



XV WORLD FORESTRY CONGRESS

Building a Green, Healthy and Resilient Future with Forests

2–6 May 2022 | Coex, Seoul, Republic of Korea

Development of Criteria and Indicators for Sustainable Mangrove Forest Management: Experiences in Three Mangrove Ecosystems in the Philippines

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Abstract

The Philippines' coastline measuring about 36,000 km is home to mangroves which play an important role in fisheries, forestry, and wildlife production. The Food and Agriculture Organization of the United Nations Environment Program defines mangroves as forest that occurs on tidal flats bordering coastal areas and along the mouths of rivers where water is brackish. Through the years, the area of mangrove forests has dwindled due to deforestation and other anthropogenic activities. Thus, the need for their rehabilitation and sustainable management is a very important concern. Recognizing this, the Socio-economic Team of the ASEAN-Korea Environmental Cooperation Project from the Philippines conducted research on the development of a set of Criteria and Indicators (C & I) for sustainable mangrove forest resources management. The C & I for mangroves were adapted from the C & I for Sustainable Forest Resources Management of the Philippines' Forest Management Bureau. The research involved an assessment of the C & I for their applicability and adaptability to mangrove forests. The C & I covered the following criteria: 1) Enabling conditions for sustainable mangrove forest management, 2) Extent and condition of mangrove forests, 3) Mangrove ecosystem health, 4) Forest production, 5) Biological diversity, 6) Coastal resources protection, and 7) Economic, social, and cultural aspects. These criteria covered 35 indicators.

The proposed C & I were field validated through focus group discussion (FGD) with selected members of the people's organizations in the local communities and key informant interview (KII) with the Department of Environment and Natural Resources personnel. The study was conducted in Padre Burgos, Quezon; Puerto Princesa City, Palawan; and Getafe, Bohol. The results revealed that the FGD and KII respondents perceived the applicability and importance of the C & I in maintaining the sustainability of the mangrove resources in these areas.

Keywords: criteria and indicators, mangroves, forest management

Introduction, scope and main objective

The Food and Agriculture Organization-United Nations Environment Program (1981) defines mangroves as forest which occurs on tidal flats bordering coastal areas and along the mouths of rivers where water is brackish. In the Philippines, mangroves abound in the country's coastlines which measure about 36,000 km. Despite the important role of mangroves in country's fisheries, forestry and wildlife resources, their area has declined from 450,000 ha to 120,000 ha, mostly due to the conversion of mangroves into aquaculture (Primavera and Esteban 2008).

C & I for forests are tools which can be used both in the conceptualization and in the process of achieving sustainable forest management. Criteria define the essential elements of forest management against which the forest sustainability may be assessed. Each criterion relates to a key element of sustainability in forestry and may be characterized by one or more related qualitative, quantitative or descriptive indicators. The overall effects of forest management interventions can be assessed, and evaluated through the measurement and monitoring of these indicators and action can be adjusted to better meet stated the goals and objectives. Recognizing the importance of mangroves as a forest resource, the ASEAN-Korea Environmental Cooperation Project (AKECOP) implemented a Regional Research on Participatory Assessment and Evaluation of Mangrove Forest Restoration focusing on the development of C & I for the sustainable management of mangroves. It aimed to develop, through participatory process, a set of C & I which can be used to measure progress towards sustainable management of mangroves.

C & I can provide a structure to organize shared knowledge and information about sustainable forest management. If developed by the stakeholders in a participatory manner, C & I can be important learning tools for communities and their partners.

This paper presents the results of the participatory assessment done in three mangrove ecosystems in the Philippines, namely, Padre Burgos, Quezon; Getafe, Bohol; and Puerto Princesa City, Palawan (Fig. 1).



Fig: 1. Location of the study sites.

Methodology/approach

The existing C&I for Sustainable Forest Management formulated by the Forest Management Bureau-Department of Environment and Natural Resources (2003) which is composed of 7 criteria and 56 indicators were reviewed. The researchers assessed the C&I for their applicability and adaptability to mangroves forests. The 7 criteria were adopted and out of 65 indicators, 35 were deemed to be applicable to mangroves (Appendix Table 1).

The research method involved a combination of focus group discussions (FGD) and key informant interviews (KIIs). The set of C & I identified as applicable to mangrove forest restoration were presented to the project participants through FGD to get their opinions and suggestions. The C&I which were first translated to Filipino to facilitate the discussion were printed on brown paper and presented to the FGD participants. The people's organization (PO) members were asked to state whether the C&I were important (I) or not important (NI) in monitoring and evaluating mangrove forest restoration projects. For those indicators identified to be important, the PO members were asked to rate their degree of importance, i. e. important (I) or very important (VI). The DENR representatives were likewise asked to rate the relative importance of the C & I using a prepared questionnaire.

The C&I were validated by actually visiting the communities and assessing their mangrove management practices. In addition, FGDs using a set of guide questions were conducted in the communities. Hopmans et al. (2003) emphasized the importance of field testing the C&I since "it is unlikely that a single set of C&I will apply across the globe, as plantations have been established to fulfill different goals.

Results

The POs in the three mangrove areas have different levels of perceptions as to the relative importance of the indicators under the seven criteria (Table 1). The POs in Quezon, namely, Anak Dagat (Samahan ng Anak Dagat ng Cabuyao Sur), Pamayanang Laging Kaagapay sa Ikauunlad ng Biyayang Dagat sa Danlagan (PALAKAIBIGAN), Kasapian ng Barangay Rizal sa Ikauunlad ng Kalikasan at Pamayanan (KAZALIKAPA) considered 6 out of 11 indicators while those in Bohol (BAFMAPA or Banacon Fisherfolk and Mangrove Planters Association) perceived 8 out of 11 indicators as very important. Among the three areas, the PO in Palawan (KCRDAI or the Kamuning Coastal Residents Development Association, Inc.) considered all the indicators of *Criterion 1* as very important for sustainable mangrove forest management. For *Criterion 2*, the POs in Quezon and Bohol felt that only 2 out of the 3 indicators are very important. On the contrary, the PO in Palawan perceived all the 3 indicators as very important. For *Criterion 3*, the POs in Quezon felt that both indicators are very important, while the POs in Bohol and Palawan considered that extent and nature of forest encroachment, degradation and disturbance caused by humans are more important than the those caused by natural disasters.

For *Criterion 4*, the PO members in both Bohol and Palawan opined that all the 6 indicators are very important while the POs in Quezon thought that Indicator 4.2 (composition of forest) and Indicator

4.6 (availability of historical records on the extent, nature and management of mangroves) are very important information for sustainable mangrove management.

The POs' perceptions as regards *Criterion 5* varied across the three sites. The POs in Quezon did not consider any of the 3 indicators of biological diversity as very important whereas the PO members in Palawan considered all of them as very important. Meanwhile, the PO members in Bohol considered *Indicator 5.1* (protected areas containing forests) and *Indicator 5.2* (protected areas connected by biological corridors) as very important.

The same trend was observed as regards *Criterion 6* in that POs in Quezon did not consider any of the 2 indicators of coastal resource protection as very important whereas the PO members in Palawan considered both indicators as very important. On the other hand, the PO members in Bohol considered procedures to assure the protection of downstream catchment values as very important.

Lastly, for *Criterion 7*, the PO members in Palawan considered all the 8 indicators of the economic, social, and cultural aspects as very important. However, those in Quezon and Bohol considered the existence and implementation of mechanisms for the equitable sharing of forest management's costs and benefits, existence and implementation of conflict resolution mechanisms for resolving disputes between forest stakeholders, number of people depending on mangrove forests for their livelihood, training, capacity building and manpower development programs, extent to which tenure and other rights of communities cover publicly- owned mangrove forests are recognized and practiced, and extent of involvement of local communities in mangrove process, decision making and implementation.

Table 1: Very important indicators as rated by the POs

Criteria	Study Site		
	Quezon	Bohol	Palawan
Criterion 1. Enabling conditions for sustainable mangrove forest management (11 indicators)	1.1, 1.2, 1.3, 1.4, 1.5, 1.8	1.1, 1.2, 1.5, 1.6, 1.7, 1.8, 1.9, 1.11	All indicators
Criterion 2. Extent and condition of mangrove forests. (3 indicators)	2.1, 2.3	2.1, 2.2	All indicators
Criterion 3. Mangrove ecosystem health (2 indicators)	Both indicators	3.1	3.1
Criterion 4. Forest production (6 indicators)	4.2, 4.6	All indicators	All indicators
Criterion 5. Biological diversity (3 indicators)	None	5.1, 5.2	All indicators
Criterion 6. Coastal resource protection (2 indicators)	None	6.2	All indicators
Criterion 7. Economic, social, and cultural aspects (8 indicators)	7.1, 7.4, 7.6, 7.8	7.2, 7.3, 7.4, 7.6, 7.8	All indicators

The assessment of the Community Environment and Natural Resources Office (CENRO) personnel differed between the two study sites (Table 2). The CENRO personnel in Bohol considered only Indicators 1.1 and 1.2 as very important, while those in Palawan perceived 8 out of 11 indicators as very important. For Criteria 2, 3, 4, 6 and 7, all the indicators were considered important only by the CENRO personnel in Bohol. However, the CENRO personnel in Palawan considered all the indicators for Criteria 2, 3, and 6 very important. For Criterion 7, 4 of the 8 indicators were deemed very important while the rest were important only.

Table 2: Very important indicators as rated by DENR personnel

Criteria	Study Site	
	Bohol	Palawan
Criterion 1. Enabling conditions for sustainable mangrove forest management (11 indicators)	1.1, 1.2	1.1, 1.3, 1.4, 1.5, 1.7, 1.9, 1.10, 1.11
Criterion 2. Extent and condition of mangrove forests (3 indicators)	None	All indicators
Criterion 3. Mangrove ecosystem health (2 indicators)	None	Both indicators
Criterion 4. Forest production (6 indicators)	None	4.5
Criterion 5. Biological diversity (3 indicators)	5.1	5.1, 5.2
Criterion 6. Coastal resource protection (2 indicators)	None	Both indicators
Criterion 7. Economic, social, and cultural aspects (8 indicators)	None	7.1, 7.3, 7.4, 7.8

Discussion

The POs in Quezon, Bohol, and Palawan considered the criteria and indicators for sustainable forest management adapted by the Philippines were also applicable to the mangrove forests. The indicators under the seven criteria were very important in managing mangrove resources' sustainability. But as Dizon et al. (2009) reported, in general, the POs in Padre Burgos, Quezon perceived some of the indicators more important than the others since they thought some of the indicators were not applicable given that the mangrove forests under their care and protection were intended as carbon sink where commercial utilization was not allowed. The BAFMAPA members in Bohol rated 25 out of 35 indicators as very important and the rest important. The KCRDAI members in Puerto Princesa City, Palawan unanimously rated 34 out of the 35 indicators as very important for sustainable mangrove management. The only indicator that KCRDAI members did not consider very important is the extent and nature of mangrove degradation and disturbance due to natural causes and the control procedures applied because the area is seldom visited by typhoon, unlike Quezon.

The CENRO personnel in Bohol and Palawan differed quite differently in the perception of the relative importance of the indicators. While the CENRO personnel in Palawan considered 22 out of 35 indicators as

very important, those from Bohol considered only three indicators as very important and the rest as important. This perception can be explained by the results of the validation that mangroves in the study area in Bohol are public lands and therefore private ownership is not allowed, harvesting is not allowed, there are no species dependent on mangroves which are threatened, there are no conflicts among the stakeholders, tenure over public land has been recognized and indigenous knowledge system is not applied to mangrove management. While these conditions also exist in Palawan, the CENRO personnel still considered majority of the indicators as very important for the sustainable management of the mangroves (Dizon et al. 2013).

Conclusions/ wider implications of findings

Some indicators are not applicable to the objectives by which the plantations were established. In all the plantations visited, harvesting is not allowed. Hence, indicators pertaining to harvesting may be difficult to measure. In relation to this, there is a need to determine the applicability of the C & I for mangroves in areas where harvesting is allowed.

Only five POs and two CENROs were involved in the preliminary process of developing the C & I for mangroves. The results have to be validated with a wider group of stakeholders which include the POs, DENR, local government units (LGUs), and civil society groups. Afterwards, a policy which will embody the identified C & I for mangroves should be crafted (maybe a DENR administrative order) to guide the local communities in managing the mangroves in their localities.

Acknowledgements

The authors thank the ASEAN-Korea Environmental Cooperation Project (AKECOP) for funding the research and the members of the Anak Dagat, KAZALIKAPA, PALAKAIBIGAN in Padre Burgos, Quezon; BAFMAPA in Getafe, Bohol; and KCRDAI in Puerto Princesa City, Palawan; and the CENRO-DENR personnel who participated in the research.

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Appendix Table 1. List of proposed criteria and indicators for mangroves.

Criteria	Indicators
Criterion 1. Enabling conditions for sustainable mangrove forest management	1.1 Existence and implementation of policies, laws and regulations to govern mangrove management 1.2 Forest tenure and ownership 1.3 Amount of funding in mangrove forest management, administration, research, and human resource development 1.4 Existence and implementation of economic instruments and other incentives to encourage sustainable mangrove management 1.5 Structure and staffing of institutions responsible for sustainable mangrove management 1.6 Number of professional and technical personnel to perform and support mangrove management 1.7 Existence of communication strategies and feedback mechanisms to increase awareness about sustainable mangrove management 1.8 Existence of and ability to apply appropriate technology to practice sustainable mangrove management and the efficient utilization and marketing of mangrove forests 1.9 Capacity and mechanism for planning sustainable mangrove management and for periodic monitoring, evaluation and feedback on progress 1.10 Public participation in mangrove forest management planning, decision making, data collection, monitoring and assessment 1.11 Existence of mangrove forest management
Criterion 2. Extent and condition of mangrove forests.	2.1 Extent of forests committed to production and protection 2.2 Changes in forested area 2.3 Forest condition
Criterion 3. Mangrove ecosystem health	3.1 Extent and nature of mangrove encroachment, degradation, and disturbance caused by humans and the control procedures applied

	3.2 Extent and nature of mangrove degradation and disturbance due to natural causes and the control procedures applied
Criterion 4. Forest production	<p>4.1 Actual and sustainable harvest of wood and non-wood forest products applied</p> <p>4.2 Composition of forest</p> <p>4.3 Existence and implementation of harvesting/operational plans and other harvesting permits</p> <p>4.4 Existence of control mechanisms</p> <p>4.5 Long-term projections, strategies and plans for forest production</p> <p>4.6 Availability of historical records on the extent, nature and management of mangroves</p>
Criterion 5. Biological diversity	<p>5.1 Existence and implementation of procedures to identify and protect endangered, rare and threatened species of mangrove flora and fauna</p> <p>5.2 Number of endangered, rare, and threatened mangrove-dependent forest species</p> <p>5.3 Extent and percentage of mangrove forest which has been set aside for biodiversity conservation</p>
Criterion 6. Coastal resource protection	<p>6.1 Extent and percentage of total mangrove forest area managed exclusively for the protection of habitat of fishes and other beneficial aquatic flora and fauna</p> <p>6.2 Procedure for conservation of buffer strips along coastal areas</p>
Criterion 7. Economic, social, and cultural aspects	<p>7.1 Existence and implementation of mechanisms for the equitable sharing of forest management's costs and benefits</p> <p>7.2 Existence and implementation of conflict resolution mechanisms for resolving disputes between stakeholders</p> <p>7.3 Number of people depending on mangrove forests for their livelihood</p> <p>7.4 Training, capacity building and manpower development programs</p> <p>7.5 Area of mangrove forests upon which the people are dependent for subsistence use and traditional/customary life styles</p> <p>7.6 Extent to which tenure and other rights of communities over publicly-owned mangrove forests are recognized and practiced</p> <p>7.7 Extent to which indigenous knowledge is used on mangrove management planning and implementation</p> <p>7.8 Extent of involvement of local communities in mangrove capacity building, consultation process, decision making and implementation</p>