Community-based conservation through stakeholder collaboration in the Essential Ecosystem Area (EEA) of Kao, North Halmahera Regency

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Abstract. Mangrove forest in Kao Village, North Halmahera Regency, North Maluku Province, is a Key Biodiversity Area. Since 2017, the community has been protecting mangrove forests through Kao Village Regulation No.03/2007. In 2020, through the collaboration between stakeholders from universities, NGOs and the government, the Kao mangrove forest area of 300.92 Ha was designated as an Essential Ecosystem Area (EEA) based on the North Halmahera Regent Decree No.078/102/HU/2020. This study describes the biodiversity and the community-based conservation through stakeholder collaboration in the EEA of Kao. The study found that there are 13 mangrove species and 56 bird species, of which 10 are protected species. In 2020, the community has built a mangrove nursery and rehabilitated 8 ha of degraded mangrove forest with the participation of about 70 people. Since the establishment of EEA, the community has stopped hunting for eggs of the endemic moluccan scrubfowl (\textit{Eulipoa wallacei}) and is trying to increase its population through semi-natural hatching on the beach. The community has also learned to use non-timber mangrove forest products and ecotourism through the support of stakeholders.

1. Introduction
Mangrove forests have various benefits that are very important for human life and biodiversity. A number of animal and plant species live and depend on the mangrove forest ecosystem. Communities who live around the mangrove forests take benefit both directly and indirectly[1,2]. The directly benefit such as taking crabs and shellfish, while indirect benefit are coming from its capability to protect the land ecosystems from coastal abrasion and sea water intrusion. However, the mangrove ecosystem is very vulnerable to the environmental changes caused by human and nature [3].

Community-based conservation is a voluntary initiative for conserving the natural resources or biodiversity carried out by and for the community. The purpose of community-based conservation is to increase biodiversity protection and improve local people's livelihoods [4]. The Community-based conservation (CBC) is the most important tool and has been widely used recently in natural resource management especially in managing the sustainability of the protected area, restoring ecosystem and reducing poverty in rural areas [5].
Various studies on community-based mangrove conservation have been conducted in Indonesia such as in Probolinggo, Bekasi, Pesawaran, Tiwoho North Sulawesi [3], and East Lombok [6]. Meanwhile, the information concerning mangrove conservation based on the local community participation and the collaboration between stakeholders in the coast of Kao, North Halmahera Regency, is not yet known. Therefore, this research is important to be conducted. Various community activities such as mangrove nursery and rehabilitation as well as the use of mangrove forest could be some indication of the community participation on the conservation of the mangrove forest in Kao. This study aims to describe the community-based conservation through stakeholder collaboration in the management of Kao mangrove forest which is designated as an Essential Ecosystem Area (EEA) since 2020.

2. Study site and methods
This research was conducted during January to December 2020 in the mangrove forest of Kao (1°9'27.657'' N, 127°54'10.579' E) which is an Essential Ecosystem Area (EEA) (Figure 1). The mangrove forest of Kao is located in Kao Bay, North Halmahera Regency, North Maluku Province. It covers the administrative of Kao Village in Kao District as well as Gayok Village and Wangeotak Village in Malifut District. The North Halmahera Regency has an average temperature of 24.4 °C, the rainfall of 175.2 mm, and the relative humidity of 87.8% [7].

![Figure 1. Map of Essential Ecosystem Area (EEA) of Kao](image-url)

In this research, the biodiversity inventory of mangrove plants and birds was carried out. The identification of mangrove plants was conducted by seeing the difference between roots, leaves, flowers and fruit as well as the physiology of mangrove stands. The mangrove identification refers to the literature of Mangrove Introduction Guide in Indonesia [8] and Mangrove Guidebook for
Southeast Asia [9]. Meanwhile, the bird identification refers to the bird nomenclature guides MacKinnon et al [10]. This research of community-based conservation through stakeholder collaboration in managing the Essential Ecosystem Area (EEA) of Kao uses a qualitative descriptive approach. The data concerning the management and the utilization of mangrove forest in the EEA of Kao were obtained through field observation and in-depth interviews using a question guide. The informants in this study were chosen by using a snowball sampling technique which allows collecting data from one informant to another without limiting the number in order to enrich the information. The in-depth interview was stopped when the additional informants no longer produce any new information concerning the topic.

3. Results

3.1. Biodiversity of mangrove plants and birds
A total of 13 species of true mangrove plants were found in the mangrove forest of Kao (Table 1). The ecosystem is dominated by the types of middle mangrove and brackish mangrove. The species from the genus Rhizophora are the most dominant in this area.

The research of bird diversity throughout August to September 2020 recorded 56 species of birds that utilized the mangrove and coastal areas of Kao as a habitat of life (Table 2). There are 10 species of birds protected by the government such as brahminy kite (Haliastur indus), great white egret (Ardea alba), greater crested tern (Thalasseus bergii), common tern (Sterna hirundo), little tern (Sternum albifrons), moluccan scrubfowl (Eulipoa wallacei), halmahera paradise-crow (Lycocorax pyrrhopterus), red-cheeked parrot (Geoffroyus geoffroyi), red-flanked lorikeet (Charmosyna placentis), and whimbrel (Numenius phaeopus).

Table 1. Plant species of true mangrove in the EEA of Kao

| No | Local Name | Latin Name          | Family       |
|----|------------|---------------------|--------------|
| 1  | Ranga      | Aegiceras corniculatum | Myrsinaceae  |
| 2  | -          | Avicennia alba      | Avicenniaceae |
| 3  | Soki Ping  | Bruguiera cylindrica | Rhizophoraceae|
| 4  | Soki Dao   | Bruguiera exaristata | Rhizophoraceae|
| 5  | Fika fika  | Camptostemon schultzii | Malvaceae |
| 6  | Goro-goro raci | Excoecaria agallocha L. | Euphorbiaceae |
| 7  | Gumira     | Heritiera littoralis | Malvaceae    |
| 8  | Bobo       | Nypa fruticans     | Arecaeeae    |
| 9  | Hutu Lage  | Rhizophora apiculata | Rhizophoraceae|
| 10 | Lemo-lemo  | Rhizophora mucronata | Rhizophoraceae|
| 11 | Gabi dora  | Rhizophora stylosa  | Rhizophoraceae|
| 12 | Posi-posi  | Sonneratia alba    | Sonneratiaceae|
| 13 | Kira kira  | Xylocarpus granatum | Meliaceae    |

Table 2. Bird species found in the EEA of Kao

| No  | Local Name | Indonesian Name | Latin Name          | Protected by the government |
|-----|------------|-----------------|---------------------|-----------------------------|
| 1   | Guheba     | Elang bondol    | Haliastur indus     | Yes                         |
| 2   | -          | Cekakak suci    | Todirhamphus sanctus| -                           |
| 3   | Raja udang | Raja-udang Erasia | Alcedo atthis      | -                           |
| 4   | Raja udang | Raja-udang kecil | Ceyx pusillus       | -                           |
| 5   | -          | Umukia Raja     | Radjah radjah      | -                           |
| 6   | Glori      | Kapinis laut    | Apus pacificus      | -                           |
| No. | Category       | Species                | Common Name | Status |
|-----|----------------|------------------------|-------------|--------|
| 7   | Walet Maluku   | Aerodramus infuscatus  |             |        |
| 8   | Swengko Kuntul besar | Ardea alba       |             | Yes    |
| 9   | Swengko Kuntul karang | Egretta sacra    |             |        |
| 10  | Swengko Kuntul kecil | Egretta garzetta   |             |        |
| 11  | Kuntul kerbau  | Bubulcus ibis       |             |        |
| 12  | Bambangan kuning | Ixobrychus sinensis  |             |        |
| 13  | Burung kapas   | Ardea alba           |             |        |
| 14  | Burung minya   | Artamus leucorynchus  |             |        |
| 15  | Lori kusu-kusu | Coracina papuensis    |             |        |
| 16  | Lori kusu-kusu | Charadrius mongolus   |             |        |
| 17  | Moygoi         | Pluvialis fulva      |             |        |
| 18  | Pombo biru     | Chalcopteryx indica  |             |        |
| 19  | Terkukur       | Streptopelia chinensis|            |        |
| 20  | Pombo Irian    | Macropygia amboinensis|            |        |
| 21  | Kum-Kum        | Ducula bicolor       |             |        |
| 22  | -              | Treron vernans       |             |        |
| 23  | -              | Eurystomus azureus   |             |        |
| 24  | -              | Eurystomus orientalis|            |        |
| 25  | -              | Cacomantis variolus  |             |        |
| 26  | Buluri kusu-kusu | Centropus bengalensis|            |        |
| 27  | Buluri kusu-kusu | Centropus goliath   |             |        |
| 28  | Idisi          | Eudynamis scolopacea |             |        |
| 29  | Midalam        | Fregata ariel        |             |        |
| 30  | Burung gunting | Hemiprocne mystacea  |             |        |
| 31  | Malinao        | Thalasseus bergii    |             | Yes    |
| 32  | Malinao        | Sterna hirundo       |             | Yes    |
| 33  | Malinao        | Sterna albisrons     |             | Yes    |
| 34  | Mamoaa         | Eulipoa wallacei     |             |        |
| 35  | Cui            | Merops ornatus       |             |        |
| 36  | Sikatan kilap  | Myiagra alecto       |             |        |
| 37  | Gotolo         | Symopsiachrus trivirgatus|            |        |
| 38  | Burung madu    | Cinnrys jugularis    |             |        |
| 39  | Burung madu hitam | Leptocoma sericea |             |        |
| 40  | Kancilan emas  | Pachycephala mentalis|            |        |
| 41  | Idisi          | Lycomorax pyrrhopterus|            |        |
| 42  | Gotolo         | Passer montanus      |             |        |
| 43  | Siba/Ciba      | Geoffroyus geoffroyi |             |        |
| 44  | Salibuta       | Charmosyna placenta  |             | Yes    |
| 45  | Burung kuning  | Alopoxys affinis    |             |        |
| 46  | Toge           | Gallirallus philippensis|            |        |
| 47  | -              | Amaurornis cinerea   |             |        |
| 48  | Baikole        | Rhipidura leucophrys |             |        |
3.2. Community's life in utilizing mangrove forest resources

The total area of Kao mangrove forest is around 400 ha. This forest is mostly accessed by the community from three villages namely Kao, Gayok and Wangeotak with a total of 3,058 people covering 1,496 men and 1,562 women. Besides the three villages, people from several other villages such as Jati, Kusu, Kusu Lofra, Soangsaji Dim-Dim, Waringin Leewi and Goruang are also take advantage from the presence of the mangrove forest for their daily lives. The main livelihoods of the communities are farmers and fishermen. The main agriculture commodity is copra which is processed from coconut. Meanwhile, Kao bay is also known as a quality source of anchovy.

The communities around the EEA of Kao come from various tribes, mainly Kao, Pagu, Boeng and Modole. They utilize the Kao mangrove forest ecosystem for the timber and non-timber products. The timber product is mainly for firewood, while the non-timber products are shellfish and crabs.

The Kao mangrove forest has long been become an open access area to the exploitative activities by various communities. In addition to the uncontrolled exploitation, the Kao mangrove forest also faces challenges by the land use conversion into coconut plantations and settlements. It is estimated that around 25% of the existing mangrove forest area has been occupied in line with the population growth of the surrounding community.

3.3. Collaboration and establishment of the Essential Ecosystem Area

The 2016-2021 vision of the Kao Village Government is to become a tourism village. Through this vision, it is hoped that the Kao mangrove forests and its coast could be managed and utilized sustainably. As an effort to this vision and in order to protect the mangrove forests as well as the coastal area, the Kao Village issued Village Regulation No. 03 of 2017 concerning Environmental Conservation.

As time goes by, the Kao Village Government had difficulty realizing the vision and implementing the village regulation that had been set. The exploitation of mangrove forests can’t be stopped, meanwhile, the hunt for eggs of the moluccan scrubfowl (Eulipoa wallacei), which is an endemic and protected bird, continues. Thus the process toward the achievement of a tourism village vision has not been able to be implemented.

In 2019, some communications were carried out between the Kao Village government, the Indigenous Peoples Alliance of North Maluku (AMAN Maluku Utara), Halmahera University, Burung Indonesia and the Natural Resources Conservation Agency of Maluku (BKSDA Maluku). These communications are part of a joint program to conserve the mangrove and the coastal ecosystems of Kao supported by the Critical Ecosystem Partnership Fund (CEPF). The parties consider the importance of changing the open access situation of mangrove forests into the community-based conservation management through an Essential Ecosystem Area (EEA). EEA is an area outside the conservation forest area which has a conservation function due to its High Conservation Value (HCV). An area with a mangrove forest ecosystem and the habitat for the endemic and protected animals is categorized as a high conservation value.

The parties mentioned above then became the initiators of the EEA by conducting a series of communications both to the government of North Halmahera Regency and to the community in Kao Village. In September 2019, the Regent of North Halmahera issued a decree No.031/267/HU/2019 regarding the Management Collaboration Forum of the Essential Ecosystem Area (EEA) of Kao.
Furthermore, in December 2019, the management collaboration forum delineated the EEA and conducted public consultations. In March 2020, the Regent of North Halmahera issued a decree No.078/102/HU/2020 concerning the Designation of Mangrove and Coastal Areas in Kao Village as an Essential Ecosystem Area (EEA) with an area of 300.92 Ha. The EEA of Kao is the first EEA established in North Maluku Province. It is determined by the Regent due to the land status which is an Other Use Area.

3.4. Management activities of the EEA of Kao

3.4.1. Mangrove rehabilitation. In 2020, through a partnership with the Watershed Management and Protected Forest Agency (BPDASHL) Ake Malamo, a community’s nursery was built to produce 20,000 mangrove seedlings in Kao Village with the involvement of 16 villagers (Figure 2A). Mangrove rehabilitation was also carried out through a labor-intensive program covering an area of 8 ha with a total community involvement of about 70 villagers (Figure 2B). The mangrove nursery and the rehabilitation have raised the awareness of the community in Kao Village to participate in conserving mangroves in their village.

3.4.2. Conservation of the moluccan scrubfowl. Before the establishment of the EEA, the community freely hunted for eggs of the moluccan scrubfowl (Eulipoa wallacei) on the Kao Village coast. This endemic bird of the Maluku islands is protected at the family level (Megapodiidae) based on the Government Regulation Number 7 of 1999 concerning the Preservation of Plant and Animal Species. The Ministry of Environment and Forestry has also made the moluccan scrubfowl as a protected species through Regulation P.106/Menlhk/Setjen/Kum.1/12/2018 of the Minister of Environment and Forestry of the Republic of Indonesia. The daily habitat of this species is in the upland forests, but the bird lays its eggs in the beach sand. The entry of moluccan scrubfowl's egg-laying habitat in the EEA area has stopped egg hunting activities. Communities who previously hunted its eggs have turned to the mangrove rehabilitation and the utilization of the non-timber mangrove forest products.

Several villagers of Kao have also conducted a field study with the ‘Salabia’ youth community in Simau Village, North Halmahera Regency, who previously succeeded in semi-natural hatching of moluccan scrubfowl and releasing them into the wild. Currently, the trials of hatching moluccan scrubfowl eggs in Kao Village are being carried out to increase the bird population.

3.4.3. Ecotourism training. To support Kao's vision as a tourism village, the ecotourism concept was chosen to be able to utilize environmental services from mangrove forests and the coast in a sustainable manner. Related to this, ecotourism training has been carried out by the North Halmahera Regency Tourism Office with the support of Burung Indonesia. The community has also been trained to process mangrove fruits into a variety of special foods and beverages such as lunkhead, candy and syrup to support ecotourism. Meanwhile, a gold mining company operating in Kao District, PT. Nusa Halmahera Minerals, has expressed a commitment to build a tourist bridge through the mangrove forest by 2022.
3.4.4. Community-based Biodiversity Research. The biodiversity research in the EEA of Kao is mainly carried out to identify the diversity of mangrove plant species and birds (Figure 2C, 2D). The research is not only conducted by the competent parties but also involves the active participation of the community. The community was participated in the identification of flora and fauna in order to recognize the biodiversity of their own village so that they will have the awareness to conserve it.

4. Discussion
The community-based natural resource management is seen as a mechanism to address environmental and socio-economic problems that balance the exploitation and conservation of valuable ecosystem components as well as to encourage the sustainable use of natural resources [11]. Through a co-managed system [4], it is possible to have a good collaboration from various parties in the management of the EEA of Kao. This integration is in line with the concept described by Abdullah et al [5] that community based conservation places community involvement at the centre of conservation program which is generally a collaborative management framework between four major groups that share the power and responsibility to manage natural resources in conservation area that consists of the government agencies, the non-governmental groups, the local communities and the ecological scientists (Figure 3).
The success of a community-based conservation in other areas on the coast of North Halmahera Regency is also found in the moluccan scrubfowl conservation in Simau Village. For the conservation purposes, the land owners who are also egg diggers carry out a semi-natural egg hatching program with the ‘Salabia’ youth community. They are supported by the Halmahera University and the Burung Indonesia [12]. Partially harvested eggs are planted in the beach sand near the nearest cage. Eggs hatch and chicks emerge from the sand about 60 days of natural incubation. The feed given during rearing in the cage is chicken pellets and sometimes ants (from the anthill) as additional food until the birds are ready to be released, after about two weeks. This hatchery program was successful with a survival success percentage reached 85.7% [7]. In addition, the rehabilitation of mangrove forests around the laying eggs habitat for the moluccan scrubfowl is also supported by various stakeholders [13]. This shows that the Community-Based Conservation through Stakeholder Collaboration is the key to achieve the goal of conservation.

5. Conclusion
The Community-Based Conservation through Stakeholder Collaboration is the key for achieving the conservation goal. In the Essential Ecosystem Area (EEA) of Kao, the initial initiative to conserve the mangrove forest and its coast ecosystem came from the community by setting an eco-tourism vision and establishing village regulation concerning environmental conservation. The collaboration between stakeholders was then built to strengthen the vision and the commitment of the community. This study found that there are 13 mangrove species and 56 bird species, of which 10 are protected species. The community has built a mangrove nursery and rehabilitated 8 ha of degraded mangrove forest. Since the establishment of the EEA of Kao in 2020, the community has stopped hunting for eggs of the endemic moluccan scrubfowl (Eulipoa wallacei). They have also learned to use non-timber mangrove forest products and ecotourism through the support of stakeholders.

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