

Local Community Perception on the Sustainable Uses of Ayamaru Lake, West Papua Indonesia

Albertho Hendrikus Solossa¹, Soemarno^{2,4}, Ika Rochjatun Sastrahidayat²,
Luchman Hakim^{3,4}

⁽¹⁾Office of Agriculture, Maybrat District, West Papua Province and Student of Graduate Scholl of Science and Environmental Technology, University of Brawijaya, Jl. Veteran Malang, 65145, East Java, Indonesia

⁽²⁾Faculty of Agriculture, University of Brawijaya, Jl. Veteran Malang, 65145, East Java, Indonesia

⁽³⁾Department of Biology, Faculty of Mathematics and Natural Sciences, University of Brawijaya, Jl. Veteran Malang, 65145, East Java, Indonesia

⁽⁴⁾Graduate Scholl of Science and Environmental Technology, University of Brawijaya, Jl. Veteran Malang, 65145, East Java, Indonesia

Abstract : *This study aims at examining local community perception on the management of the Lake Ayamaru as a potential tourism attraction in Maybrat Regency, West Papua Province. The results of the study show that the local community is able to recognize the problems faced by the lake. Some of the problems mentioned by the local community were decrease of local wisdom and environmental problems caused by human activities. Tourism can support economy and can be accepted by the local people by considering some basic aspects, such as community involvement and environmental preservation. The local community thinks that other than the natural resources, the culture of the people living around the lake can also become the attraction when it is synergically developed with the effort to develop sustainable tourism in the lake. The results of the study show that this local community living in remote area has much concern on the effort to conserve nature and sees tourism as one of the alternatives in the sustainable uses of the lake.*

Keywords: *Lake, tourism attraction, Indigenous knowledge, conservation, rural development*

I. Introduction

The rapid growth of human population and economy development has caused too much pressure on the biodiversity existence leading to the extinction of many of the natural resources. A lake is one of the most important ecosystems for many forms of living organisms. All over the world, ecosystem in lakes has been experiencing damages due to housing development [1]. Local community living around lakes is the first and the most important groups affecting the sustainability of the lakes [2] [3].

Ayamuru Lake is one of the natural resources in West Papua, and is one of the important symbols of the people on Maybrat Regency. The lake has been socially and economically supporting the lives of the local people around the lake. The lake has become the source of water for clans in Maybrat, consisting of Solossa, Bless, Kareth, Hlumbless, Naa, Sentuf, Isir, Jidmau, and Kambuaya [4]. As with many lakes in developing areas, Ayamaru Lake is also threatened by human activities around the lake.

Local wisdom has been considered as one of the effective methods in the management of natural resources and has been supported by local community [5] [6]. Many studies on the integration of local wisdom in the management of forests report that local wisdom can give such real contribution to the uses of natural resources from forests and seas in good and sustainable ways [7] [8] [9] [10]. Local wisdom is the holistic perspective of the local people in seeing the systems working in the nature in which human beings become an inseparable part of those systems. Local wisdom is found in many developing countries that still preserve the culture of the local communities.

Tourism sector is one of the economy accelerators, and is nowadays considered as one of the components in the conservation of the natural resources. This is mainly experienced by areas having abundant natural resources potential to be developed into tourism attractions. One of the advantages of tourism is its ability to grow in harmony with the spirit of nature preservation, community empowerment, and quality environment creation. In Indonesia, tourism becomes one of the resources to improve national and local income [11] [12]. The tourism potential in Indonesia is also supported by the rich natural resources and abundant cultural components.

Optimalization and integration of various approaches for the integrated and sustainable management of natural resources is one of the agendas in sustainable development [13]. In the context of Lake Ayamaru conservation, the integration of local wisdom and tourism becomes one of the potential aspects in the

management of the lake. To do so, information on the perception of the local community on the problems faced by the lake and the role local wisdom plays in solving the problems must be studied. This study then aims at understanding and revealing local community perception on sustainable uses of Lake Ayamaru.

II. Methodology

Study Site

Ayamaru Lake is a land-water ecosystem that is very important for the lives of human beings as well as many living organisms that contribute directly and indirectly to the lives of Maybrat people. The lake is located at 200 – 500 asl and is surrounded by some forests; this site is still a very crucial hot spot for the natural biodiversity of Papua and of the world.

The forests are dominant, as wide as 3,049.30 km² or 99.44% from the total area [14]. Compared to other areas in Indonesia, Maybrat Regency is one of the regencies having high number of forests. This makes possible for the municipality to be developed in the basis of sustainable natural resources conservation and preservation (Figure 1).

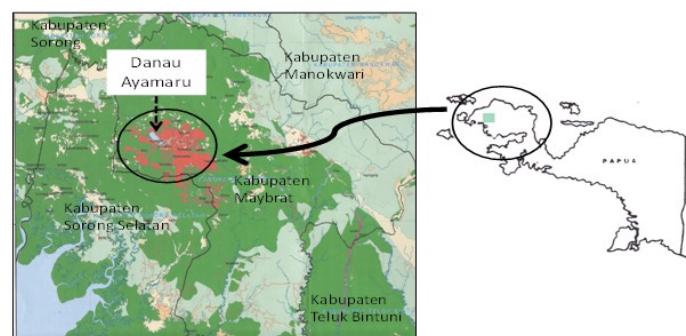


Fig. 1. Study site of Ayamaru Lake in Maybrat Regency

Methods

This study was conducted using a qualitative approach through in-depth interviews and Focus Group Discussion (FGD). Informants for interviews were selected through purposive sampling. The informants consisted of traditional elderly leaders, clan leaders, informal leaders, and farmers considered to have knowledge related to the condition of Ayamaru Lake. The themes of the questions were focused on the problems related to the lake, the causes, and the solutions. Interviews were done during exploration in order to get data from the study site. Interviews were done in the garden, at home, and public places for the community to gather—as agreed by both the researcher and the informants. Interviews were done using the local community language and were not more than 45 minutes. Focus Group Discussion was conducted in two stages. The first stage was conducted with the lake stakeholders consisting of the government and environment activists or practitioners. The second discussion was held with the local community around the lake. Direct observations on the lake and its surrounding areas were done in order to get comprehensive pictures on the forms of local wisdom, tourism attraction, and community involvement the management of the lake.

III. Result And Discussion

Problems of the lake from the Perspectives of the local community

The lake was facing such great threat, in which it was gradually going into extinction. The informants of the FGD stated various problems faced by the lake, which principally can be classified into three main issues namely sedimentation, water-volume reduction in springs, and rapid growth of settlements around the lake.

A. Sedimentation

Sedimentation has been clearly seen and felt by the local people around the lake as the main problem faced by the lake. One of the intellectual leaders of Maybrat Regency stated that:

“There have been changes in the ecosystem of the lake—it was huge layers of water in the past, yet it looks like a field nowadays”.

Physically, what the people have caught is sedimentation. Some government documents also mention that sedimentation is the main problem which cannot yet be systematically solved [15]. The result of the FGD showed that the local people realized that environment degradation around the lake was the main cause for sedimentation.

“Sedimentation happens due to forest and field fire, as well as burning of materials from building”.

This is relevant with the data on housing development around the lake. The housing and settlement development has changed the land use proportion, in which 3.07 km² (approximately 0.34% of the land in Maybrat) has been converted into settlements and 1.66 km² (approximately 0.20% of the land in Maybrat) is permanently used as farmlands. Plantation also starts to grow and uses 0.14 km² (approximately 0.02% of the land in Maybrat) [14]. A study by Hakim et al. (2010) also concludes that human activities around Ranupani Lake give such bad impacts to the lake in form of high sedimentation level [3].

Sedimentation and reduction in the width of the lake has been reported to happen so fast, as stated by one of the FGD informants:

“...the water level reached up to areas around the houses in the past, and the areas were used for bath, washing, etc.”

The FGD informants agreed that the problem had to be solve immediately and comprehensively, by focusing not only on the lake but also on the springs whose water run into the lake. These springs contribute so much to the lives of the people in the villages in Ayamaru, such as Arus, Ayamaru, Kambuaya, Kambuskato, Kartapura, Sauf, Segior, and Seni.

B. Reduction of Water Volume in springs

The people around the lake stated that the reduction in the number of springs and the water volume in the existing springs were caused by the degradation in the forest ecosystems:

“...we have cut too many trees in our forests for settlements, and this has caused decreasing water volume in rivers flowing to the lake, and the result is obviously decreasing water volume in the lake...”

Another FGD informant added:

“... the springs are covered with the stones sliding from areas above them, and the stones slid because of human activities, and this has made decreasing water volume in those springs”

The scientific relation between forest degradation and water availability has long been known [16]. Forests are ecologically important, as they play the role of rainwater infiltration and evapotranspiration [17], which keep the hydrological balance of the areas surrounding the forests and water availability.

The effects of settlement development around the lake

The houses of the local community grow around the lake on the slope of 8-15%. Some of the houses are built on the slope of 15-20%. In the process of building houses, the sloping land is made flat and the soil from the flattening process flows with the rain water to the lake; this leads into sedimentation. The houses normally consist of two parts. The first part is the main house for the family to stay and is built permanently using bricks, concrete, and palma leaves. The second part is the kitchen located in the back yard and is built using local materials found nearby.

The type of soil in the gardens is dominated by sandy soil and rocky soil. Each family owns approximately 0.25 – 0.50 Ha garden. Many types of plants grow in the garden. Plants for food and medicine are grown randomly following the agroforestry patterns. According to the observation, these gardens are rich in fruit plants such as rambutan (*Nephelium lappaceum*), durian (*Durio zibethinus*), langsung (*Lansium domesticum*), rose apples (*Eugenia aquea*), mangoes (*Mangifera indica*), oranges (*Citrus sinensis*), jackfruit (*Artocarpus heterophyllus*), zersak (*Annona muricata*), and avocados (*Persea americana*). This structure is similar to the patterns of management of gardens found in other communities in Indonesia [18] [19]. The other types of plants grown are vegetables which can grow well in open areas and under the canopy of the fruit plants. Local people also plant keladi johar (*Xhantosoma* sp), cassava (*Manihot esculenta*) and sweet potatoes (*Ipomea batatas*) as additional food sources.

The management of land by the local people

For the local people of Papua, all the land belongs to the society and the culture, known as “*tanah adat*”. Land is inherited from one generation to the next, and has certain width. The local people do farming in their “*tanah adat*” and the location of “*tanah adat*” can be moved under family agreement. In the spatial context, the land surrounding the lake is used as settlements, farmlands, forests, and unused lands. The management of land around the lake highly influences the ecosystems in the lake.

Based on the field observations, the distance of the gardens to the backyard is normally 100 meters to 2 km, the width of the farms is 0.25 – 0.50 Ha. The types of plants found in the gardens are local plants, such as keladi (*Colocasia esculenta*), cassava (*Manihot esculenta*), sweet potatoes (*Ipomea batatas*), corn (*Zea mays*), nuts (*Arachis hypogea*), banana (*Musa paradisiaca*), sugar cane (*Sacharum officinarum*), pumpkin (*Cucurbita mixta*), eggplants (*Solanum melongena*), watermelon (*Citrullus lanatus*), spinach (*Amarantus spec*), endives (*Brassica rapa*), long beans (*Vigna unguiculata sesquipedalis*), local bean variety, rica (*Capsicum frutescens*)

and tomatoes (*Solanum lycopersium*). Bananas and papayas are the main fruit planted in the gardens. Wild plants used as medicine are also found inside, outside, and in areas surrounding the gardens.

The results of FGD showed that slash and burn agriculture became the traditional farming technique which was still maintained up to these days. The process of this technique starts with planning, opening new land, burning, and planting, maintaining, and harvesting (Figure 2). This process is similar to other forms of slash and burn agriculture found all over Indonesia [20].

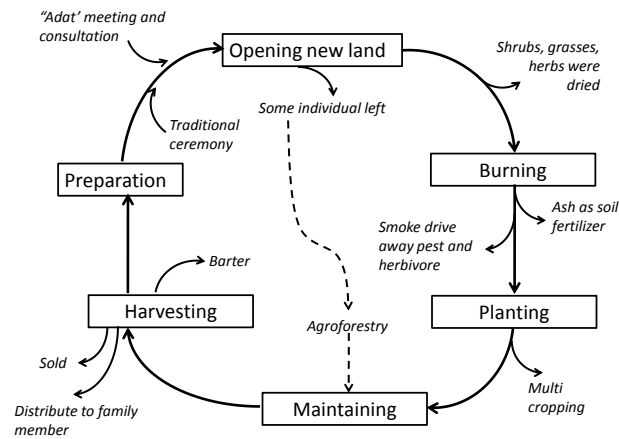


Fig. 2. Slash and burn practices among local people in Maybrat

a. Preparation

Field observation is done to choose the location of the new gardens. The choice is made based on some consideration, such as the uncultivated length of the land which should be around 10 – 15 years, the vegetation around it—grasses, bushes, and trees which should have a certain diameter and leafy branches. The owners of the land will do certain rituals to call the souls of their ancestors to ask for the ancestors' permission to cultivate the land.

b. Opening new land

The stage starts with cleaning the grasses, bushes, and trees having a diameter of 3 – 5 meters. The bigger trees with a diameter of more than 5 – 10 meters are left alive and are only trim to reduce their branches and leaves. The logs of the cut trees are then used for fences.

c. Burning Stage

This stage starts when all the cut trees as well as grasses and bushes are dry. The ash from the burning process is good as natural fertilizer and insecticide according to the local wisdom. The smoke from the burning process is used to frighten wild animals such as boars, deers, and birds, as well as microorganisms which can attack and damage the plants in the garden.

d. Planting

Seeds can be planted after 3 – 5 days of the burning stage. There are two types of planting, namely monoculture and polyculture techniques. The kinds of plants normally found in monoculture type are keladi, cassava, sweet potatoes, nuts, and corn. The kinds of plants normally found in polyculture type are keladi, cassava, sweet potatoes, nuts, corn, bananas, spinach, gedi, long beans, endives, pumpkins, cucumbers, watermelons, and other local commodities including medicinal plants. The local people mostly like the polyculture type since it contains varied plants and has higher anticipation for hunger and harvest failure.

e. Maintaining

The maintenance activities consist of cleaning shrubs and other disturbing plants. The organic material from those plants is used as organic fertilizers. Disease control is done in traditional ways by planting certain plants having certain smell or colors to cast away diseases.

f. Harvesting

Harvest is done in stages. The products harvested are consumed by the family and is also sold for some money. The harvested products bartered for other daily needs such as fish and meat, and are also given to other relatives or friends as a sign of good friendship and relationship.

Perception on the Sustainable Management of the Lake

Spiritual Basis in the Management

Ayamaru Lake is one of the natural resources supporting the lives of Maybrat people living around the lake. The local people catch fish by using traditional fishing equipment such as Kalawai and Bubu. Kalawai is a hunting tool in a form of a spear made from bamboo and metal (the point). Bubu is made from the root of gagar trees (a kind of palma) and rotan. Kalawai is mostly used by younger people to look for fish in shallow water, while bubu is used by older people to look for fish in shallow water. Fishing nets are also used for catching fish.

The informants in the discussion also have the same opinion that Ayamaru Lake is the grant from God Almighty for all people in Maybrat and it must be managed well for the sake of the next generations.

“God creates us to complete each other, thus the people living around the lake is responsible to preserve the lake”

The ancestors of the people in Maybrat had also taught how to develop harmonious relationship between human beings and the nature; and this is the responsibility of the present generation and the next to keep that spiritual relationship. Deep ecology understanding can be easily found in the Eastern culture having such strong spiritual basis [21] [22] [23]. The elderly people of Maybrat also emphasize the importance of this relationship. This attitude is similar to the one held by other local communities [11] [24]. To emphasize the importance of the lake in the spiritual context of Maybrat people, one of the informants stated that:

“From the point of view of culture, this lake has a lot of myths such as its formation and the sacred value of springs”

Myths and beliefs to the spiritual power of a place often become such important instrument in the preservation of the nature [22]. This is in line with the statement of one of the informants:

“Ayamaru Lake was well preserved until 1980s for there was harmonious relationship between human beings and nature. The nature is a sacred place, a place for the souls of our ancestors to stay. Natural disasters happen when this harmony is disturbed. We have to introspect ourselves and re-build the harmonious relationship by visiting the sacred places”

Damage to the ecosystem of Ayamaru Lake is caused by disharmony in the relationship between human beings and nature. According to the informants, the present generation disobeys the traditional norms inherited from their ancestors. There is tendency for appreciation toward local wisdom to decrease—and many tribes in the world face this problem (Pilgrim et al., 2008). In the social context, the decrease in the number of traditional leaders and elderly people who become the guardians of human spirituality in Maybrat has made the problem worse.

The Development Prospect of Ayamaru Lake

Many opinions during FGD asked for the development of Ayamaru Lake as a tourism object. Tourism is expected to stimulate natural biodiversity and local industries such as restaurants, accommodation, souvenir shops, etc. For the sector to be useful for the local people, the development must involve local community. The government must also participate actively in the development of Ayamaru Lake as a tourism object.

“Tourism has to be developed in Ayamaru Lake, and is managed by both the government and the local community”.

The local community can accept tourism as a new concept with some expectation, including improvement on physical and biological environment, by keeping attention on protection on the local culture.

Ayamaru Lake offers various tourism attractions. The areas surrounding the lake offer such beautiful scenery and various plants as the habitat for many flora and fauna. In addition, the traditional lifestyle of the local people can also become such good attraction for the tourism in Ayamaru Lake.

Other than just natural resources, the social basic resources for Maybrat people can be classified as follows:

- Traditional dances such as Srar/musioh, Semar, Kanaet (Syair), Slawah and Yosim Pancar;
- Art products made based on local wisdom such as traditional jewelery such as Kiet Taut (Cawat), Khaban (beads used as body ornaments), Iveah (a piece of cloth used as headcover), Waji (canine tooth of a pig used as a necklace), Watar (rib of a pig used as a necklace), Treel (bracelet), Ruma Wen (feather used on head), Suum (belt made of a kind of bark of a certain tree), Weh Yaa (a piece of cloth used asselendang used from the right shoulder up to the waist), Kak Taai (a nose stick made from wing bones of bats and kuskus tail), dan Yume (a kind of bag made from bark of a certain tree).
- Many types of traditional houses and traditional culture which can be used as tourism attractions are: (1) Samu Mos, a house located on top of hills or mountains to keep sacred things; (2) Harit, a hanging house to spy on enemies and to keep an eye on the farmlands; (3) Subiah, is a house having ground as the floor shaped in honay; (4) Samu Bah, is a kind of traditional pawnshop, in which collateral is kept for a certain

time and then distributed to those entitled through a traditional ceremony guided by the traditional leader; (5) Samu Guba, is a place to educate male students about traditional knowledge and healing rituals, how to control season, and war strategies; and (6) Samu Finya Mikiar, a place to educate young female on how to manage domestic affairs and to educate their children in the future.

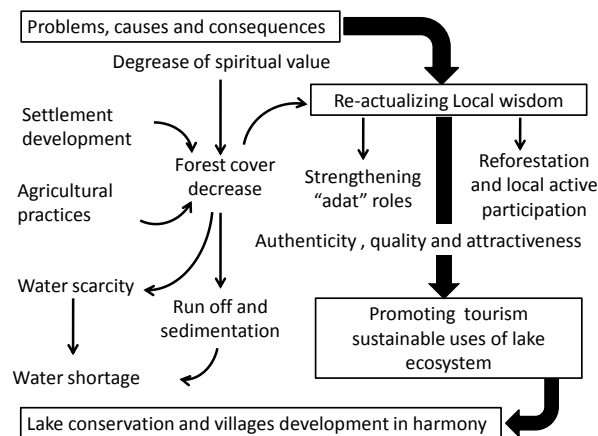


Fig. 3. Schematic diagram representing the local community perception on the problems, causes, and consequences of Ayamaru Lake degradation

Based on the results of FGD, we now understand that social and cultural resources of Maybrat Regency can be used and developed as tourism attractions to support tourism in the lake (Figure 3). The government needs to establish regulations which support the local people and local wisdom. Scholar states that social and cultural resources owned by local community can be integrated in the development of tourism with such good, wise, and comprehensive planning by involving local community itself [25]. It is particularly important for indigenous knowledge and environmental conservation [26].

IV. Conclusion

Ayamaru Lake has experienced many changes leading into its extinction. The local people around the lake can actually recognize and classify the causes of degradation and the effects. Reactualization of local wisdom is very important in the preservation of Ayamaru Lake. Local wisdom will increase local community participation and involvement in the sustainable management of the lake and in keeping the original values of the lake and the lives of the people around it. Tourism is one of the keys in the development of Maybrat Regency, yet it must be developed in cooperation with the local community

References

- [1] Hecky, R. E., Bootsma, H. A., & Odada, E. O. (2006). African lake management initiatives: the global connection. *Lakes & Reservoirs: Research & Management*, 11(4), 203-213.
- [2] Takamura, N. (2002). Biodiversity and lake conservation. *Aquabiology*, 24(3), 197-202.
- [3] Hakim, L. B. Yanuwadi, Sunaryo. 2010. Project for Restoration of Ecosystem in Conservation Area in Bromo Tengger Semeru National Park, Bromo Tengger Semeru National Park- Japan international Cooperation Agency
- [4] Solossa A.H, Soemarno,I.R. Sastrahidayat, L Hakim, 2013. Home Gardens of the Local Community Surrounding Lake Ayamaru, West Papua Province, and Its Consequences for Tourism Development and Lake Conservation. *Journal of Biodiversity and Ecological Conservation*. Vol. 3 (3): 1-11
- [5] Sen, B. 2005. Indigenous knowledge for development: Bringin research and practices together. *The International information and library Review*. 37;375-382.
- [6] Theilade, I., H.H. Hansen, M. Krog. 2007. Ethnobotanical knowledge; implication for partisipatory forest management. *The journal of transdisciplinary Environmental Studies* 6(1):1-14
- [7] Lingard, M., Raharison, N., Rabakonandrianina, E., Rakotoarisoa, J., & Elmqvist, T. (2003). The role of local taboos in conservation and management of species: The radiated tortoise in southern Madagascar. *Conservation and Society*, 1(2), 223.
- [8] Drew, J. A. (2005). Use of traditional ecological knowledge in marine conservation. *Conservation Biology*, 19(4), 1286-1293.
- [9] Pedrosa-Júnior, N. N., & Sato, M. (2005). Ethnoecology and conservation in protected natural areas: incorporating local knowledge in Superagui National Park management. *Brazilian Journal of Biology*, 65(1), 117-127.
- [10] Lauer M and S. Aswani. 2008. Integrating indigenous ecological knowledge and multi-spectral image classification for marine habitat mapping in Oceania. *Ocean & Coastal Management* xxx 1–10
- [11] Hakim, L, J. E. Kim,S.K. Hong. 2009. Cultural Landscape and Ecotourism in Bali Island, Indonesia. *Journal of Ecology and Field Biology*. *Journal of Ecology and Field Biology* 32 (1): 1-8.
- [12] Pitana, I. (2010). Tri Hita Karana–The Local Wisdom of the Balinese in Managing Development. In *Trends and Issues in Global Tourism 2010* (pp. 139-150). Springer Berlin Heidelberg.
- [13] Infield, M., Director, A. P. R., & Mugisha, A. (2010). Integrating cultural, spiritual and ethical dimensions into conservation practice in a rapidly changing world. Prepared for the John D. and Catherine T. MacArthur Foundation.
- [14] BPS Maybrat. 2012. KAbupaten maybrat dalam NAGka. BAdan Pusat Statistiuk Kabupaten MAYbrat, Propinsi Papua Barat

- [15]. Kabupaten Sorong Selatan, 2007. Study inventarisasi dampak lingkungan Danau Ayamaru. Dinas Lingkungan Hidup dan Kebersihan Kabupaten Sorong Selatan, Propinsi Papua Barat.
- [16] Chang, M. (2012). Forest hydrology: an introduction to water and forests. CRC PressI Llc.
- [17] Giambelluca, T. W. (2002). Hydrology of altered tropical forest. *Hydrological processes*, 16(8), 1665-1669.
- [18] Mulyoutami, E., Rismawan, R., & Joshi, L. (2009). Local knowledge and management of simpukng (forest gardens) among the Dayak people in East Kalimantan, Indonesia. *Forest Ecology and Management*, 257(10), 2054-2061.
- [19] Whitten, T., R.E. Soeriaatmadja, S.A. Afif. 1997. The ecology of Java and Bali. The Ecology of Indonesia Series Vol II. Periplus, Singapore.
- [20] Kusumanto, T., E.I. Yuliani, P. Macoum, Y. Indriatmoko, H. Adnan, 2005. Learning to adapt: Managing forest together in Indonesia, CIFOR, Jakarta.
- [21] Henning, D. H. (1998). Buddhism and Deep Ecology: protection of spiritual and cultural values for natural tropical forests in Asia. In Personal, societal, and ecological values of wilderness: Proceedings of the Sixth World Wilderness Congress (Vol. 1, pp. 108-112).
- [22] Colding, J., & Folke, C. (2001). Social taboos: "invisible" systems of local resource management and biological conservation. *Ecological Applications*, 11(2), 584-600.
- [23] Oviedo, G. (2012). Spiritual values and conservation. *Sacred Species and Sites: Advances in Biocultural Conservation*, 28.
- [24] Torri, M. C., & Herrmann, T. M. (2011). Spiritual Beliefs and Ecological Traditions in Indigenous Communities in India: Enhancing Community-Based Biodiversity Conservation. *Nature and Culture*, 6(2), 168-191.
- [25] McKercher B and H duCros (2008). *Cultural tourism: the partnership between tourism and cultural heritage management*. Roudledge, New York.
- [26] Pilgrim, S. E., Cullen, L. C., Smith, D. J., & Pretty, J. (2008). Ecological knowledge is lost in wealthier communities and countries. *Environmental science & technology*, 42(4), 1004-1009.