degree	10
Job	Non employed	14.4
	Self-employed	48.9
	Public Sector	20
	Private Sector	16.7

Table 3 shows that majority of the respondents are male (64.4%) and 35.6% are female. Most of them are already married (84.4%) while 14.6% are still single. In terms of the religion, majority of the respondents are Muslims (75.6%) and Christians (24.4%). Respondents of the research come from various ethnic groups, which are: were Bajau (33.3%), Kadazan Dusun (26.7%), Malay (13.3%), Iranun (11.1%), Melayu-Brunei (5.6%), Murut (4.4%), Bisaya (2.2%) and 1.1% (Rungus, Suluk and Sungai)

The table also tabulates the educational background of the respondents, where majority of them attended primary and secondary schools (51.1%), 27.8% do not have formal education, while 21.1% are degree and diploma holders. In terms of the job, 48.9% of the respondent is self-employed (farmers, entrepreneurs and fisherman), 20.0% are working in public sector, 16.7% are in private sector and 14.4% are unemployed.

B. Knowledge of Biodiversity

This part reports the level of knowledge among indigenous people towards the concept of biodiversity. Most of the items in the questionnaire are phrase as statements with responses based on the five-point Likert scale. The respondents have to indicate one of the five possible responses to each statement, i.e. 1= strongly disagree, 5 = strongly agree. In presenting the result, the mean and standard deviation of the findings are revealed.

TABLE IV: KNOWLEDGE OF BIODIVERSITY

Variable	Mean	Std. Deviation
Biodiversity can be understand as biological of nature	3.87	.864
Flora and fauna are elements of biodiversity	3.99	.893
Slash and burn are methods in biodiversity conservation	3.02	1.151
Environmental and social concern is an important element in preserving sustainable development	4.06	.740
Biodiversity is vital in order to sustain our human ecology	4.08	.824
Biodiversity is a form of law	3.04	.923
Biodiversity conservation and nurturing the environment is the same concept	3.54	.863
There are various methods and efforts that can be made to conserve biodiversity	3.84	.923
Sabah Biodiversity Enactment (SBE) is an act that related to biodiversity conservation in Sabah	3.57	.765
Traditional knowledge among indigenous people can help to preserve the environment and biodiversity	3.71	.890
The usage of pest pesticide may destroy the environment	3.74	.924
Tuba-fishing will not endanger the ecosystem of the river *	3.94	1.219

*negative question

C. The Level of Knowledge towards Biodiversity

Based on their responses, the study examines the level of knowledge of biodiversity among the indigenous people. The level of knowledge can be determined based on the following level of measurement in Table 5.

TABLE V: LEVEL OF MEASUREMENT

Scale	Class
1.00 – 2.33	little knowledge
2.34 – 3.66	average knowledge
3.67 – 5.00	great knowledge

Table 6 presents the level of knowledge of the concept of biodiversity among respondents. The result shows that majority of the respondents have an average knowledge of the biodiversity concept (mean = 3.656).

TABLE VI: LEVEL OF KNOWLEDGE OF BIODIVERSITY

Variable	Mean
Level of Knowledge of Biodiversity	3.656

Overall, the finding shows that the level of knowledge of the concept of biodiversity among indigenous people of Sabah is at the average knowledge. It indicates that the respondents can understand

VI. CONCLUSION

It is common knowledge that natural resources, in particular biodiversity possess important economic, social and technological implications. Biodiversity also contributes to humankind through stabilizing effect on the environmental; an ecological function that is so crucial in maintaining and preserving the survival of many living species that form our biological heritage. Scientific application and indigenous knowledge not just can help in conserve our system but also contribute to our nature and society. Practices and beliefs that have been embedded in the indigenous knowledge (IK) among Sabah indigenous communities are good examples to establish biodiversity conservation and environmental obligations. Indigenous forms of communication and organization are vital to local-level decision-making process and to the preservation, development and spread of IK. For this purpose, collaborations among government sectors, Non Governmental Organisation (i.e. PACOS Trust) and community leaders have to be strengthened. Researchers at all levels doing research into biodiversity and indigenous knowledge should extend their outcomes and findings to include government and policy makers. Publications are strongly encouraged.

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